Australian Government

Australian Maritime Safety Authority

AUSTRALIAN GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) HANDBOOK

The Australian GMDSS Training and Operations Manual

SEPTEMBER 2013

Erratum

1. There are several references in this Handbook to the closure date for the Inmarsat-B service and the Inmarsat-M (and Mini-M service) being 31 December 2014.

   This was correct at the time of publication, however Inmarsat has since advised that Inmarsat-B, M and mini-M services will now be discontinued from 30 December 2016.

   This reference appears on:
   Page 28, Section 4.1.7;
   Page 29, Section 4.1.7;
   Page 30, Table 2;
   Page 84, Section 14.4.

2. The title of Appendix 12 in this Handbook reads ‘Guidelines for Operational use of Shipborne AIS’. This should read ‘Operation of Marine Radar for SART Detection’

FOREWORD

This Handbook has been produced by the Australian Maritime Safety Authority (AMSA), and is intended for use on ships that are:

- Compulsorily equipped with GMDSS radiocommunication installations in accordance with the requirements of the *International Convention for the Safety of Life at Sea Convention 1974* (SOLAS) and Commonwealth or State Government marine legislation; or
- Voluntarily equipped with GMDSS radiocommunication installations.

It is the recommended textbook for candidates wishing to qualify for the Australian GMDSS *General Operator's Certificate of Proficiency.*

This Handbook replaces the ninth edition of the GMDSS Handbook published in April 2011, and has been amended to reflect changes to regulations adopted by the 2012 International Telecommunication Union (ITU) World Radio Conference, changes to Inmarsat services, an updated AMSA distress beacon registration form, changes to various ITU Recommendations, the transition from AUSREP to MASTREP, changes to the publications published by the ITU, developments in 'man overboard' devices, the Automatic Identification System (AIS), clarification of GMDSS radio log procedures, and general editorial updating and improvements.

Procedures outlined in the Handbook are based on the ITU *Radio Regulations*, on radio procedures used by Australian Maritime Communications Stations and satellite earth stations in the Inmarsat network.

Careful observance of the procedures covered by this Handbook is essential for the efficient exchange of communications in the marine radiocommunication service, particularly when safety of life at sea is concerned. Special attention should be given to those sections dealing with distress, urgency, and safety.

Operators of radio communications equipment on vessels not equipped with GMDSS installations should refer to the *Marine Radio Operators Handbook* published by the Australian Maritime College, Launceston, Tasmania, Australia.

No provision of this Handbook or the ITU *Radio Regulations* prevents the use by a ship in distress of any means at its disposal to attract attention, make known its position and obtain help.

Similarly, no provision of this Handbook or the ITU *Radio Regulations* prevents the use by ships engaged in search and rescue operations of any means at their disposal to assist a ship in distress.

For the purposes of this Handbook, references to distress and safety communications include distress, urgency and safety calls, messages, including alerts and announcements promulgated by digital selective calling.

AMSA acknowledges the assistance of Inmarsat and the Bureau of Meteorology for reviewing relevant parts of the text.

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1 AN INTRODUCTION TO THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM

1.1 HISTORY

Radio was first used to save lives at sea in 1899. Subsequently it has helped to rescue tens of thousands of people and become the key element of maritime search and rescue systems.

Since that date numerous technological advances have been made. However, until the introduction of the Global Maritime Distress and Safety System (GMDSS) in 1992, the way in which a message from a ship in distress was sent had changed very little from those early days; namely, a radio operator sending a message by Morse code or radiotelephone and hoping that another ship (or shore station if within range) would hear the call and respond.

The GMDSS has introduced new technology which has completely transformed maritime radio-communications. The new system enables a distress alert to be transmitted and received automatically over long range, with a significantly higher reliability.

1.2 BASIC CONCEPT OF THE GMDSS

1.2.1 Equipment carriage

A major difference between the GMDSS and the previous 'Wireless Telegraphy' (W/T) and 'Radio Telephony' (R/T) systems is that the equipment to be carried by a ship should be determined by its area of operation rather than by its size.

1.2.2 Search and rescue

The GMDSS uses modern technology, including satellite and digital selective calling techniques on the MF, HF and VHF bands (the latter known as 'terrestrial' systems) enabling a distress alert to be transmitted and received automatically over short and long distances.

The system allows search and rescue authorities ashore, as well as shipping in the vicinity of the ship in distress to be rapidly alerted to a distress incident so that they can assist in a co-ordinated search and rescue operation with the minimum of delay.

1.2.3 Maritime Safety Information (MSI)

Additionally, the GMDSS provides for urgency and safety communications, and the dissemination of Maritime Safety Information (MSI) - navigational and meteorological information to ships. Two systems are used for broadcasting maritime safety information.

They are provided specifically to serve the requirements of Chapter IV of the 1974 SOLAS convention, as amended in the areas covered by these systems. The international NAVTEX service transmissions in coastal regions and the International SafetyNET service cover all the waters of the globe, including the Polar Regions. Five new Artic NAVAREAs and METAREAs became operational from 1 June 2011. In addition some national meteorological services may issue warnings and forecasts for transmission by using HF narrow band direct printing.

1.3 AREAS OF OPERATION UNDER THE GMDSS

Because the different radio systems incorporated into GMDSS have individual limitations with respect to range and service provided, the equipment required to be carried by a ship is determined by the ship's area of operation. The GMDSS has divided the world's oceans into four distinct areas. All vessels are required to carry equipment appropriate to the sea area or areas in which they trade.

GMDSS operational areas

Area A1 within the radiotelephone coverage of at least one VHF coast station in which continuous VHF DSC alerting is available;

Area A2 within the radiotelephone coverage of at least one MF coast station in which continuous MF DSC alerting is available (excluding sea area A1);

Area A3 within the coverage area of an INMARSAT geostationary satellite in which continuous alerting is available (excluding sea areas A1 and A2); and

Area A4 the remaining sea areas outside areas A1, A2 and A3 (basically, the polar regions).

The Australian Government has designated its surrounding waters as GMDSS Sea Area A3. The only exception to this designation is the Antarctic waters south of approximately 70° S which are Sea Area A4.

1.4 THE GMDSS MASTER PLAN

The International Maritime Organization (IMO) regularly publishes a list of proposed and actual GMDSS shore based communications facilities available worldwide. This document is referred to as the 'GMDSS Master Plan'.

1.5 INTRODUCTION OF GMDSS

The International Convention for the Safety of Life At Sea (SOLAS) is a set of international regulations and standards governing all aspects of merchant ship operation. The convention has been ratified by all major maritime nations which operate through the International Maritime Organization (IMO), an agency of the United Nations.

Amendments to the 1974 SOLAS Convention concerning radiocommunications for the GMDSS were published in 1989 and entered into force on 1 February 1992.

All ships over 300 gross tonnage (GRT) on international voyages, and hence subject to the 1974 SOLAS Convention, have been required to comply with the carriage requirements of the GMDSS since 1 February 1999.

1.5.1 Relevant conventions and legislation

The carriage requirements for ships subject to the SOLAS Convention, or voluntarily GMDSS equipped are contained in Chapter IV of SOLAS with amplifying advice provided in AMSA *Marine Order 27 (Radio Equipment) 2009*. Some requirements (e.g. for SAR locating devices) are also contained in Chapter III of SOLAS, the International Life-Saving Appliance (LSA) Code, and the High Speed Craft (HSC) Code. For vessels not subject to the SOLAS Convention but are required to be GMDSS 'compatible' by Commonwealth legislation the carriage requirements are contained in Appendix 6 AMSA *Marine Order 27 (Radio Equipment) 2009*. The carriage requirements for both GMDSS compliant and GMDSS compatible ships are designed to ensure the vessel can meet the functional requirements of the GMDSS relevant to that vessel and its operating area/s.

1.6 FUNCTIONAL REQUIREMENTS

1.6.1 Functional requirements for GMDSS compliant (SOLAS) vessels

The functional requirements for GMDSS compliant vessels (vessels to which the SOLAS Convention applies) are contained in Regulation IV/4 of the SOLAS convention. This regulation requires that every ship, to which the regulation applies and while at sea, shall be capable of:

- Transmitting ship-to-shore Distress Alerts by at least two separate and independent means, each using a different radio communication service;
- Receiving shore-to-ship Distress Alerts;
- Transmitting and receiving ship-to-ship Distress Alerts;
- Transmitting and receiving search and rescue co-ordinating communications;
- Transmitting and receiving on-scene communications;
- Transmitting and receiving locating signals;
- Receiving maritime safety information;
- Transmitting and receiving general radio-communications relating to the management and operation of the vessel; and
- Transmitting and receiving bridge-to-bridge communications.

1.6.2 Functional requirements for GMDSS compatible (non-SOLAS) vessels

The functional requirements for GMDSS-compatible vessels (vessels to which the SOLAS Convention does not apply) are contained in Provision 7.2 of AMSA *Marine Order 27 (Radio Equipment) 2009*. This regulation requires that every ship, to which the regulation applies and while at sea, shall be capable providing for the safety of the ship with the ability to:

- Perform ship-to-shore distress alerting by two independent means;
- Transmit ship-to-ship distress alerting;
- Transmit and receive on-scene communications, including appropriate SAR co-ordinating communications;
- Transmit locating signals; and
- Receive maritime safety information.

The installation on the ship must be capable of assisting other ships in distress, particularly the ability to:

- Receive shore-to-ship distress alerting; and
- Receive ship-to-ship distress alerting.

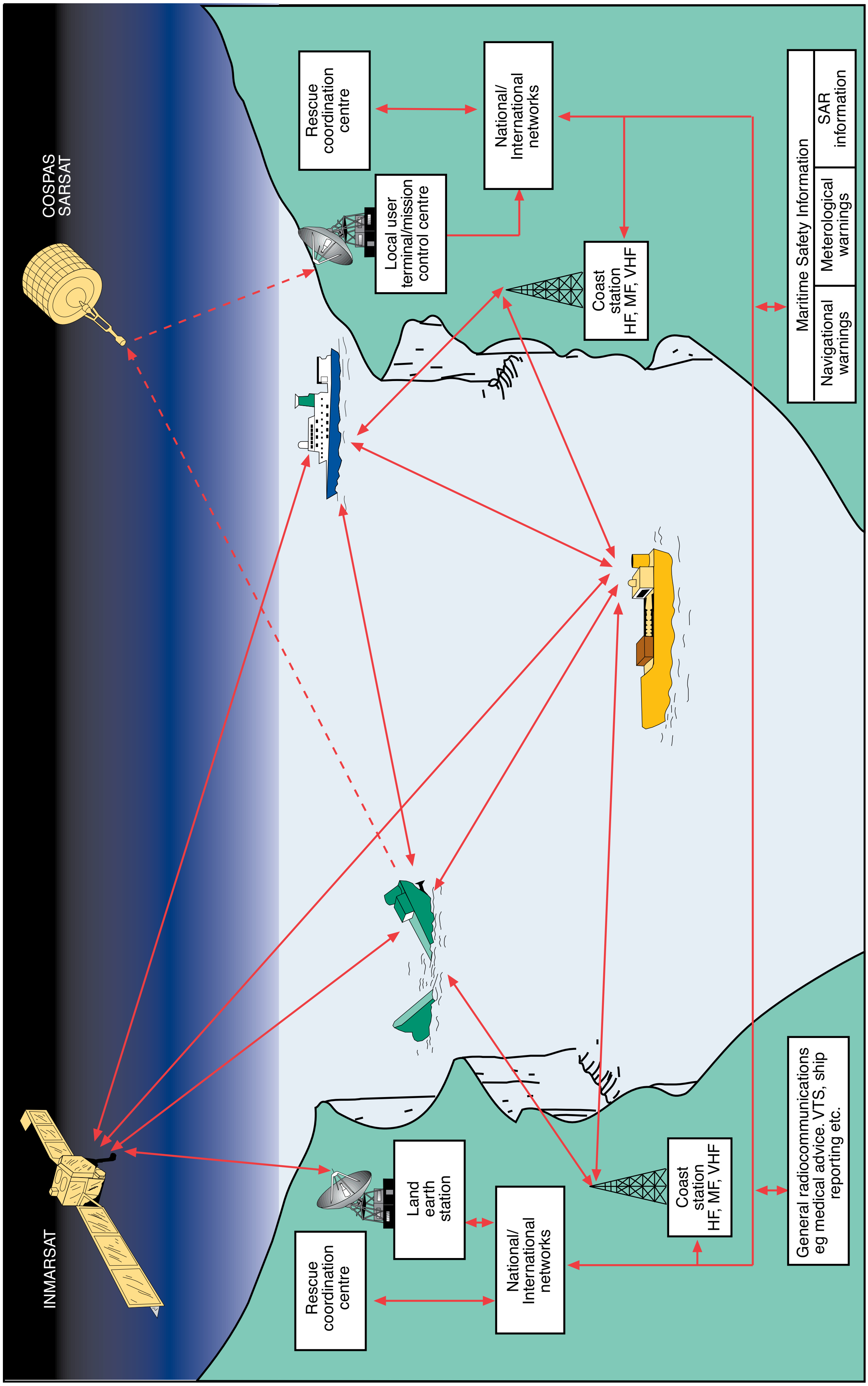


Figure 1 - The Global Maritime Distress and Safety System (GMDSS) - simplified overview

2 GENERAL PRINCIPLES AND FEATURES OF THE MARITIME MOBILE SERVICE

2.1 PRIORITIES OF COMMUNICATIONS IN THE MARITIME MOBILE SERVICE

Article 53 of the International Telecommunication Union *Radio Regulations* states that all stations in the Maritime Mobile and the Maritime Mobile-Satellite service shall be capable of offering four levels of priority in the following order:

2.1.1 Distress

A distress message indicates that a mobile unit or person is threatened by grave and imminent danger, and requires immediate assistance.

A distress message has absolute priority over all other communications.

- Distress calls transmitted by radiotelephony are prefixed by the word 'MAYDAY' sent three times. Subsequent messages are preceded by the word MAYDAY once only (refer to Section 14.7.2).

2.1.2 Urgency

An urgency message indicates that the calling station has a very urgent message concerning the safety of a mobile unit or person.

An urgency message has priority over all other communications, excepting distress.

Urgency messages transmitted via radiotelephony are prefixed by the words 'PAN PAN' sent three times.

2.1.3 Safety

A safety message indicates that the calling station has an important navigational or meteorological warning to transmit.

A safety message has priority over all other communications, excepting distress and urgency.

Safety messages sent via radiotelephony are prefixed by the word 'SECURITE' sent three times.

2.1.4 Routine/public correspondence (Other)

A routine message is one not covered by the previous categories. Public Correspondence communications are those which are used to convey routine information between persons on board vessels and those ashore through the public telecommunications network. Examples of Public Correspondence communications are: telephone, fax, email and data messages.

2.2 TYPES OF STATION IN THE MARITIME MOBILE SERVICE

2.2.1 Ship stations

A ship station is a radio station established on board a vessel for communications with stations ashore and other ship stations.

2.2.2 Coastal radio stations

A coast radio station is a radio station established on land for the purpose of communicating with ships at sea.

In Australia there are typically two types of coast radio stations:

- Major Coast Station - a station whose major function is the transmission and reception of messages on behalf of the public and also provides GMDSS distress and safety services.
- Limited Coast Station - a station whose major function does not include the handling of messages of a public correspondence nature (see 2.1.4). These stations do not provide GMDSS distress and safety services, and are often operated by volunteer organisations, some State and Territory Government entities and private or commercial entities.

The term Maritime Communications Station (MCS) better describes the stations operated by AMSA at Wiluna and Charleville and which form the AMSA HF DSC network.

2.2.3 Port operations stations

Port operations stations are established for the operational control of ships in and around ports and harbours. They are also known as "Harbour Control" stations. Some of these stations are classified as Vessel Traffic Service (VTS) stations as defined by the International Maritime Organization (IMO) Resolution A.857(20).

2.2.4 Aircraft stations

Ship stations communicate with aircraft stations during search and rescue operations on designated frequencies.

2.2.5 Rescue Coordination Centre (RCC)

The Australian RCC (referred to as RCC Australia) is located at Canberra, and operated by the Australian Maritime Safety Authority (AMSA). The RCC coordinates search and rescue operations for ships and aircraft and the promulgation of navigation warning information (referred to as Maritime Safety Information - MSI). An RCC is connected by various communications links to coast radio stations, land earth stations and other search and rescue organisations.

2.3 FREQUENCIES AND FREQUENCY BANDS

2.3.1 Frequency and wavelength

The number of times that the alternating current in a radio wave performs its complete cycle per second is known as its frequency. The international unit of measurement of frequency is the hertz (abbreviated - Hz).

The wavelength of a radio wave is the distance between two successive positive peaks of two cycles. Wavelength is inversely proportional to frequency, i.e. as the frequency of a radio wave increases, the wavelength decreases, and vice-versa.

The wavelength of a radio wave is determined by the formula:

wavelength (m) = velocity in metres (m)s per second (s) divided by frequency in hertz (Hz).

The velocity of a radio wave is a constant 300 000 000 m per second.

2.3.2 Units of frequency

Units of frequency are:

The kilohertz (kHz) = 1 000 hertz

The megahertz (MHz) = 1 000 000 hertz

The gigahertz (GHz) = 1 000 000 000 hertz

2.3.3 Sub-division of the radio frequency spectrum

The radio frequency spectrum is sub-divided into eight bands, as follows:

Very Low Frequencies	(VLF)	3 to 30 kHz
Low Frequencies	(LF)	30 to 300 kHz
Medium Frequencies	(MF)	300 to 3 000 kHz
High Frequencies	(HF)	3 to 30 MHz
Very High Frequencies	(VHF)	30 to 300 MHz
Ultra High Frequencies	(UHF)	300 to 3 000 MHz
Super High Frequencies	(SHF)	3 to 30 GHz
Extra High Frequencies	(EHF)	30 to 300 GHz

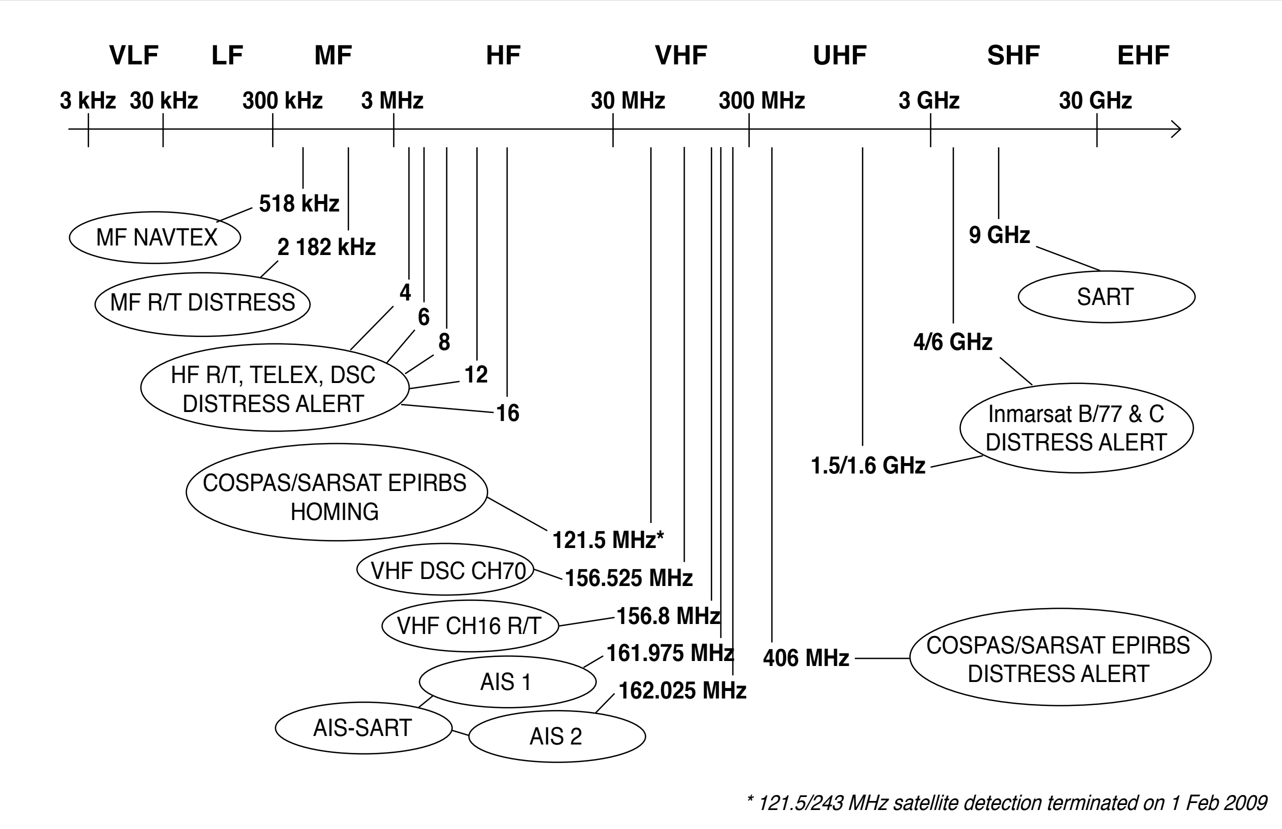


Figure 2 - ITU radio frequency bands and GMDSS usage

2.4 FREQUENCIES ALLOCATED TO THE MARITIME MOBILE SERVICE

2.4.1 Allocations

The International Telecommunication Union (ITU) has allocated various bands of frequencies throughout the radio frequency spectrum to the Maritime Mobile Service and the Maritime Mobile-Satellite Service.

The bands and their uses are detailed in Figure 2.

2.4.2 Simplex and duplex channels

All HF and all VHF marine frequencies are arranged in a channelised format.

Channels are designated as either:

Simplex – operating method in which transmission is made possible alternatively in each direction of a telecommunication channel, for example, by means of manual (see single frequency); or

Duplex – operating method in which transmission is possible simultaneously in both directions of a telecommunication channel.

2.4.3 Simplex operation

A simplex system allows only one station to transmit at any one time. Communications equipment designed for simplex operation uses one antenna, which is connected to either the transmitter or the receiver through a change-over relay or switch.

Channels used for distress and calling purposes are always operated in simplex mode, so that all stations can hear all others using the frequency.

Simplex operation is depicted in Figure 3.

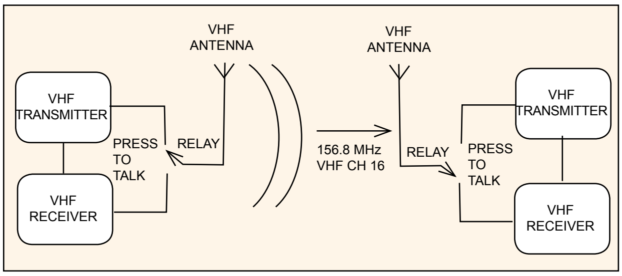


Figure 3 - Simplex operation

2.4.4 Duplex operation

Communications equipment designed for duplex operation allows simultaneous transmission and reception on two different frequencies through the use of either two widely spaced antennas or one antenna connected to the transmitter and receiver through special combining and filtering circuitry.

Duplex channels are normally used for public correspondence purposes (i.e. radio telephone calls). Each duplex channel comprises two separate frequencies - one for transmit and one for receive.

Duplex operation allows radiotelephone calls to and from suitably equipped vessels and coast radio stations to be conducted in the same way as telephone calls made over the conventional land telephone system - i.e. both parties can speak and be heard at the same time.

Only two stations can use a duplex channel at any one time.

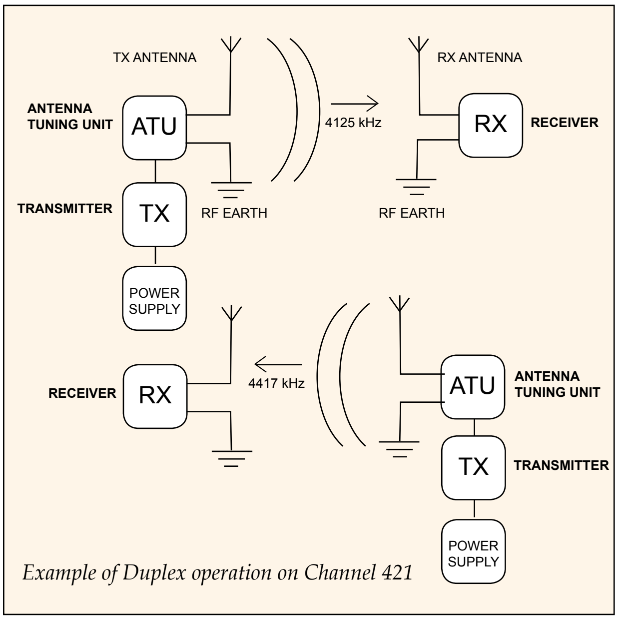


Figure 4 - Duplex operation

2.4.5 Semi-duplex operation

Communications equipment that does not have the facility for simultaneous transmission and reception often operates in 'semi-duplex' mode - i.e. a method which is simplex operation at one end of the circuit and duplex operation at the other.

2.4.6 HF Radiotelephone Channel Plan

The HF radiotelephone channel plan is described in Appendix 17 of the ITU *Radio Regulations*, and reproduced in the *Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services* (carried by every GMDSS ship).

The plan allocates a series of channels for duplex operation, and a series of channels for simplex (inter-ship) operation. Duplex channels are always referred to by their channel number. This channel number is comprised of 3 or 4 digits, the first one or two representing the frequency band (4, 6, 8, 12, 16, 22 and 26 MHz), and the last two representing the actual channel number, i.e. channel 403 is the third channel in the 4 MHz band, and channel 1602 is the second channel in the 16 MHz band.

Appendix 17 (as per the 2011 edition of the *Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services*) lists both the simplex and duplex channels available in the 4 to 26 MHz range. As a result of the introduction of GMDSS, and the move to satellite-based communications methods, these sub-bands have become under-utilized, and with full international agreement, new digital technologies are expected to be introduced into these bands. Each country is allocated a number of channels from each band for use by its coast and ship stations.

2.4.7 VHF radiotelephone channel plan

The VHF channel plan as described in Appendix 18 of the ITU *Radio Regulations*, and reproduced in the Manual for use by the *Maritime Mobile and Maritime Mobile-Satellite Services* (carried by every ship using the GMDSS), and is provided in Appendix 10 of the Handbook. The *Radio Regulations* Appendix 18 was updated at ITU WRC-12, and while the GMDSS channels are unchanged, new single-frequency channels have been created, and more flexibility exists for new digital channels, as well as channels for testing of new technologies. Some of these changes will come into effect from 1 January 2017 and administrations are evaluating how the new channels are to be used locally, and there are some regional variations for the new digital channels. The remarks below refer to the new channel plan.

A total of 68 VHF channels are available in the VHF channel plan. Of these at least 65 are expected to be selectable by the user, but additional channels could be available depending on the manufacturer programming, since a number of channels can be operated in single-frequency or two-frequency mode under various Appendix 18 Notes.

A new channel 2006 has been designated for experimental use for future applications or systems (e.g. new AIS applications, man overboard systems, etc.) – if authorised by administrations. At present, no equipment can monitor this channel, but new equipment may. The eventual usage of this channel in reality is yet to be determined.

Four digit channel numbering

It will be noted that the channel plan now includes four-digit channel numbering for certain channels. Equipment manufacturers are examining how this will be incorporated into their equipment. It is based on Recommendation ITU-R M.1084-4 Annex 4, which adds the "10" prefix to a single-frequency channel number, if a two-frequency channel is operated in single-frequency mode using the ship transmit frequency. Alternatively, the "20" prefix is added to a single-frequency channel number, if a two-frequency channel is operated in single-frequency mode using coast station frequency.

Two channels are exclusively for AIS (AIS 1 and AIS 2) and one is exclusively for DSC (Channel 70). Each simplex and duplex channel is assigned a specific purpose by the ITU. However while the entire list is contained within the *Manual for use by the Maritime Mobile and Maritime Mobile Satellite Services* specifically note the following:

Channel 06: may be employed for communication between ship stations and aircraft stations engaged in co-ordinated SAR operations and ship stations should avoid harmful interference on this channel.

Note: Channel 06 is also used in Australia and other countries for port operations, pilotage, tugs, VTS, and harbourmaster purposes.

Channel 13: is designated worldwide as a navigation safety communication channel primarily for inter-ship navigation safety communications.

Channel 16: may only be employed for Distress, Urgency, Safety and Calling.

Channels 15 and 17: may be used for on board communications provided the radiated power does not exceed 1 W (low power setting) and such communications are permitted in the waters of the coastal state in which the ship is operating.

Channel 70: is used for Digital Selective Calling for Distress, Safety and calling.

Channels 75 and 76: should be restricted to navigation related communications and as these channels are located in the band either side of channel 16 (see Appendix 10). Measures should be taken to minimize the risk of harmful interference on that channel such as using low power (1 W). At WRC-12, it was agreed that these channels shall also be used to enhance the satellite detection of AIS transmissions from ships. New AIS Class-A and Class-B "SO" transceivers fitted with this capability, will automatically transmit a special AIS Message 27 which can be detected by satellite, alternatively on channels 75 and 76 (at 12.5 watts) every 3 minutes, when outside VHF coverage of a terrestrial AIS base station. These transmissions are not expected to cause interference to channel 16.

The frequencies of 161.965 MHz and 162.025 MHz are known as AIS 1 and AIS 2 and are used exclusively for AIS.

Each country determines their own individual channel allocations, based on the ITU guidelines. The band is extensively used by ship, coastal, limited coastal and port operations stations world-wide.

2.4.8 HF Narrow Band Direct Printing (Radio Telex) channel plan

The HF Narrow Band Direct Printing (NBDP - also known as 'Radio Telex') channel plan is described in Appendix 17, Section III of the ITU *Radio Regulations*.

Commercial HF NBDP channels are assigned in a similar fashion to duplex radiotelephone channels. Each channel consists of two frequencies, one for the ship and one for the coast station.

As a result of WRC-12, the *Radio Regulations* contains two versions of Appendix 17, one which will remain in force until 31 December 2016 and one which will come into force from 1 January 2017. The latter one will have a reduced number of channels available for non-GMDSS NBDP and Morse telegraphy, but an increased number of channels for new digitally-modulated emissions, which also provide for the combining of channels into wider blocks for larger data rates.

While NBDP or TOR (Telex over Radio) has been in sharp decline over a number of years as a commercial service, a new method of text communications has been developed using the same spectrum. This new system which allows the use of e-mail over the terrestrial (HF) bands has been developed as a global network, but does not form part of the GMDSS.

2.4.9 GMDSS distress and safety frequencies

The ITU has allocated simplex (i.e. single frequency) frequencies in the MF, the VHF and each of the HF maritime bands exclusively for distress and safety purposes. These frequencies are protected by international agreement, and any transmission capable of causing harmful interference to distress and safety signals is prohibited.

2.5 CHARACTERISTICS OF FREQUENCIES

2.5.1 Introduction to radio propagation

The way in which energy, in the form of radio signals, propagates or travels from one point on the surface of the Earth to another, or from the surface of the Earth to a communications satellite in orbit around the Earth, depends upon the radio frequency used.

Each item of maritime radio communication equipment is designed to operate on a particular band of radio frequencies. The nature of the propagation of those radio frequencies determines the range or distance over which communicationcan be established. This in turn greatly influences the use to which the particular radio communication equipment is put.

2.5.2 Electromagnetic waves

Radio frequency energy, generated by a transmitter, is radiated from an antenna connected to the transmitter. The antenna is specially designed for use on a particular band of frequencies. The radiated radio frequency energy travels away from the antenna in the form of an electromagnetic (EM) wave. Visible light is one form of electromagnetic wave energy.

The radiated electromagnetic wave may be formed by the transmitting antenna into a narrow beam which must then be directed in a particular direction in order to establish communication, (e.g. Inmarsat employs this type of antenna). Alternatively the antenna may be designed to radiate EM waves omni-directionally (in all directions).

2.5.3 Ground wave and sky wave propagation

Radio waves will radiate from the antenna as:

Surface waves or ground waves - which will travel over the Earth's surface. The distance over which they will travel is determined by their radio frequency. Very Low Frequencies (VLF) will travel thousands of km while Ultra High Frequencies (UHF) travel only a few km. At VHF and UHF, it is mainly the height of the transmitting and receiving antenna that determines the range over which communication can be conducted, apart from the gain of the transmitting and receiving antennas.

Sky waves - which are radiated upwards at all angles from the antenna, until they reach the ionosphere. The ionosphere is a layer of ionised particles that lies between 50 and 500 km above the earth's surface. At High Frequencies (HF), the radio wave is refracted by the ionosphere and returns to the earth's surface, having travelled over thousands of kilometres. Long distance terrestrial communication is conducted using HF in this way. At VHF, UHF and SHF sky waves are not absorbed to any great extent and travel through the ionosphere into space, thus enabling communications via satellite to be conducted.

The propagation of ground waves and sky waves is depicted in Figure 5.

2.5.4 Ionospheric propagation

The upper atmosphere surrounding the Earth suffers high levels of ultraviolet and X-ray radiation from the sun which causes the gas molecules of the atmosphere to ionise or become electrically charged.

These charged ions form into regions of particular density namely:

Region (or Layer)	Approx Altitude
F2	> 210 km
F1	140 – 210 km
E	90 – 140 km
D	50 – 90 km

The D Region absorbs radio frequencies around 2 MHz during daytime. At night the ionisation level of the D Region reduces and thus does not absorb the radio energy at 2 MHz. Therefore radio signals around 2 MHz travel longer distances at night, reflected by the ionosphere.

High Frequency propagation is totally influenced and controlled by the changing state of the ionosphere.

Radio propagation conditions will vary by the hour due to magnetic storms and flares generated by the sun. Complete radio blackouts can occur, especially at high latitudes.

2.5.5 Radio propagation at MF and HF

At medium and high frequencies, reliable use can be made of both ground and sky wave energy components allowing communications over short and long ranges.

MF/HF marine radio equipment will always offer the operator a selection of frequencies in different bands e.g. 2 182 kHz in the 2 MHz band, 4 125 kHz in the 4 MHz band, 12 290 kHz in the 12 MHz band, etc. This allows the operator to select a frequency which will be suitable both for the distance over which communications are required, and the time of day and season.

The general rule for frequency selection is to use the lower frequencies when close to the required station, and the higher frequencies when further away. During hours of darkness, a frequency lower than that necessary during the day is more likely to be effective.

Less interference from distant stations will be experienced on the lower frequencies. However, in tropical waters, high static levels may make communications difficult or impossible at times.

A very approximate guide to the use of MF/HF frequencies is:

- Use 2 MHz band frequencies for communicating with stations within 50 to 150 n miles, day or night;
- (Note: much greater range is possible at night on 2 MHz);
- Use 4 MHz band frequencies for daytime communications with stations at distances greater than 60 n miles or if no response to calls on 2 MHz, and for night-time communications when 2 MHz is unsatisfactory;

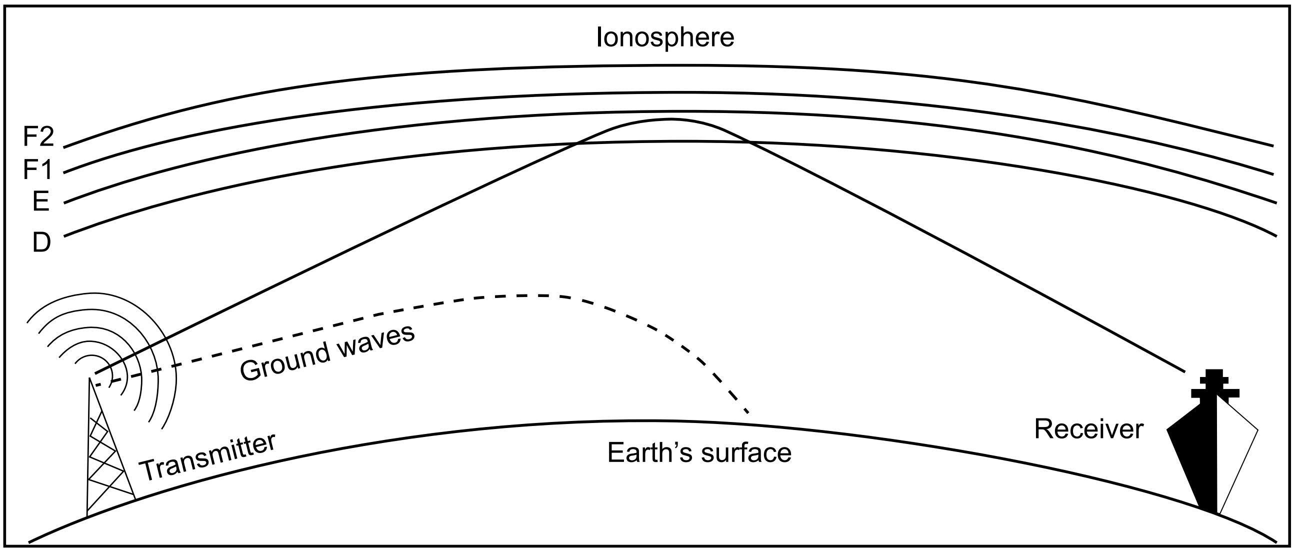


Figure 5 - Propagation of ground waves and sky waves

- Use 6 MHz band frequencies for daytime communications when 4 MHz is unsatisfactory, and at night when 2 MHz and 4 MHz are unsatisfactory; and
- Use frequencies in the 8, 12, 16 and 22 MHz bands to provide progressively greater communications distances and when distance prevents the satisfactory use of the lower frequencies.

The correct selection is the lowest frequency that will provide satisfactory communications with the wanted station. However, this is often a matter of experience gained by listening to different stations operating over different ranges rather than "textbook" knowledge.

Additional guidance in respect of the appropriate HF frequency to employ for communications with Australian Maritime Communications Stations (MCS) is provided by the Australian Government's (Bureau of Meteorology) IPS Client Support System which is available on line at: www.ips.gov.au (then select 'Products & Services' then select 'AMSA' under 'Client Support').

This system provides hourly frequency coverage charts for both the AMSA HF stations at Wiluna (WA) and Charleville (Qld) to facilitate HF frequency selection for ship to shore communication.

2.5.5.1 Maximum Usable Frequency (MUF)

This is the maximum (i.e. highest) usable frequency which is reflected by the ionosphere over any particular path. It depends on time of day, time of year, latitude of sending and receiving stations, and the stage of the sunspot cycle. In general the strongest signals occur using frequencies just below the MUF, for a particular path distance and layer involved. The greatest electron density in a given layer of the ionosphere reflects the MUF, and any higher frequency will penetrate the ionosphere completely and not be reflected. MUFs are higher when the sunspot number is high.

2.5.5.2 Optimum Traffic Frequency (OTF)

The MUF at night will be about half the daytime value for a given path. Long-range communications at night can be quite reliable at lower frequencies. The MUF is generally higher during the summer than in winter. The first choice of a working frequency for sustained reliability would be around 85% of the MUF. The Optimum Traffic Frequency (OTF) is a term used for an optimal frequency which takes the above factors into account.

2.5.6 Radio propagation at VHF and UHF

Under normal conditions there is no reflection of VHF radio energy from the ionosphere. Consequently, VHF communications must be conducted by ground wave and are therefore effective for short ranges only.

As a general rule, the range achievable from VHF communications is approximately 10 - 20 percent further than visual line of sight. UHF offers slightly less range. The greater the heights of the transmitting and receiving antennas, the greater the range achieved at UHF and VHF.

Under certain atmospheric conditions, particularly during the summer months, a phenomenon called 'ducting' occurs, which causes refraction of VHF/UHF signals in the atmosphere, thereby allowing communications over many hundreds or even thousands of km. Communications under these conditions are highly unreliable and must be taken into consideration when making decisions about the suitability of VHF/UHF marine radio equipment for a given application.

2.6 COMPONENT PARTS OF MARINE RADIO EQUIPMENT

2.6.1 The major parts of radio equipment

Marine radio equipment, whether operating in the VHF or MF/HF bands, is made up of three major sections:

- The antenna or aerial;
- The transmitter and the receiver, and
- The power supply.

Each part is dependent on the other. A fault in any one of the parts will not allow the equipment to function correctly.

2.6.2 The antenna

The antenna has two functions:

- During transmission, to radiate into space the radio frequency energy generated by the transmitter; and
- During reception, to gather radio frequency energy from space and pass it to the receiver.

The antenna, therefore, is connected to either the transmitter or the receiver, depending whether transmission or reception is taking place.

The changeover is controlled by the 'press to talk' switch or button on the microphone or handset. When pressed, the transmitter is turned on and the antenna is connected to it. When released, the transmitter is turned off and the antenna is re-connected to the receiver.

On MF/HF transceivers, to achieve effective communications, it is essential to provide an "earth" to the water surrounding the vessel. Usually, this is achieved by running a heavy flat copper strip from the earth terminal of the transceiver to part of the metallic superstructure.

2.6.3 The transmitter and the receiver

The function of the transmitter is to turn voice (audio) or data signals into a form where they can travel over very long distances. This is achieved by converting voice signals spoken into the microphone or data signals presented to the transmitter into high powered radio frequency energy which is passed to the antenna and radiated as ground and sky waves.

The function of the receiver is to select only those radio frequency signals which are required by the operator and amplify them. These signals are then converted back into voice or data signals and reproduced by a loudspeaker or fed to a data device.

It is usual with marine radio equipment for the transmitter and receiver to be combined in a single unit called a transceiver.

2.6.4 The power supply

The function of the power supply is to supply electrical energy to the transmitter and the receiver to enable them to carry out their tasks.

Fuses located in the wiring between the power supply and the transceiver protect the equipment against damage should a malfunction occur.

2.7 MODES OF COMMUNICATIONS

2.7.1 Overview

Marine radio equipment uses various modes of emission for different functions. These modes can be summarised as follows:

Radiotelephone - the most common mode of operation. In this mode, voice signals are transmitted over a radio link using various forms of modulation (see below).

Narrow Band Direct Printing (NBDP) - telex signals are transmitted over radio.

Digital Selective Calling (DSC) - A paging system that uses data signals to automate the transmission of distress, urgency or safety calls via MF, HF or VHF radio.

As outlined in Section 2.4.6, the ITU has allocated a specific frequency in the MF, each of the HF and the VHF marine bands for distress and safety traffic via each of these three modes of operation. These frequencies are listed in Appendix 1.

The following sections explain the three modes.

2.7.2 Radiotelephone

In this system, at the transmitter, audio (voice) signals are modulated (or combined) with a radio frequency signal - referred to as a carrier. In the receiver, these signals are de-modulated, the audio is separated from the radio carrier, amplified and passed to the loudspeaker.

There are two main types of modulation used in Maritime Mobile radiotelephone transmissions -

Amplitude Modulation (AM)
and
Frequency Modulation (FM)

Amplitude Modulation (AM) is the method of modulation used on all MF and HF Maritime Mobile Bands. In this system the amplitude of the radio frequency carrier is modulated or varied by the audiosignal. This type of modulation produces a radio frequency carrier and two 'sidebands' which contain the audio information. It is sometimes referred to as 'Double Sideband'.

This system is used by broadcasting stations, such as commercial and ABC radio stations.

Single Side Band, suppressed carrier. The two sidebands in the double sideband system described previously each contain identical audio information. Single Side Band, suppressed carrier equipment contains special filters that completely remove the radio carrier and one of the sidebands from a double sideband signal. This allows a great increase in efficiency, as all the radio frequency power is concentrated in one sideband only - either the Lower Side Band (LSB) or the Upper Side Band (USB). SSB receivers automatically re-insert the carrier, and de-modulate the audio signals in the same way as a double sideband AM (A3E) receiver.

Single Side Band, suppressed carrier (J3E) operation is mandatory on all maritime MF and HF radiotelephone channels, apart from 2 182 kHz. The Upper Side Band (USB) mode of operation is used. Some equipment does provide facilities to enable selection of the Lower Side Band (LSB) mode of operation - this must not be used.

Single Side Band full carrier. Under the ITU *Radio Regulations* this mode is only permitted on the MF International Distress frequency of 2 182 kHz. This mode is known as “compatible AM” or H3E.

Because of its full carrier, Double Side Band receivers are able to receive these signals. Although the H3E emission mode has been phased out, some ships and coast stations continue to use SSB full carrier (H3E) on 2 182 kHz. However radiotelephone communications, including distress traffic, on 2 182 kHz should be conducted on SSB suppressed carrier emission (J3E). (Further information is available in ITU 2012 *Radio Regulations* Appendix 15.)

Note: At the ITU WRC-07, it was agreed to suppress (i.e. delete) Appendix 13 in the *Radio Regulations* as part of a simplification of the GMDSS and non GMDSS regulations. Refer to No. 30 and 33.

The various forms of amplitude modulation are shown in Figure 6.

Frequency Modulation (FM) - in this system the frequency of the radio frequency carrier is modulated or varied by the audio signal. As FM produces high quality sound, given sufficient bandwidth, it is used in television and radio broadcasting (e.g. FM stereo).

FM is not used on marine MF or HF frequencies. A close variant of FM, called Phase Modulation (PM), is used exclusively on the VHF marine band.

2.7.3 Narrow Band Direct Printing (NBDP)

This system, also known as radio telex, is based on various combinations of two tones being sent over a radio link. Each specific tone combination represents different letters of the alphabet and figures 0 - 9. The modulation methods used for NBDP are very similar to those used in SSB or FM. The tones from a telex terminal are applied to the transmitter, which modulates them on a carrier in the same fashion as a voice signal. The receiver demodulates the tones, which are fed to the telex receiving equipment in the same way as voice signals are fed to a loudspeaker.

NBDP is used in the MF and the HF bands for the promulgation of Maritime Safety Information (MSI-weather reports/navigation warnings) and distress and safety communications. It is not used on the VHF marine band.

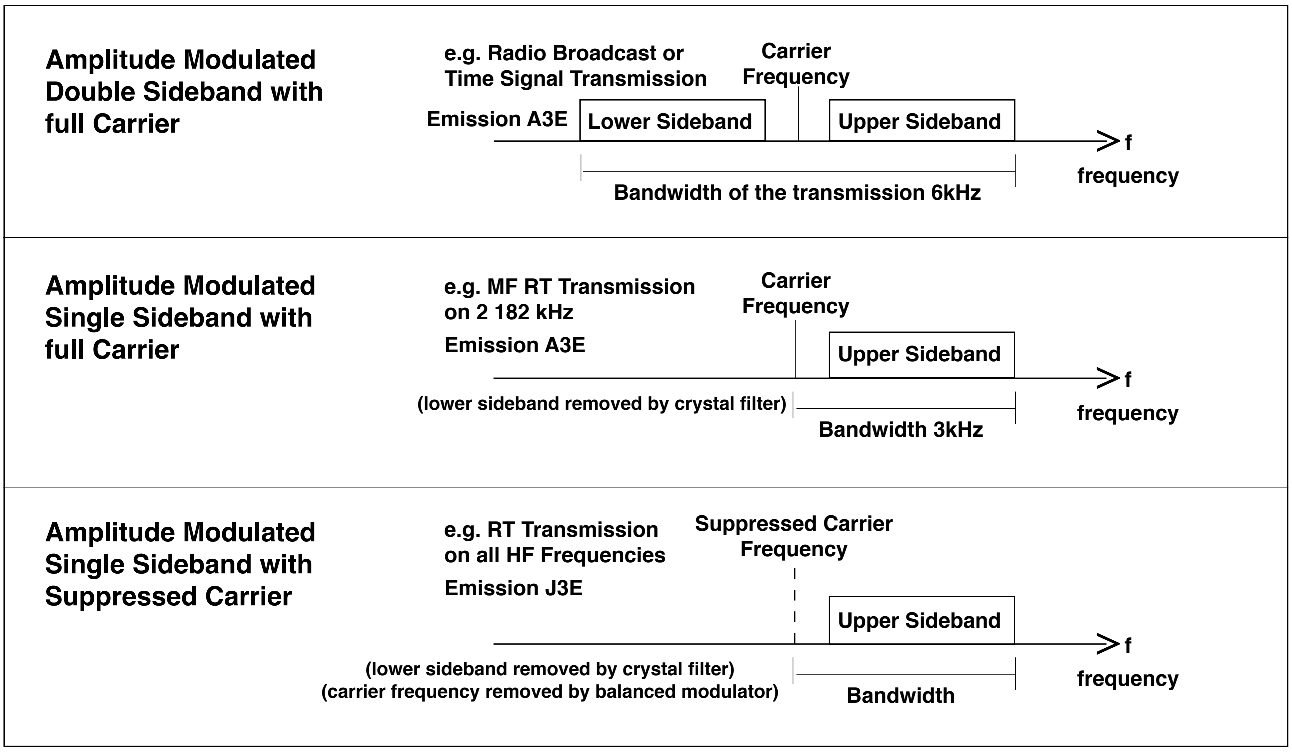


Figure 6 - Various forms of amplitude modulation

2.7.4 Digital Selective Calling (DSC)

DSC is a paging technique used to automate the initial call between two stations. The technical principles are almost identical to NBDP, in that tone information is transmitted from one DSC system to another over a radio link.

DSC is used in the MF, HF and VHF marine bands for distress, urgency and safety alerting.

VHF DSC systems operate at far greater speed than MF or HF systems - 1 200 bits of information per second on VHF, 100 bits of information per second on MF / HF.

2.7.5 Bandwidth of emissions

The bandwidth of a signal is the amount of Radio Frequency spectrum occupied by that signal. Different modulation methods produce different bandwidths. Typical bandwidths for the various forms of modulation in maritime are:

FM – up to 10 kHz (however signals of up to 16 kHz may be accommodated)

AM – 3 kHz

SSB – up to 3 kHz

NBDP and DSC – 170 Hz

2.7.6 Classification and designation of emissions

Appendix 1 of the ITU *Radio Regulations* establishes a system of identifying radio emissions by designating the bandwidth and classifying the characteristics of the emission. As such an emission can be identified in terms of:

- The bandwidth allocated;
- The characteristics of the modulation and the modulating signal; and
- Any additional characteristics.

A total of nine letters and figures can be used to classify a radio emission, the first four indicating the bandwidth, and the next three the modulation characteristics. The last two characters are optional and may be used to identify the details of the signal and the nature of multiplexing where appropriate. The first two groups of characters are of greatest relevance to the GMDSS, an example of how these groups are employed is demonstrated below:

From the emission classified as:

2K80J3E

Bandwidth

The first four characters (2K80) designate a bandwidth of 2.8 kHz.

Classification

The next three characters give the:

1. Type of Modulation of the main carrier;
2. Nature of signal modulating the main carrier; and
3. The type of information to be transmitted.

For the example J3E this corresponds to:
J = single sideband, suppressed carrier
3 = single channel containing analogue information
E = telephony

The following simplified designators are commonly used in the GMDSS:

J3E = Single sideband (SSB)

F3E = Frequency modulation (FM)

G3E = Phase modulation used on VHF

F1B or J2B = Narrow Band Direct Printing (NBDP) or Digital Selective Calling (DSC)

F3C = Facsimile (Fax)

A complete list of emission designators may be found in the Manual for use by the *Maritime Mobile and Maritime Mobile - Satellite Services* (detailed in Appendix 1, Section II). This publication is carried by all GMDSS vessels.

2.7.7 Australian GMDSS terrestrial network

The Australian GMDSS HF Digital Selective Calling (DSC) network is provided under contract to the Commonwealth by Kordia Solutions Pty Ltd, with remote-controlled stations located at Charleville, Queensland and Wiluna, Western Australia. The stations are controlled from a single manned network control centre located in Canberra as shown in Figure 7.

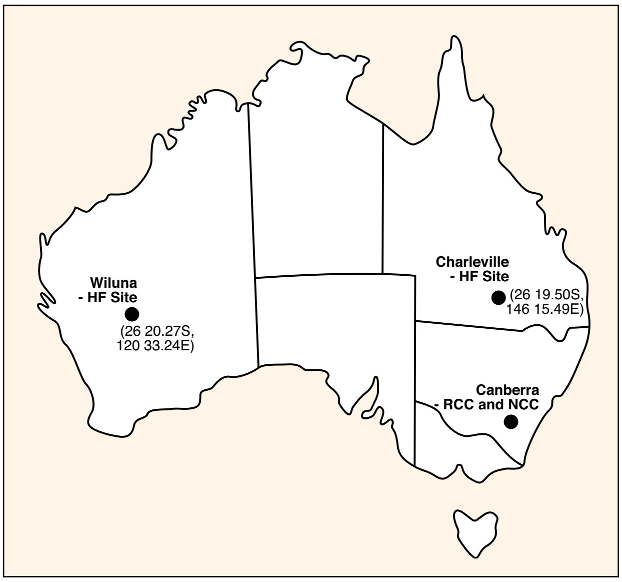


Figure 7 - Australian GMDSS Terrestrial Network

The services provided by the Commonwealth are significantly different to those previously provided prior to 1 July 2002 in that only services necessary to meet Australia's GMDSS obligations required under the ITU Conventions and SOLAS are supported.

The network consists of a HF DSC alerting network with the ability to provide follow-on HF voice or NBDP communications on at least two frequencies simultaneously. The network is centrally controlled and operated from Canberra alongside the RCC with all HF sites being unmanned. The sites are linked to the Network Control Centre (NCC) and the RCC directly by a Ku-band satellite and indirectly by a C-band satellite via the DRF site as shown in Figure 8.

The Bureau of Meteorology has established transmit sites at Charleville (VMC – "Weather East") and Wiluna (VMW – "Weather West") for the provision of voice and weather fax broadcasts. This service is co-located with the Australian Maritime Safety Authority's GMDSS Digital Selective Calling (DSC) network, and uses common linking equipment to the operations centre in Canberra. The weather service uses dedicated 1 kW transmitters with high and low- angle take-off omni-directional antennas.

Details of the services and frequencies provided by the Bureau of Meteorology are provided on the Bureau's web site: www.bom.gov.au/marine

For GMDSS-compliant and GMDSS-compatible vessels, all the high-seas weather information provided by the Bureau of Meteorology MF/HF service is also provided via Inmarsat-C EGC.

The Australian GMDSS HF Digital Selective Calling DSC network, MMSI 005030001 and station callsign (VIC) are used for communicating with either location. The Australian GMDSS HF Digital Selective Calling DSC network does not provide voice watchkeeping on the distress radiotelephony frequencies. MSI is transmitted via Inmarsat-C EGC only.

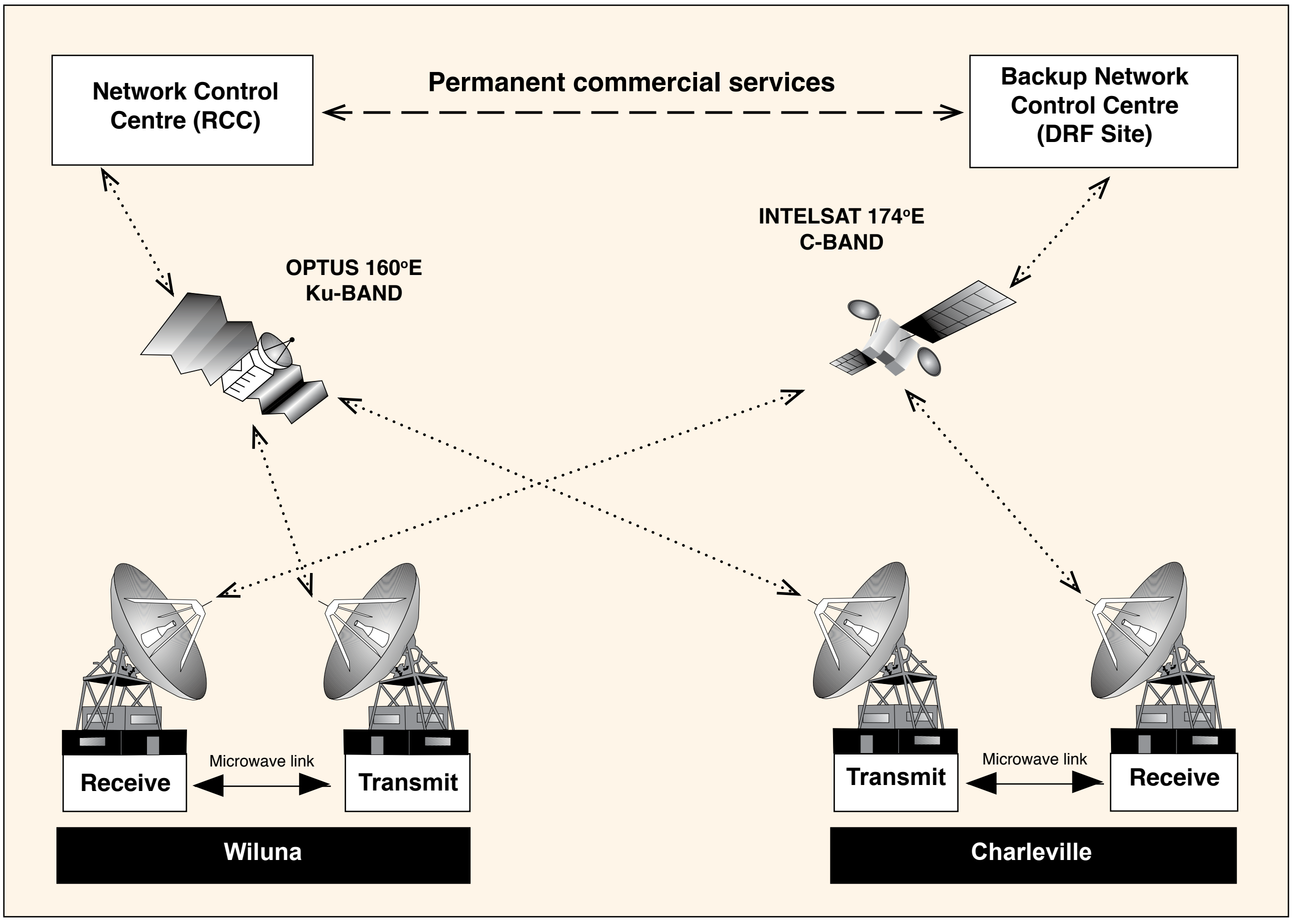


Figure 8 - AMSA HF DSC Network

3 GENERAL FEATURES AND PRINCIPLES OF THE MARITIME MOBILE AND MARITIME MOBILE-SATELLITE SERVICES

3.1 FUNCTIONAL REQUIREMENTS OF SHIP STATIONS

3.1.1 Regulatory requirements

The GMDSS regulations, as detailed in the International SOLAS Convention (see Chapter 1, Section 1.6) require that every ship shall be capable of:

- Transmitting ship–to–shore Distress Alerts by at least two separate and independent means, each using a different radio communication service;
- Receiving shore–to–ship Distress Alerts;
- Transmitting and receiving ship–to–ship Distress Alerts;
- Transmitting and receiving search and rescue coordinating communications;
- Transmitting and receiving on–scene communications;
- Transmitting and receiving locating signals;
- Receiving maritime safety information;
- Transmitting and receiving general radio communications relating to the management and operation of the vessel; and
- Transmitting and receiving bridge–to–bridge communications.

Equipment performing the functions detailed above must be simple to operate and, wherever appropriate, be designed for unattended operation. In addition, Distress Alerts must be able to be initiated from the position from which the ship is normally navigated (i.e. the bridge).

The GMDSS combines various sub-systems - all of which have different limitations with respect to coverage - into one overall system. The following sections summarise the various GMDSS sub-systems.

3.1.2 Terrestrial communications - long range

Long range services are provided by the use of High Frequencies (HF). As detailed in Appendix 2, frequencies have been designated in the 4, 6, 8, 12 and 16 MHz HF marine bands to provide means for transmitting and receiving Distress Alerts and for passing distress and safety traffic. Initial calls to and from ships are normally performed by Digital Selective Calling (DSC) techniques, and the subsequent communications by either radiotelephony or NBDP. Frequencies are also available for commercial traffic and the dissemination of Maritime Safety Information.

3.1.3 Terrestrial communications - medium range

MF radiocommunications provide the medium range service. In the ship-to-shore, ship-to-ship, and shore-to ship direction, 2 187.5 kHz is used for distress alerts and safety calls using DSC. As Australia is a designated A3 Sea Area, MF DSC is only used in our ocean region for ship-to-ship alerting. DSC is used for initial calls to and from ships, followed by communications via radiotelephony or NBDP on the designated channel as indicated in the DSC message.

3.1.4 Terrestrial communications - short range

Short range services are provided by the use of Very High Frequencies (VHF). DSC is used for initial calls, followed by communications on radiotelephony (NBDP is not used on VHF). VHF DSC is not provided from official shore stations in Australia, but some limited coast stations may monitor DSC on a voluntary basis, and is used primarily for ship-to-ship alerting in Australian waters. VHF voice is also used for on-scene distress communications to and from survival craft.

3.1.5 Satellite communications - Inmarsat

Satellite communications are used in both ship-shore and shore-ship directions.

3.1.6 Ship and shore distress alerting

The GMDSS enables a ship in distress to send a message in various ways, and be virtually certain that the message will be received and acted upon. The distress, urgency or safety message will be picked up by ships in the area, and by shore stations in range (as with the original system), if sent on MF, HF or VHF DSC. It will be picked up by MRCCs if transmitted by Inmarsat or satellite distress beacons, and relayed to coast stations and ship stations as required in these cases.

3.2 EQUIPMENT CARRIAGE REQUIREMENTS FOR SOLAS VESSELS

3.2.1 Introduction

Equipment requirements for GMDSS vessels vary according to the area (or areas) in which a ship operates. Coastal vessels, for example, only have to carry minimal equipment if they do not operate beyond the range of shore based VHF stations (Sea Area A1). Ships which trade further from land are required to carry MF equipment in addition to VHF (sea area A2). Ships which operate beyond MF range are required to carry HF and/or Inmarsat equipment in addition to VHF and MF (sea areas A3 and A4).

3.2.2 Minimum requirements

Every GMDSS ship is required to carry the following minimum equipment (as defined by SOLAS Chapter IV, regulation 7):

- A VHF radio installation capable of transmitting DSC on channel 70, and radiotelephony on channels 16, 13 and 6;
- A SART (Two on vessels over 500 GRT, one on vessels 300 - 500 GRT);
- A NAVTEX receiver, if the ship is engaged on voyages in any area where a NAVTEX service is provided;
- An Inmarsat EGC receiver, if the ship is engaged on voyages in any area of Inmarsat coverage where MSI services are not provided by NAVTEX or HF NBDP; and
- A 406 MHz EPIRB. Vessels trading exclusively in sea area A1 may fit a VHF DSC EPIRB in lieu of a 406 MHz EPIRB).

3.2.2.1 Passenger ships

Every passenger ship shall be provided with means of two-way on-scene radio-communications for search and rescue purposes using the aeronautical frequencies 121.5 MHz and 123.1 MHz from the position from which the ship is normally navigated.

3.2.3 Equipment carriage requirements for GMDSS sea areas

The carriage requirements for the various GMDSS sea areas are defined in the following regulations taken from SOLAS Chapter IV. Detailed guidelines when implementing new GMDSS installations on board SOLAS ships should be referred to COMSAR/Circ.32.

Radio equipment – sea area A1

In addition to carrying the equipment listed in Section 3.2.2 every ship engaged on voyages exclusively in sea area A1 shall be provided with either of the following installations for the transmission of ship- shore Distress Alerts:

- **A 406 MHz EPIRB**, (which may be the one specified in Section 3.2.2) installed close to, or capable of remote activation from the position from which the ship is normally navigated;

OR

- **A VHF DSC EPIRB**, installed close to, or capable of remote activation from the position from which the ship is normally navigated;

OR

- **A MF DSC System**, if the ship is engaged on voyages within coverage of MF coast stations equipped with DSC;

OR

- **A HF DSC System**;

OR

- **An Inmarsat ship earth station.***

** This requirement can be met by Inmarsat ship earth stations capable of two-way communications, such as Inmarsat-B, Fleet 77 or Inmarsat-C ship earth stations. Unless otherwise specified, this footnote applies to all requirements for an Inmarsat ship earth station prescribed by this chapter.*

Radio Equipment - sea areas A1 and A2

In addition to carrying the equipment listed in Section 3.2.2, every ship engaged on voyages **beyond sea area A1, but remaining within sea area A2**, shall be provided with:

- **An MF radio installation** capable of transmitting and receiving, for distress and safety purposes, on the frequencies:
  - 2 187.5 kHz using DSC; and
  - 2 182 kHz using radiotelephony.
- **A DSC watchkeeping receiver operating on 2 187.5 kHz**

Means of initiating the transmission of ship-to shore Distress Alerts by a radio service other than MF, either:

- **A 406 MHz EPIRB**, (which may be the one specified in Section 3.2.2) installed close to, or capable of remote activation from the position from which the ship is normally navigated;

OR

- **A HF DSC system**;

OR

- **An Inmarsat ship earth station;***

OR

- The ship shall, in addition, be capable of transmitting and receiving general radio-communications using radiotelephony or direct-printing telegraphy by either:

- A HF radio installation operating on working frequencies in the bands between 1 605 kHz and 4 000 kHz or between 4 000 kHz and 27 500 kHz. This requirement may be fulfilled by the addition of this capability in the MF equipment referred to earlier;

OR

- An Inmarsat ship earth station.*

** This requirement can be met by Inmarsat ship earth stations capable of two-way communications such as Inmarsat-B, Fleet 77 or Inmarsat-C ship earth stations. Unless otherwise specified, this footnote applies to all requirements for an Inmarsat ship earth station prescribed by this chapter.*

Radio equipment - sea areas A1, A2 and A3

These vessels have two broad options to satisfy their GMDSS requirements. The options allow a vessel to choose the primary method to be used for ship-shore alerting:

OPTION 1

In addition to carrying the equipment listed in Section 3.2.2, every ship engaged on voyages **beyond sea areas A1 and A2, but remaining within sea area A3**, shall, **if it does not comply with the requirements of Option 2**, be provided with:

- **An Inmarsat-C ship earth station;**
- **An MF radio installation** capable of transmitting and receiving, for distress and safety purposes, on the frequencies:
  - 2 187.5 kHz using DSC; and
  - 2 182 kHz using radiotelephony.
- **A DSC watchkeeping receiver** operating on 2187.5 kHz.

Means of initiating the transmission of ship-to-shore Distress Alerts by either:

- A **406 MHz EPIRB**, (which may be the one specified in Section 3.2.2) installed close to, or capable of remote activation from the position from which the ship is normally navigated;

OR

- **A HF DSC system.**

OR

OPTION 2

In addition to carrying the equipment listed in Section 3.2.2, every ship engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of Option 1, be provided with:

- An MF/HF radio installation capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1 605 kHz and 4 000 kHz and between 4 000 kHz and 27 500 kHz: using DSC, radiotelephony; and NBDP.
- **An MF/HF DSC watchkeeping receiver** capable of maintaining DSC watch on 2 187.5 kHz, 8 414.5 kHz and on at least one of the distress and safety DSC frequencies 4 207.5 kHz, 6 312 kHz, 12 577 kHz or 16 804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies.

Means of initiating the transmission of ship-to-shore Distress Alerts by a radiocommunication service other than HF, either:

- **A 406 MHz EPIRB**, (which may be the one specified in Section 3.2.2) installed close to, or capable of remote activation from the position which the ship is normally navigated;

OR

- **An Inmarsat ship earth station.***

In addition, ships shall be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on working frequencies in the bands between 1 605 kHz and 4 000 kHz and between 4000 kHz and 27 500 kHz. This requirement may be fulfilled by the addition of this capability in the MF/HF equipment referred to earlier.

** This requirement can be met by Inmarsat ship earth stations capable of two-way communications such as Inmarsat-B, Fleet 77 or Inmarsat-C ship earth stations. Unless otherwise specified, this footnote applies to all requirements for an Inmarsat ship earth station prescribed by this chapter.*

Radio equipment - sea areas A1, A2, A3 and A4

In addition to carrying the equipment listed in Section 3.2.2, every ship engaged on voyages in all sea areas shall be provided with:

- **An MF/HF radio installation** capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1 605 kHz and 4 000 kHz and between 4 000 kHz and 27 500 kHz: using DSC, radiotelephony; and NBDP.
- **An MF/HF DSC watchkeeping receiver** capable of maintaining DSC watch on 2 187.5 kHz, 8 414.5 kHz and on at least one of the distress and safety DSC frequencies 4 207.5 kHz, 6 312 kHz, 12 577 kHz or 16 804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies.

Means of initiating the transmission of ship-to- shore Distress Alerts by:

- **A 406 MHz EPIRB**, (which may be the one specified in Section 3.2.2) installed close to, or capable of remote activation from the position from which the ship is normally navigated.

In addition, ships shall be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on working frequencies in the bands between 1 605 kHz and 4 000 kHz and between 4 000 kHz and 27 500 kHz. This requirement may be fulfilled by the addition of this capability in the MF/HF equipment.

Figure 9 summarises the equipment Australian GMDSS vessels are required to carry.

Two complete VHF installations, providing radio-telephone and DSC operation *(for vessels trading to or through A1 areas, and for all vessels from 1999)*

AND

- **One 406 MHz EPIRB** (mounted in a float free bracket located close to the navigating bridge)
- **Two Search and Rescue Radar Transponders (SARTs)** (one for vessels 300-500 GRT) *or* AIS Search and Rescue Transmitters (AIS- SARTs)
- **Three portable VHF transceivers for use in survival craft** (two for vessels 300-500 GRT)

AND

A NAVTEX receiver (if the vessel trades to or through an A2 area)

AND either a combination of:

- **Two Inmarsat-C systems**
- **One MF radio system providing radiotelephone and DSC operation**
- **One MF DSC watchkeeping receiver**

OR a combination of:

- **One Inmarsat-C system**
- **One MF/HF radio system providing radiotelephone, DSC and NBDP operation**
- **One MF/HF scanning DSC watchkeeping receiver**

Figure 9 - Equipment required for Australian GMDSS vessels trading without an onboard maintainer

3.3 EQUIPMENT CARRIAGE REQUIREMENTS FOR NON-SOLAS VESSELS

As noted in Section 3.2 equipment requirements for GMDSS vessels vary according to the area (or areas) in which a ship operates. For vessels not subject to the SOLAS Convention but subject to the *Navigation Act 2012* and required to be GMDSS compatible carriage requirements are only stipulated relevant to Sea Area A3 and A4. This is because these vessels should expect to operate beyond MF ranges during domestic voyages noting that all Australian waters are designated Sea Area A3. The recommended equipment carriage requirements for non-SOLAS Vessels are contained in Appendix 7 of AMSA *Marine Order 27 (Radio Equipment) 2009*.

3.3.1 On Australian coastal voyages (Sea area A3)

Option 1

- **A VHF radio installation** with DSC capability;
- **An MF radio installation** capable of transmitting and receiving, for distress and safety purposes, on the frequencies:
  - 2 187.5 kHz using DSC; and
  - 2 182 kHz using radiotelephony;
- **A DSC watchkeeping receiver** operating on 2 187.5 kHz;
- An approved **9 GHz search and rescue radar transponder (SART) or an approved AIS Search and Rescue Transmitter (AIS-SART)**;
- **An INMARSAT ship earth station** capable of:
  - Transmitting and receiving distress and safety communications using direct-printing telegraphy;
  - Initiating and receiving distress priority calls;
  - Transmitting and receiving general radio communications, using either radio-telephony or direct-printing telegraphy; and
  - Receiving Maritime Safety Information (MSI) using enhanced group calling.
- An approved **406 MHz EPIRB**; and
- **A hand held VHF radiotelephone apparatus** fitted with VHF channels 6, 13, 16 and 67.

Option 2

- **A VHF radio installation** with DSC capability;
- **An MF/HF radio installation** capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1 605 kHz and 4 000 kHz and between 4 000 kHz and 27 500 kHz: using DSC and radiotelephony;
- **An MF/HF DSC watchkeeping receiver** capable of maintaining DSC watch on 2 187.5 kHz, 8 414.5 kHz and on at least one of the distress and safety DSC frequencies 4 207.5 kHz, 6 312 kHz, 12 577 kHz or 16 804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies;
- An approved **9 GHz search and rescue radar transponder (SART) or an approved AIS Search and Rescue Transmitter (AIS-SART)**;

- **An INMARSAT ship earth station** capable of receiving Maritime Safety Information (MSI) using enhanced group calling;
- An approved **406 MHz EPIRB**; and
- **A hand held VHF radiotelephone apparatus** fitted with VHF channels 6, 13, 16 and 67.

3.3.2 On international voyages (Sea area A3)

Non-SOLAS vessels shall be required to be fitted with, in addition to equipment listed at 3.3.1 above, a NAVTEX receiver when operating in NAVTEX areas.

3.3.3 On voyages in sea area A4

- **A VHF radio installation** with DSC capability;
- **An MF/HF radio installation** capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1 605 kHz and 4 000 kHz and between 4 000 kHz and 27 500 kHz: using DSC, radiotelephony and NBDP;
- **An MF/HF DSC watchkeeping receiver** capable of maintaining DSC watch on 2 187.5 kHz, 8 414.5 kHz and on at least one of the distress and safety DSC frequencies 4 207.5 kHz, 6 312 kHz, 12 577 kHz or 16 804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies;
- An approved **9 GHz search and rescue radar transponder (SART) or an approved AIS Search and Rescue Transmitter (AIS-SART)**;
- **An INMARSAT ship earth station** capable of receiving Maritime Safety Information (MSI) using enhanced group calling;
- An approved **406 MHz EPIRB**; and
- **A hand held VHF radiotelephone apparatus** fitted with VHF channels 6, 13, 16 and 67.

Note: GMDSS ships are required to monitor VHF channel 16 'where practicable'. Watchkeeping on channel 16 is to continue until further notice.

3.4 TYPES OF ALERTING FROM GMDSS VESSELS

3.4.1 Types of alerts

There are two ways in which a distressed GMDSS vessel may broadcast a distress message:

- **Ship to shore alerts** - are directed via Coast Stations and Land Earth Stations to the nearest Rescue Coordination Centre (RCC). The RCC for the Australian area is located in Canberra, operated by the Australian Maritime Safety Authority (AMSA). It is connected by landline to the Australian Land Earth Station at Perth, as well as the Australian GMDSS HF DSC network.

  Ship to shore Distress Alerts may be sent either:
  - Using VHF DSC (for ships in A1 sea areas);
  - Using MF DSC (for ships in A2 sea areas);
  - Using HF DSC (for ships in A3 and A4 sea areas); or
  - Via one of the two satellite systems (Inmarsat or COSPAS-SARSAT).

  Surrounding ships will not directly receive the message if sent via one of the two satellite systems, as the systems pass it directly to the nearest RCC. Distress alerts sent via HF DSC are received by suitably equipped coast radio stations, and passed to the nearest RCC. Once the RCC has received the message, it will re-broadcast it to all ships in the area via Inmarsat satellite, and/or terrestrial radio from the nearest coast radio station.

- **Ship to ship alerts** - are sent using terrestrial radio on a VHF and/or MF frequency, using Digital Selective Calling (DSC). All ships in range will receive the call, range being determined by frequency band used. In addition, the nearest coast radio station may receive the call - depending again upon the distance and frequency used.

3.4.2 Methods of sending alerts

Specific methods for sending Distress Alerts will vary depending upon the vessels area of operation, and are summarised as follows:

Area A1 - ships will transmit a ship-ship and ship-shore alert on VHF channel 70, using DSC or by a VHF DSC EPIRB. Other ships in range, and the nearest coast radio station will receive the call directly.

Area A2 - ships will transmit a ship-ship and ship-shore alert on MF DSC. All ships and coast stations in range will receive the call, as for area A1. Ships may also transmit a ship-shore alert via satellite EPIRB.

Area A3 - ships will transmit a ship-ship alert on VHF/MF DSC and a ship-shore alert either via Inmarsat-C or HF DSC and satellite EPIRB.

Area A4 - ships will transmit a ship-ship alert on VHF/MF DSC and a ship-shore alert on one of the higher HF DSC frequencies (8, 12 or 16 MHz). In addition, a ship- shore alert will be sent via Cospas-Sarsat EPIRB.

3.5 WATCHKEEPING ON DISTRESS FREQUENCIES

3.5.1 Requirements

Every GMDSS ship, whilst at sea shall maintain a continuous watch:

- On VHF DSC channel 70
- On VHF channel 16 where practicable.
- On the 2 MHz DSC frequency of 2 187.5 kHz, if the ship is required to be fitted with MF DSC facilities.
- On 8 MHz and at least one of the 4, 6, 12 or 16 MHz HF DSC distress frequencies (as appropriate for the time of the day and the position of the ship) if the ship is required to be fitted with HF DSC facilities. This watch may be kept by means of a scanning receiver (see Section 8.3.2).
- For Inmarsat shore-to-ship Distress Alerts, if the ship is required to be fitted with an Inmarsat ship earth station.
- For Maritime Safety Information broadcasts, using the appropriate system(s) with which the ship is equipped (e.g. NAVTEX, EGC or NBDP).

These watches must be kept from the position from which the vessel is normally navigated.

3.5.2 Suggested frequencies for DSC watchkeeping

Table 1 is a guide to channel selection for Australian coastal trading GMDSS vessels required to scan HF DSC channels. For those with on line access more specific information can be obtained from the IPS Client HAPS charts as detailed in Section 2.5.5.

Note: 2 187.5 kHz watchkeeping is mandatory for all vessels. For vessels equipped with HF, 8 414.5 kHz watchkeeping is mandatory.

3.6 SOURCES OF ENERGY OF SHIP STATIONS

3.6.1 Power sources

GMDSS equipment is required to be powered from:

- The ship's main source (normal alternators or generators);
- The ship's emergency source (emergency generator - if fitted); and
- A dedicated radio battery supply.

When the reserve source of power consists of rechargeable batteries, the arrangement may consist either of batteries used solely in the absence of ship's power supply or of batteries used in an uninterruptible power supply (UPS) configuration. (See Section 16.6.3).

3.6.2 Battery supply capacity

The battery supply referred to above is required to supply the GMDSS equipment for a period of:

- 1 h, for ships fitted with an approved emergency generator; and
- 6 h, for ships not fitted with an approved emergency generator.

3.6.3 Battery charging facilities

An automatic battery charger, capable of charging GMDSS radio batteries to minimum capacity requirements within 10 h, and maintaining the charge state must be fitted. Australian GMDSS vessels are fitted with an audible and visual alarm to indicate failure of this battery charger. The audible alarm may be reset but the visual alarm cannot be reset until the fault has been rectified.

Full details of recommended GMDSS power supplies and configuration are contained in IMO COMSAR/Circ.16. This is reproduced at Appendix 7.

Location/Time	Suggested HF DSC distress channels to be monitored (kHz)		
All areas - Night	4 207.5	6 312	8 414.5
Bass Strait - Day	8 414.5	12 577	16 804.5
East Coast and Tasman Sea - Day	8 414.5	12 577	16 804.5
Remote parts of the Australian coast - Day	8 414.5	12 577	16 804.5

Table 1 - Frequencies for DSC Watchkeeping

3.7 MEANS OF ENSURING AVAILABILITY OF SHIP STATION EQUIPMENT (SOLAS VESSELS ONLY)

3.7.1 Methods

There are three methods used to ensure availability of GMDSS radio services:

- At sea electronic maintenance, requiring the carriage of a qualified radio/electronic officer (holding a GMDSS First or Second Class Radio-Electronic Certificate) and adequate spares, manuals and test equipment; or
- Duplication of certain equipment; or
- Shore-based maintenance.

3.7.2 Sea area requirements

Ships engaged on voyages in sea areas A1 and A2 are required to use at least one of the three maintenance methods outlined above, or a combination as may be approved by their flag administration. Ships engaged on voyages in sea areas A3 and A4 are required to use at least two of the methods outlined above.

3.7.3 Equipment to be duplicated for area A3 vessels

If a vessel operating in sea area A3 uses duplication of equipment as one of the two methods used to guarantee availability of radio services, the following duplicated equipment is required to be carried:

Two complete VHF installations (including DSC), and either:

- Two complete Inmarsat-C systems; or
- One complete Inmarsat-C system and one complete MF/HF radio system (including scanning DSC receiver and NBDP equipment).

3.8 OPERATOR QUALIFICATIONS

3.8.1 General requirements

Australia is a member of the International Telecommunication Union (ITU), the international body established to provide standardised communications procedures, usage of frequencies and regulations on a world-wide basis.

All Australian GMDSS equipped ship stations must be under the control of a person holding a valid operator's certificate issued in accordance with ITU regulations and the Commonwealth's *Radiocommunications Act 1992*.

The categories of operators' certificates valid for GMDSS-equipped ships are:

- First Class Radio-Electronic Certificate;
- Second Class Radio-Electronic Certificate; and
- GMDSS General Operator's Certificate.

3.8.2 Technical qualifications

The First and Second Class Radio-Electronic Certificates are technical qualifications. They are relevant to personnel aboard GMDSS vessels where an on-board maintainer must be carried.

Information concerning training and examination for the First and Second Class Radio-Electronic Certificates should be sought from the:
Admissions Officer,
Australian Maritime College,
PO Box 986, Launceston, Tasmania 7250.

3.8.3 Non-technical qualification

The GMDSS General Operator's Certificate is a non-technical qualification and is relevant to:

- Vessels subject to the Commonwealth's *Navigation Act 2012* where an on-board maintainer is not carried (i.e. where duplication of most GMDSS equipment must be provided); and
- Vessels voluntarily equipped with GMDSS equipment.

3.8.4 Australian Navigation Act operator requirements

An Australian GMDSS vessel which uses equipment duplication and therefore does not require an on–board maintainer, must carry the following qualified operators:

- For a non–passenger ship, every person in charge of a navigational watch must hold a valid GMDSS General Operator's Certificate.
- For a passenger ship, in addition to the above requirements, one person other than the Master or a Deck Officer must also hold a valid GMDSS General Operator's Certificate, although this may be waived if AMSA is satisfied that there are enough GMDSS GOCs on board.

On all GMDSS ships, one of the holders of the GMDSS General Operator's certificate must be designated on the ship's muster list as having primary responsibility for radiocommunications during distress incidents.

An Australian GMDSS vessel which does not use equipment duplication must carry one person holding a valid GMDSS First or Second Class Radio–Electronic Certificate.

Radio operator qualifications are covered under AMSA *Marine Order 6 (Marine radio qualifications) 2000*.

3.9 LICENCES, SAFETY RADIO CERTIFICATES, INSPECTION AND SURVEYS

3.9.1 The SOLAS Convention

Contracting governments to the International Convention for the Safety of Life at Sea (SOLAS) base their own national marine radio regulations on the corresponding SOLAS regulations. AMSA Marine Orders are based on the applicable chapters of the SOLAS regulations and Seafarers' Training, Certification and Watchkeeping (STCW) Code.

Radio equipment is covered in Marine Order 27. GMDSS requirements are also mentioned in some way in Marine Order 21, 25, 28 and 62.

3.9.2 Annual radio surveys

The SOLAS convention sets down survey requirements leading to the issue of statutory radio certificates to ships as part of their international certification. The radio equipment may be surveyed at a 12 month or five year interval for the re–issue of this statutory certificate. Where a five year interval is used the equipment must be inspected annually and the certificate endorsed.

On completion of a successful survey, vessels are issued annual Safety Radio Certificates to indicate conformity with the applicable SOLAS regulation or regulations. The certificate includes details of the equipment required to satisfy various functions, contained in a Record of Equipment attached to the Safety Radio Certificate.

All GMDSS equipment used on Australian vessels must be of a type approved by AMSA and/or the nine major Class Societies; American Bureau of Shipping (ABS), Bureau Veritas (BV), China Classification Society (CCS), Det Norske Veritas (DNV), Germanischer Lloyd (GL), Korean Register of Shipping (KR), Lloyds Register (LR), Nippon Kaiji Kyokai (NKK) and RINA Services S.p.A, for ship station use. The equipment is required to meet the relevant performance standards and configuration requirements specified in AMSA Marine Orders.

3.9.3 Equipment licensing

All transmitting equipment (including Inmarsat equipment) on board ship stations is required to be licensed by the Australian Communications and Media Authority (ACMA). Some equipment (e.g. MF/HF equipment) is covered under a Maritime Ship Station Licence, and the remainder (such as Inmarsat terminals, VHF, AIS, radars and EPIRBs) are covered under Class Licences.

Unless covered under a Class Licence, under the *Radiocommunications Act 1992*, a station licence issued by the ACMA is necessary before radio transmitting equipment is installed or used on any Australian vessel. Application for a licence may be made in person at any ACMA office. Alternatively, a completed application form with the appropriate licence fee may be submitted through the post, fax or e-mail.

The Maritime Ship Licence will show the station licensee, the name and call sign of the ship and the conditions under which the station must be operated. The station licensee is legally obliged to ensure that these licence conditions are observed, such as preserving the secrecy of communications (see Section 18.3.2).

A ship station licence cannot be transferred to another person, business or company. It is the responsibility of the purchaser of a vessel equipped with marine radio transmitting equipment to make application to the ACMA for a ship station licence.

3.9.4 Licensing of other shipboard radiocommunication equipment

The *Radiocommunications Act 1992* requires that all radio transmitters be licensed unless exempted under the Act.

Amateur band or land mobile equipment installed on a vessel is not covered by a ship station licence and must be licensed separately. The use of cellular telephones on board vessels is authorised by transmitting licences held by the service provider.

Emergency Position Indicating Radio Beacons (EPIRBs) do not require separate licencing since they are covered under a Class Licence.

3.9.5 Restrictions to the use of shipboard radio equipment

Due to risk of explosion, radio transmissions must not be made, and all transmitting antennas must be earthed (with the exception of VHF antennas, and Inmarsat antennas) when a vessel is loading fuel, or when loading or discharging any flammable cargo. Vessels should consult local port or shore terminal guides to verify which equipment cannot be used, or switched to low power when in port of alongside. Some foreign administrations may also prohibit the use of shipboard radio equipment in their ports.

3.10 SHIP STATION IDENTIFICATION

A ship station licence issued by ACMA to an Australian vessel will show the official international radio call sign allocated to the ship.

Each radio call sign is unique and may consist of five letters or a combination of letters and figures. Call signs for Australian vessels participating in the GMDSS are usually assigned a call sign which is a combination of four letters commencing with the letters 'VJ, VK,VL, VM, VN or VZ' (these are licensed by the ACMA as ship stations Class C. However there are occasional exceptions for some SOLAS vessels on the coastal trade, where a seven-character format is in use, with two letters as above, followed by another letter (which can be any letter), followed by four numerals (These vessels are licensed at ship stations Class B).

The radio call sign must be used whenever conducting communications by radiotelephony.

Transmissions from VHF radio equipment aboard survival craft should be identified by the use of the parent vessel's call sign followed by two digits (other than 0 or 1 where they follow a letter, refer to ITU *Radio Regulations* No. 19.60). The numbers 22 are normally used.

406 MHz EPIRBs are identified by a unique beacon identification code which includes a 3–digit country identifier.

A maritime mobile service identity (MMSI) is necessary for DSC operations and will be assigned on application to the Rescue Coordination Centre located in the Australian Maritime Safety Authority Head office in Canberra, freecall number 1800 406 406 from within Australia.

In Australia, Inmarsat issues Inmarsat Mobile Numbers (IMN) to ships for use with marine satellite communications equipment.

4 INTRODUCTION TO THE INMARSAT SYSTEM AND THE MARITIME MOBILE-SATELLITE SERVICE

4.1 MARITIME SATELLITE COMMUNICATIONS

4.1.1 Inmarsat

Inmarsat's primary satellite constellation consists of four satellites in geostationary orbit, covering the surface of the earth up to latitude 76 degrees North/ South, comprising IMO sea area A3. The Inmarsat system provides voice, e-mail, telex, data and facsimile services to shipping. The system also incorporates distress and safety communications services.

The Inmarsat services in Australia are provided via the Perth Land Earth Station (LES) in Western Australia and linked also to the Burum Land Earth Station in the Netherlands.

4.1.2 System overview

The Inmarsat system employs four operational satellites in geostationary orbit approximately 36,000 kilometres above the equator, over the Atlantic, Indian and Pacific Oceans, providing overlapping coverage. The service delivers high quality communications on a 24 hour a day basis. Back-up satellites are ready for use if necessary.

A geostationary satellite follows a circular orbit in the plane of the Equator so that it appears to stay stationary with respect to the Earth's surface.

Powered by solar energy, each satellite acts as a transmitting and receiving station, relaying messages between stations located on the Earth's surface.

Each satellite has its own coverage area (called a 'footprint') which is that area on the Earth's surface within which an antenna can obtain a 'view' of the satellite.

The coverage chart reproduced below shows the four Inmarsat satellites and their coverage areas.

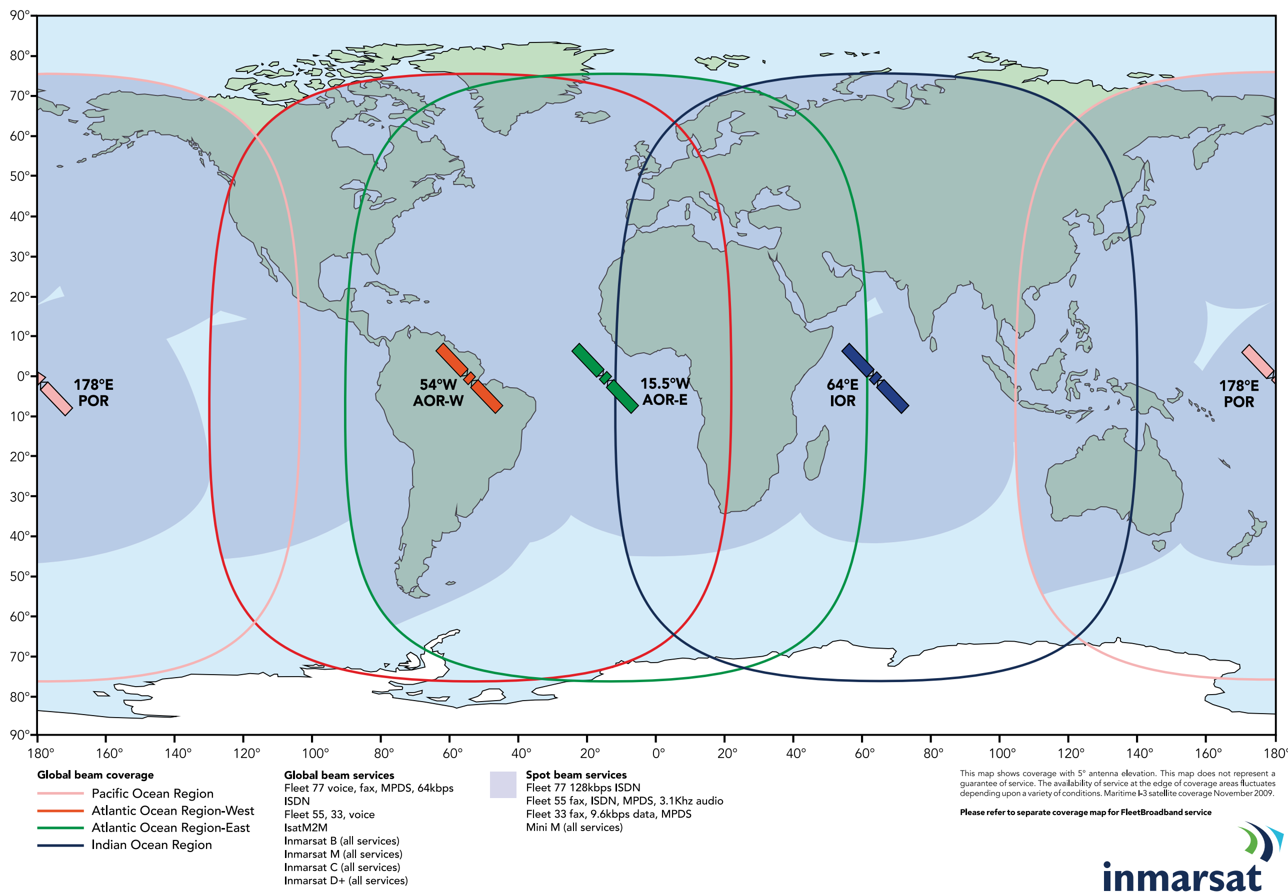


Figure 10 - Inmarsat global coverage applicable to GMDSS

It can be seen that these correspond to four ocean regions:

- Pacific Ocean (POR);
- Indian Ocean (IOR);
- Atlantic Ocean East (AOR East); and
- Atlantic Ocean West (AOR West).

Shore-to-ship communications are in the 6 GHz band (C-band) from the LES to the satellite and in the 1.5 GHz band (L-band) from satellite to ship. Ship-to-shore communications are in the 1.6 GHz band from the ship to the satellite and in the 4 GHz band (C-band) from satellite to the LES. Each satellite continuously relays a Time Division Multiplex (TDM) carrier signal from the Network Co-ordination Station (NCS). This signal is used by the ship terminals for antenna tracking and receiving channel assignment messages from the shore stations. The Inmarsat-C NCS common signalling channel is also used to broadcast maritime Safety Information to ships in addressed geographical areas.

The Inmarsat Network Operations Centre (NOC) in London, UK functions around the clock, coordinating the activities of the network coordination stations (NCSs) and the LESs in each ocean region.

4.1.3 Satellite technology

The basic concept of satellite communications involves the relay of radio signals up to a satellite where it is converted to another frequency and retransmitted in a downlink. A transponder is the device that converts the frequencies and amplifies them before retransmission back to earth.

The uplink and downlink use different frequencies to prevent interference. Signals to and from the satellite can be subject to rain interference which becomes more critical at the higher frequencies. Higher power is one way of dealing with this interference and as one has access to more power on the ground rather than on a spacecraft the frequency to the satellite is sent on the higher frequency. For example, the C-band uplink is in the 6 GHz band and the downlink is in the 4 GHz band.

4.1.4 Modes of communication

The Inmarsat system provides the following modes of communications:

- Telex, both ‘real time’ and ‘store and forward’; *(Note: Fleet77 does not support telex)*
- Voice and facsimile;
- Email, and
- Data, both ‘real time’ and ‘store and forward’.

4.1.5 Dedicated Distress button

Inmarsat GMDSS satellite terminals include a dedicated Distress button which can be used to activate the Distress alerting functions directly, which is important where time is critical. In some installations, the Distress button is combined with a Distress alarm unit, which can be located remote from the main below deck terminal installation.

4.1.6 Distress facilities

Priority distress facilities exist for both voice and data/messaging. Once the vessel in distress selects the “DISTRESS PRIORITY” mode and transmits the request channel signal, the call is automatically routed via dedicated landlines to the appropriate Maritime Rescue Co-ordination Centre (MRCC).

4.1.7 Inmarsat services

Inmarsat provides, in addition to safety services, many varied commercial applications at sea, including, Internet access, fleet monitoring, security and vessel management.

Inmarsat-B – The digital successor to Inmarsat-A, terminals offering data at speeds up to 9.6 kb/s (with a high speed option to 64 kb/s), fax at 14.4 kb/s and voice at 16 kb/s and range of other services, to/from anywhere in the world. Inmarsat-B is being displaced by Fleet77.

> Inmarsat has advised IMO that the Inmarsat-B service will be discontinued from 31 December 2014. (Please see note on inside front cover)

Fleet77 – Inmarsat Fleet77 is the successor to the Inmarsat-A and B services. In addition to PSTN voice and fax, the digital Fleet77 provides both mobile Integrated Services Digital Network (ISDN) and Mobile Packet Data Service (MPDS), The 64 kb/s ISDN channel enables large volumes of data to be transferred, also allows for internet protocol compatibility, and enhanced services at 128 kb/s are available. Compatibility with the GMDSS is a standard feature of Fleet77 and complies with the IMO Resolution A.1001(25). This means provision of Voice services with four priorities (Distress, Urgency, Safety and Routine) with pre-emption.

Fleet77 does not support telex however, which is rarely used now, and in some countries is no longer available.

Fleet55/33 – offers a combination of voice and data communications and is suited for vessels which require a small antenna lightweight deck equipment and simple hardware.

Fleet55 - provides voice (4.8 kb/s), ISDN data (64 kb/s), mobile packet data service (9.6 kb/s) and fax.

Fleet33 - provides voice (4.8 kb/s), mobile packet data service (9.6 kb/s) and fax.

FleetBroadband – At the time of publication of this Handbook, FleetBroadband has not been granted GMDSS approval, but this is expected to be achieved prior to the closure of the Inmarsat-B service on 31 December 2014 (see Section 14.4).
(Please see note on inside front cover)

Inmarsat FleetBroadband provides broadband voice and data, simultaneously using IP (internet protocol), whilst still supporting existing voice and ISDN data capability for legacy applications. It can be regarded as a follow- on from Fleet77, and supports standard IP at up to 432 kb/s on a shared channel, streaming IP on demand up to 256 kb/s, voice, ISDN 64 kb/s data and SMS (Simple Message Service) text.

It supports a non-GMDSS 505 Emergency Calling service and non-GMDSS Distress and Urgency voice calls in ship-to-shore and shore-to-ship directions. Distress test function is also available.

At the time of publication of this Handbook, Inmarsat is working on the specific elements of service and backup that would be required by IMO for FB500 terminals to be approved for use in GMDSS ship installations as required by IMO Resolution A.1001(25), and real-time, hierarchical call pre-emption will be available in both ship-to-shore and shore-to-ship.

Although the coverage is similar to the existing Inmarsat services like Inmarsat-B and Inmarsat-C, the satellite footprints for FleetBroadband are slightly different in that there are only three ocean regions, I-4 Americas (AMER), I-4 Europa, Middle East and Africa (EMEA) and I-4 Asia-Pacific (APAC). The overlap regions are different to those used for Inmarsat-B, Inmarsat-C and Inmarsat Fleet services, etc. This is because FleetBroadband services are provided via Inmarsat 4th Generation satellites.

FleetBroadband Terminals

FB500 – provides digital voice (4 kb/s), standard TCP/IP data at up to 432 kb/s, fax, and SMS messages of up to 160 characters. GMDSS approval pending at time of publication of this Handbook.

FB250 – provides FB150 - provides digital voice (4 kb/s), standard TCP/IP data at up to 284 kb/s, fax and SMS messages of up to 160 characters. Not approved for use in the GMDSS.

FB150 – provides digital voice (4 kb/s), standard TCP/IP data at up to 150 kb/s, and SMS messages of up to 160 characters. Not approved for use in the GMDSS.

Inmarsat-C – This system is the only satellite system required by the SOLAS Convention as a carriage requirement to receive Maritime Safety Information (MSI). Inmarsat-C and mini-C terminals support 5 out of 9 communications functions defined by SOLAS Chapter IV.

Communications via the Inmarsat-C system are data or message-based. Anything that can be coded into data bits can be transmitted via Inmarsat-C. Messages are transferred to and from an Inmarsat-C terminal at an information rate of 600 bits/second (b/s). Inmarsat-C can handle messages up to 32 kilobytes (kB) in length transmitted in interrogate automatic data at fixed or variable intervals.

Data reporting allows for the transmission of information in packets of data on request, or at prearranged intervals. Polling allows the user base to interrogate an MES at any time, triggering automatic transmission of the required information. Inmarsat-C does not provide voice communications.

Inmarsat mini-C – offers the same functions as Inmarsat-C depending on terminal model. Some terminals are GMDSS compatible, providing Distress calling and reception of Maritime Safety Information. Mini-C terminals are lower-power terminals than Inmarsat-C with a smaller antenna, smaller in size and with lower power consumption.

Inmarsat-M – provides digital voice and medium speed data (2.4 kb/s) in 'real time' mode for both ship-shore and shore-ship directions. Inmarsat-M is not approved for use in the GMDSS. The service will be discontinued from 31 December 2014.
(Please see note on inside front cover)

Inmarsat mini-M – provides digital voice (4.8 kb/s) and 9.6 kb/s data, mobile packet data service and fax (9.6 kb/s) in 'real time' mode for both ship-shore and shore-ship directions. Inmarsat mini-M is not approved for use in the GMDSS. The service will continue after Inmarsat-M is discontinued.
(Please see note on inside front cover)

Inmarsat-D+ – has an integral GNSS and can be used for surveillance, asset tracking and short information broadcasts. It is also suitable for use in meeting IMO requirements for Ship Security Alert Systems (SSAS). Not part of GMDSS.

Table 2 summarises some basic Inmarsat terminal ID numbering.

Number of digits in Inmarsat Mobile Number (IMN)	First digit/s of Inmarsat Mobile Number (IMN)	Inmarsat terminal type
nine	3	B (to close on 31 December 2014)*
nine	4	C and mini-C
nine	6	M (to close on 31 December 2014)*
nine	76	mini-M*
nine	76	Fleet33, 55 and 77 (Voice/9.6 kb/s data)
nine	77	FleetBroadband and FB150, FB250 and FB500
*Please see note on inside front cover		

Table 2 - Inmarsat Terminal Numbering

Inmarsat ID numbering must be prefixed with a 3-digit International Country Code - 870. Please refer to Section 7.1.13 for more information.

More information on Inmarsat terminal identification and numbering is contained in the *Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services* (refer to Recommendation ITU-R E.217).

Inmarsat terminals are also assigned an Inmarsat Serial Number (ISN). This number may need to be quoted during commissioning, and for technical support via a Land Earth Station.

4.1.8 Enhanced Group Calling (EGC) service

The Inmarsat system has a capability known as Enhanced Group Calling (EGC) which allows land based organisations (known as 'information providers') to broadcast messages to selected ships located anywhere within an ocean region. The system also allows for broadcasts to all ships within a defined geographical area. This area may be fixed, or it may be uniquely defined by the message originator. Area calls will be received automatically by all ships whose equipment has been set to the appropriate area or recognises an area by its geographic position.

The IMO requires Inmarsat's EGC service as one of the primary means of promulgating maritime safety information for the GMDSS. Australian SOLAS compliant ships are required to carry an EGC receiving facility.

A special receiver is required to receive EGC services and these are usually built into Inmarsat-C and mini-C maritime terminals.

4.2 TYPES OF STATION IN THE MARITIME MOBILE-SATELLITE SERVICE

4.2.1 Land Earth Stations (LES)

Each Inmarsat ocean region has a number of Land Earth Stations (LES), which provide the interface between ships at sea and shore-based telecommunications networks. This function is fully automated, and the LES is effectively 'transparent' as far as the system user is concerned. The Australian LES is located at Perth, Western Australia, and serves both the Indian and Pacific Ocean Regions. The Perth LES is part of the Stratos Global network, which also uses an LES at Burum in the Netherlands, giving access to the Atlantic Ocean Regions and Indian Ocean. LESs were previously known as Coast Earth Stations (CESs).

4.2.2 Network Co-ordination Stations (NCS)

Each Inmarsat ocean region has a Network Co-ordination Station (NCS) which is responsible for the overall frequency, signalling and traffic management of its respective region. This NCS function is incorporated in one of the Land Earth Stations. There are separate NCSs established in each ocean region for each Inmarsat system except FleetBroadband.

4.2.3 Ship Earth Station (SES)

The Inmarsat installation aboard a vessel is referred to as a Ship Earth Station (SES), or sometimes as a Mobile Earth Station (MES). Inmarsat equipment is installed on a wide variety of vessels, from fishing boats to very large merchant ships and naval vessels.

5 GMDSS DIGITAL SELECTIVE CALLING EQUIPMENT AND SYSTEMS

This chapter provides general guidance in the principles and operation of GMDSS Digital Selective Calling (DSC) equipment and systems. For specific operational instructions, please refer to the equipment operator's manuals carried on board your vessel.

5.1 INTRODUCTION

A Digital Selective Calling (DSC) message is a brief burst of digitised information transmitted from one station to alert another station or stations. It indicates to the receiving station(s) who is calling and the purpose of the call.

The digital techniques used in DSC systems provide higher resistance to interference and fading than would radio telephone transmissions on the same frequency. For these reasons, DSC usually provides a greater transmission range than voice modes of operation.

5.2 PURPOSE

DSC is used as a means of establishing initial contact between stations.

Following an alert by DSC message, communications must be established between the transmitting station and the receiving station(s) by either radiotelephony or NBDP.

5.3 DSC SHIPBORNE EQUIPMENT

The DSC signal processing functions are carried out by a DSC modem (modulator demodulator) or DSC controller. To enable the transmission and reception of DSC messages, the controller is electrically connected to an associated transmitter and watchkeeping receiver. Some manufacturers produce integrated DSC watchkeeping receivers and controllers in one chassis.

If transmission of a DSC alert is required, an operator can encode the DSC controller with information identifying the station (or stations) with whom communication is desired and the purpose of the call. On command, this information is fed to the transmitter for broadcasting.

Most DSC systems also control the frequency of the associated MF/HF transmitter, automatically changing it to the DSC distress frequency when a distress message is sent from the controller. All controllers feature a 'DISTRESS' button, that automatically sends a Distress Alert using pre-programmed information.

DSC controllers have provision for interfacing to ships navigational equipment (GPS, etc.), for automatic updating of position and time information.

When not transmitting, the DSC controller is connected to the DSC watchkeeping receiver (see Section 8.3.2). All DSC calls on the frequency to which the receiver is tuned are examined by the controller and, if found to be addressed to that ship, the operator is alerted by audible and visual alarms. The contents of the DSC message are available to the operator on an alphanumeric display screen, and if connected; on a printer.

The DSC distress and safety frequencies are listed below.

MF/HF DSC Distress and Safety Frequencies (in kHz)
2 187.5
4 207.5
6 312.0
8 414.5
12 577.0
16 804.5
VHF DSC Distress and Safety Channel
VHF Marine Channel 70

5.4 CALL FORMATS

The DSC call sequence is undertaken in 9 steps (refer to Recommendation ITU-R M-493-13):

1. Dot Pattern
2. Phasing Sequence
3. Format Specifier
4. Address (The station(s) being called, a specific station or ALL ships)
5. Category (The priority of the call)
6. Self-Identification
7. Messages
8. End of Sequence (EOS)
9. Error Check Character (ECC)

5.4.1 Dot pattern and phasing

As indicated in ITU–R M.493–13 the phasing sequence provides information to the receiver to permit it determine the correct bit phasing and position of characters in the call sequence (character synchronization). A message can be rejected if the correct dot pattern is not found somewhere in the phasing sequence. In order to allow MF and HF systems to monitor a number of frequencies MF/HF distress and non–distress calls to ship stations use a dot pattern with a different duration.

200 bit pattern identifies:

- Distress Alerts;
- Distress Acknowledgement;
- Distress Relay; addressed to a geographic area;
- Distress Relay Acknowledgements addressed to all ships; and
- All calls addressed to a ship station other than those specified in 20 bit pattern Identifier.

20 bit pattern identifies:

- All acknowledgements to individual calls; and
- All calling sequences to Coast Stations with format specifier 120 and 123.

5.4.2 Format specifier

The format specifier indicates the type of message (the message format) that is being transmitted. These (numbers in parentheses are the applicable ITU symbols) are:

- Distress Alert (112);
- All Ships Call (116);
- Selective Call to a group of ships having a common interest [e.g. national or commercial] (114);
- Selective Call to an individual station (120);
- Selective Call to a group of ships in a geographical area (102); and
- Selective Call to an individual station using the semi–automatic/automatic service (123).

5.4.3 Address

The address identifies the station(s) being called. Distress Alerts and All Ships calls, as identified by the call specifier, do not require a specific address as these will be accepted by all DSC systems which receive the signal. Individual calls will only be accepted by the system which has the Maritime Mobile Service Identity (MMSI) to which the call is addressed (refer to Section 5.5) or to ships in the appropriate geographical area.

Symbol No	Related To: Format Specifier
112	Distress
116	All Ships
	Selective Call to:
120	- Individual Stations
102	- Ships in a particular geographic area
114	- Ships having a common interest
123	Individual stations semi-automatic/ automatic calls

Symbol No	Related To: Nature of Distress
100	Fire, Explosion
101	Flooding
102	Collision
103	Grounding
104	Listing, in danger of capsizing
105	Sinking
106	Disabled and adrift
107	Undesignated distress
108	Abandoning ship
109	Piracy/armed robbery attack
110	Man overboard
112	EPIRB emission

Symbol No	Category
	Safety related:
112	- Distress
110	- Urgency
108	- Safety
100	- Routine

Table 3 - ITU Symbols for DSC Messages

5.4.4 Category

The category defines the degree of priority of the call sequence. For a distress alert the priority is defined by the format specific and no category information is included in the call sequence. For safety related calls the category information specifies, urgency or safety and for other calls the category information specifies routine.

For Safety related calls[1] the category information specifies. (The numbers in parentheses are the applicable ITU symbols):

- Distress (112);
- Urgency (110); and
- Safety (108).

For Other calls the category information specifies (The numbers in parentheses are the applicable ITU symbols):

- Routine (100) (see note).

Note: ROUTINE priority calls are prohibited on the MF/HF DSC distress and safety frequencies. Further details are given in Section 5.6.

5.4.5 Self-identification

The MMSI of the calling station is stored in the memory of the DSC unit and is automatically added to the message. The MMSI should be saved into the memory of the unit during installation and it should not be possible for the operator to alter it or remove it and in doing so remove the advantage of this feature.

5.4.6 Messages

The message function depends whether the call is a distress call or other type of call. (See also Section 0 in relation to test messages). For distress alerts there are four messages while other calls normally have two (refer to Rec. ITU–R M. 493–13 Section 8).

The distress call message sequence is:

- Nature of Distress (refer to Table 3).
- Ship's Position.
- Time for which position was valid in UTC.
- Telecomm and character indicating type of communication desired, telephone or FEC.

5.4.7 End of Sequence (EOS)

After the message the EOS function indicates whether a call requires acknowledgment or the call is an acknowledgment of a call received. The end of sequence symbols are:

- Call requires acknowledgment, used for individual and automatic/semi-automatic calls only (acknowledge RQ);
- Answer to a Call requiring acknowledgment (acknowledge BQ); and
- All other calls (EOS).

5.4.8 Error Check Character (ECC)

The ECC checks the DSC call for errors using a 10 unit error detecting code. Further details are available in Rec. ITU–R M.493–13.

5.5 MARITIME MOBILE SERVICE IDENTITY (MMSI)

Each ship and coast station fitted with DSC is allocated a unique 9 digit identification number, known as a Maritime Mobile Service Identity (MMSI). The MMSI is permanently programmed into the DSC equipment, and is sent automatically with each transmission.

MMSIs are allocated on an international basis, with the first three digits representing the nationality of the administration responsible for the ship. These three digits are known as the Maritime Identification Digits (MID). The Australian MID is 503. A typical Australian MMSI would be:

503001000

MMSIs allocated to a coast radio station always commence with two leading zeros. For example, the Australian Maritime Communications Stations controlled from RCC Australia have a MMSI of:

005030001

Group MMSI numbers begin with a single 0 before the MID.

Group MMSIs can be manually programmed into a DSC-equipped radio by the user at will (unlike the self- ID). Any number with a leading zero can be used as a Group MMSI, and they do not need to be registered, but the entity deciding on a group MMSI should use the MID of the host country. Group MMSIs are finding use by fleets and yacht races. Safety and Urgency calls ('Announcements') can be sent to a Group MMSI. Each vessel desiring to be part of a group would enter the same group MMSI into their DSC equipment, which usually can be named for convenience by the user.

[1] At the ITU WRC-07, it was agreed that Distress DSC calls are to be called 'Distress Alerts' and Urgency and Safety DSC calls are to be called 'Urgency and Safety Announcements' (refer to WRC-12 *Radio Regulations* No. 33)

Summary of Australian MMSI formats currently in use

Note: x or y to be any figure 0 through 9

Type of Station	MMSI Format
Digital Selective Calling (DSC) Systems	
Ship Stations	503xxxxxx or 503xxx000 or 503xxxx00
Craft associated with a parent ship	98503xxxx
SAR Aircraft	111503xxx
Handheld Portable VHF DSC (Australia only)	5039xxxxx (up to July 2012)
Handheld Portable VHF DSC	8503xxxxx (from July 2012)
Group of Ship Stations	0503xxxxx
Coast Stations	00503xxxx
Man Overboard (MOB/MSLS) devices[1] (Australia only)	5038XXXXX (up to July 2012)[1]
Man Overboard (MOB/MSLS) devices[1]	972xxyyyy (from July 2012)
Automatic Identification Systems (AIS)	
AIS Class A/B Transceivers	503xxxxxx or 503xxx000 or 503xxxx00
AIS Base Stations	00503xxxx
Physical AIS aids to Navigation (AtoN)[2,3]	995031xxx
Virtual AIS aids to Navigation (AtoN)[4]	995036xxx
AIS on Craft Associated with Parent Ship[5]	98503xxxx
AIS-SARTs (AIS-Search and Rescue Transmitters)[6]	970xxyyyy
Man Overboard (MOB/MSLS) devices[7]	972xxyyyy
EPIRB-AIS (EPIRBs fitted with AIS)[8]	974xxyyyy
AIS on SAR Aircraft[9]	111503xxx

[1]Maritime Survivor Locating Systems (AS/NZS 4869.2 until July 2012 used the maritime identity in the format 5038XXXXX, but now use the internationally agreed format 972xxyyyy, where x and y are any numbers between 0 and 9. The number is pre-programmed. The 'xx' numbers are allocated to manufacturers by the International Association for Marine Electronics Companies (CIRM), and the 'yyyy' numbers are allocated by the manufacturer as sequential numbers. In accordance with Recommendation ITU-R M.585-6, the sequential numbers can be re-used once 9999 is reached. AMSA does not allocate these numbers, and no radio operator licence is required.

[2]AIS fitted to physical aids to navigation such as floating buoys and beacons.

[3]AIS base stations can broadcast a non-physical "synthetic" AIS AtoN to appear at the location of a real (physical) AtoN on an AIS-enabled display system (e.g. AIS, ECDIS or radar).

[4]AIS base stations can broadcast a non-physical "virtual" AIS AtoN at a particular location when no physical AtoN exists.

[5]AIS on workboats or other vessels deployed from a parent vessel.

[6]AIS-AIS-SARTs are survival craft SAR-locating devices which can be carried in lieu of radar SARTs on SOLAS vessels from 1 Jan 2010, and can be carried on non-SOLAS vessels for similar purposes.

[7]There is currently no AS/NZS standard for AIS-MOB devices.

[8]EPIRBs fitted with an AIS transmitter use the maritime identity format 974xxyyyy for the AIS transmission, so as to be distinguished from other devices using AIS, where x and y are any numbers between 0 and 9. The number is pre-programmed. The 'xx' numbers are allocated to manufacturers by the International Association for Marine Electronics Companies (CIRM), and the 'yyyy' numbers are allocated by the manufacturer as sequential numbers. In accordance with Recommendation ITU-R M.585-6, the sequential numbers can be re-used once 9999 is reached. This number is allocated by the manufacturer, and not AMSA, and should not be confused with the HEX ID or Unique Identifier used in EPIRBs, ELTs and PLBs. AMSA does not allocate these numbers, and no radio operator licence is required.

[9]AIS on search and rescue aircraft (SAR) is a variant of AIS specifically for SAR. AIS can also be used for safety-related purposes on non- SAR aircraft (such as marine pilot-transfer helicopters).

Table 4 - Australian MMSI Formats Currently in Use

5.6 TYPES OF DSC CALL AND HOW THEY ARE USED

The DSC system provides for the following types of call:

- **Distress Alert** – these calls are always addressed to ALL stations. The call contains at least the distressed vessel's MMSI, position, the nature of distress and the time the position was valid. If time is available, it is possible to also indicate the nature of distress, from a menu of options.

  Some DSC controllers offer the user a menu of possible "nature of distress" situations from which to choose, i.e. "fire, explosion", "flooding", "collision", "grounding" etc. The "nature of distress" information cannot be altered on some models of DSC controllers. These controllers send the default setting of "undesignated distress". The call will conclude with the advice that subsequent communications are to be carried out on "J3E" (radiotelephone) or "F1B" (NBDP). The frequency is not specified. It is always the associated radiotelephone or NBDP distress frequency for the band in use (refer to Appendix 1).

- **Distress Alert Relay** – normally only sent by coast stations, these calls are addressed to either ALL stations, or ships in a designated geographic area. Procedures for use of distress alert relay messages are set out in Chapter 14.

- **All Ships/All Stations** – these broadcast messages can be sent as either URGENT or SAFETY priority announcements.

  The DSC controller will prompt the user to select the appropriate priority and the frequency or channel for subsequent communications.

- **Single Ship (or Station)** – these calls can also be either URGENT or SAFETY priority. They are addressed to a particular ship or coast station. The MMSI of the required ship/station must be entered, as well as the frequency for voice or NBDP communications. Procedures for use of DSC URGENCY and SAFETY messages are set out in Chapter 14.

  At the ITU WRC-12, it was decided that in order to avoid unnecessary loading of the distress and safety calling frequencies specified for use with DSC techniques:

  Safety Messages transmitted by coast stations in accordance with a predefined timetable should not be announced by DSC techniques; and Safety Messages which only concern vessels sailing in the vicinity should be announced using radiotelephony procedures. (ITU WRC-12 *Radio Regulations, No. 33.31A*)

  However, messages containing information concerning the presence of cyclones, the presence of dangerous ice, dangerous wrecks, or any other imminent danger to marine navigation, shall be transmitted as soon as possible and shall be preceded by the safety announcement or call. (ITU 2012 *Radio Regulations, No. 33.34A & B*).

  Urgency Messages: Communications concerning medical advice may be preceded by the urgency signal (ITU 2012 *Radio Regulations, No. 33.11A*);

  Urgency communications to support search and rescue operations need not be preceded by the urgency signal (ITU 2012 *Radio Regulations, No. 33.11B*);

  Medical Transports (protected under the Geneva Convention, etc) are still required to use the Urgency Signal, followed by the word MEDICAL in NBDP and radiotelephony (ITU 2012 *Radio Regulations, No. 33.20*).

  In the maritime mobile satellite service, a separate urgency announcement or call does not need to be made before sending the urgency message. However, if available, the appropriate network priority access settings should be used for sending the message (ITU 2012 *Radio Regulations, No. 33.9B*).

- **MF/HF Test** – as routine calls are prohibited on the MF/HF DSC distress frequencies, a special TEST protocol call has been developed to provide both system verification and operator familiarisation. These calls are addressed to an individual coast station, and are acknowledged by a return DSC message. There are normally no subsequent radiotelephone or NBDP communications. DSC test procedures are described in Chapter 15.

- **VHF Test** - more modern VHF DSC radios include a TEST call, which allow TEST calls to other VHF DSC radios on board ship, other vessels and suitably equipped coast stations, who can respond with a TEST Acknowledgement. See also 15.2.1.

- **Routine or Commercial** – these calls are only sent on MF/HF frequencies specifically set aside for DSC commercial calls, as they are prohibited on the MF/ HF DSC distress and safety frequencies. However, routine priority calls are permitted on the VHF DSC distress and safety channel. DSC is not used for commercial calls in Australia.

5.7 DISTRESS ALERT ATTEMPTS

Distress alerts may be transmitted as a single frequency or a multiple frequency call attempt. Multiple frequency call attempts should always include at least the MF and HF 8 MHz DSC distress and safety frequencies.

Distress alerts should be activated by means of a dedicated distress button, with a spring loaded lid or cover. Initiation of a distress call should require two independent actions.

5.8 FREQUENCY OR CHANNEL FOR ONGOING COMMUNICATIONS

As described in the preceding paragraphs, the frequency for voice or NBDP communications to be used after the initial DSC call must be specified for all priorities of calls, except distress.

5.8.1 Auto channel-change disabling/enabling

Automatic channel switching to VHF Channel 16, on receipt of a Distress Alert, or Urgency/Safety Announcement or other calls, is a function of VHF DSC equipment.

Unless the function is disabled, a vessel's radio channel may automatically switch away from the working channel at an inopportune moment, in response to an incoming Distress Alert or Distress Acknowledgement or any other call where a channel is specified in the DSC call.

Since 2004, VHF DSC equipment has been built so that automatic channel switching can be disabled to maintain essential communications during critical operations such as ship manoeuvring n Port limits, tug operations, or during critical offshore oil/gas industry operations. This function can be disabled on the transceiver, provided that transceiver is compliant with Recommendation ITU-R M.493-11 (2004) or a more recent version (the current version is M.493-13 (2009)). The DSC equipment should provide visual indication when the automatic switching function is disabled. Different manufacturers can implement this disabling feature in different ways, and this would normally be explained in the user manual.

When automatic channel switching is disabled, radios should continue to detect Distress DSC Alerts, but the operator can decide whether to accept the channel request before taking any further action.

If automatic channel switching is disabled during critical operations, the function should be re-enabled once the critical operations are complete.

AMSA Marine Notice 12/2012 draws attention to the risk of automatic VHF channel switching whenever critical operations are being carried out. AMSA recommends inclusion of disabling and re-enabling procedures in the ship's bridge procedures, if the ship's VHF equipment has a disable function for automatic channel switching.

5.9 CANCELLATION OF INADVERTENT DISTRESS ALERTS

A station transmitting an inadvertent distress alert or call shall cancel the transmission.

An inadvertent DSC alert shall be cancelled by DSC (a so called 'self-cancellation' procedure), if the DSC equipment is so capable. The cancellation should be in accordance with the most recent version of Recommendation ITU-R M.493. Switching the DSC off and then on again should also stop the DSC alert continuing.

In all cases, cancellations shall also be cancelled aurally over the telephone distress channel associated with each DSC channel on which the "distress alert" was transmitted.

An inadvertent distress call shall be cancelled by radiotelephone in accordance with the following procedures:

- The words "ALL STATIONS", spoken three times;
- The words "THIS IS";
- The name of the vessel, spoken three times;
- The callsign or other identification;
- The MMSI (if the initial alert has been sent by DSC); and
- The words "PLEASE CANCEL MY DISTRESS ALERT OF" followed by the time in UTC.

Monitor the same band on which the inadvertent distress transmission was sent and respond to any communications concerning that distress transmission as appropriate.

6 NARROW BAND DIRECT PRINTING EQUIPMENT AND SYSTEMS

This chapter provides general guidance in the principles and operation of GMDSS Narrow Band Direct Printing (NBDP) equipment. For specific operational instructions, please refer to the equipment operator's manuals carried on board your vessel.

6.1 INTRODUCTION

6.1.1 Overview

NBDP (or 'radio telex') is a method of sending telex information over a radio channel. The system employs special error detection and correction methods to counter the effects of interference or fading over the radio circuit.

6.1.2 Identification number and answer back

All NBDP equipment is programmed with a unique identification or 'selcall' (selective calling) number, which works in the same fashion as the DSC MMSI number.

The selcall number used is either a five digit number, or (in the case of GMDSS ships) the ship's MMSI, followed by a plus (+) sign.

Selcall numbers for coast stations are usually a four digit number, followed by a plus (+) sign.

If a NBDP station is interrogated (requested for its identification) by the use of the 'Who Are You' (WRU) command, it will send an 'Answerback' – comprising its selcall and other information (usually the name of the ship or shore station in abbreviated form).

Answerbacks may also be sent by the use of the 'Here is' command.

6.1.3 System codes

The marine radio telex code consists of the normal 26 letters of the alphabet, numerals 0 to 9, punctuation marks, symbols for carriage return, line feed, letter shift, figure shift, 'here is', 'who are you?', plus three special characters known as RQ, alpha and beta. The three special characters are used to control the direction of the radio circuit (similar to the action of the 'press to talk' button in a radiotelephone system), and for the correction of errors.

6.1.4 Transmission of information

Each character of the marine radio telex code is represented by a combination of three 'lows' and four 'highs' – or three 'marks' and four 'spaces'. A mark or space is represented by a different audio tone. These tones are generated by the NBDP equipment, passed to the radio transmitter where they are modulated into a radio signal for transmission. At the receiving station, the tones are de–modulated by the radio receiver and passed to the NBDP equipment for processing and display on a monitor or a printer.

6.2 MODES OF TRANSMISSION

The following sections describe the various modes of transmission offered by the NBDP system.

6.2.1 Automatic Re-transmission ReQuest (ARQ) mode

This mode offers full error correction capabilities, and is useable even in very poor radio conditions. *In this mode, only two stations can communicate with each other at any one time, as the sending and receiving stations are synchronised (electronically locked) together.* The originating station is called the MASTER, whilst the called or receiving station is called the SLAVE. The MASTER station remains the Master throughout the entire contact, no matter which station is transmitting at any one time, as the Master controls the timing of the whole system.

The Master station transmits three characters in 210 milliseconds (ms), then switches to receive for 240 ms. During the receive period, the Master station looks for a logic reply from the Slave to indicate that the three characters have been received correctly.

If the correct reply is received the Master station then proceeds with the next three characters. However, if there has been an error in the reception at either end due to interference or fading, the last three characters are repeated for a total of 32 transmissions, at which point radio contact is automatically broken off. The master station will then attempt to re–establish contact and, if successful, it will continue the communication from the point where it was broken off.

Both master and slave stations only acknowledge receipt of the correct logic signal consisting of the 3/4 ratio. All other signals are treated as errors and not printed. Therefore interference and fading should not cause misprints, but only a slowing down of the traffic flow between the two stations.

On completion of the traffic in one direction, an automatic changeover takes place by the sending (master) station transmitting '+?' (plus, question mark). When this is acknowledged by the receiving (slave) station, a change of direction of traffic takes place, and the slave station is now the sending station (but not the master).

In the event of a loss of signal for 15 s, the master station will then resume command and start calling the slave station, as it did at the start of the contact (this is referred to as 're–phasing'). When contact is re–established, the flow of traffic will continue as though nothing has happened, so that if the slave station was the transmitting station at the time of loss of signal, then the slave station will resume sending traffic from exactly where it left off, and the master station automatically returns to the receiving situation.

The system also offers a selective calling capability similar to DSC, using the vessel's selcall number.

ARQ operation requires that both stations have their transmitters active, in order to exchange acknowledgment signals (unlike FEC operation).

Some Commonly Used Manual Commands (refer to Rec. ITU-R-492-6 in ITU Maritime Manual)	
AMV+	For AMVER reports
DIRTLX.........+	Insert the Telex country code and Telex number without any spaces. This is a real time connection.
HELP+	The ship station needs to immediately receive a list of available facilities within the system.
MAN or OPR+	For operator or manual assistance.
MED+	For urgent medical messages.
MSG+	For retrieving traffic from a coast station.
NAV+	The ship station needs to immediately receive navigation warnings.
POS+	Indicates that the following message contains the ship's position.
TLX...............+	Store and Forward Mode, insert telex number of subscriber.
URG+	The ship station needs to be connected immediately to a manual assistance operator and an audible alarm may be activated. This code should only be used in case of emergency.
WX+	The ship station needs to immediately receive weather information.

Table 5 - Commonly Used Manual Commands

6.2.2 The Forward Error Correction (FEC) mode

This is a broadcast (or one way) mode of operation. One sending station may transmit a message to an unlimited number of receiving stations. The transmitting station sends each character twice, the first transmission of a specific character is followed by the transmission of four other characters, after which the re–transmission of the first character takes place – thereby allowing for time diversity reception. Receiving stations compare the two characters, and if both are the same, print the character.

If interference or fading have caused mutilation of one of the characters, the system prints it as *. As the system does not require any acknowledgments by receiving stations, their transmitters are switched off. Please note that the asterisk (*) is not a telex character, (refer to Recommendation ITU-T F.1 in the ITU *Maritime Manual*) but is generated internally and not transmitted.

6.2.3 The Selective Forward Error Correction (SELFEC) mode

This is a variation of the FEC mode. In SELFEC, the transmitting station only sends to a specified ship or ships, which are addressed by their selcall number. This system is used to send messages to particular ships that cannot use their transmitters (vessel may be in port loading hazardous cargoes, etc).

6.3 GMDSS APPLICATIONS

6.3.1 MSI broadcasts/distress communications

NBDP is used for the broadcast of Maritime Safety Information (MSI) on various MF and HF frequencies, and for communications following a DSC distress alert. FEC mode is used for both these applications, as they each require the broadcast of data to a large number of stations. NBDP MSI and distress/safety frequencies are listed in Appendix 1. ARQ and SELFEC modes are mainly used in commercial communications.

6.4 NBDP EQUIPMENT

NBDP equipment consists of a modem (modulator, demodulator) that processes the NBDP signals to and from the radio transceiver, a computer type monitor, a keyboard and a printer.

The modem is connected to the radio equipment in much the same way as a DSC controller, excepting that NBDP systems do not use dedicated watchkeeping receivers – they use the receiver built into the vessel's MF/HF transceiver. Some NBDP systems offer control of the transceiver's frequency selection, which allows the system to scan a number of coast station channels for any selcalls and (the subsequent) commercial traffic.

7 GMDSS INMARSAT EQUIPMENT

This chapter provides general guidance in the principles and operation of Inmarsat equipment and systems, relevant to GMDSS only. For specific operational instructions, please refer to the equipment operator's manuals carried on board your vessel.

7.1 INMARSAT-B/FLEET77 SHIP EARTH STATIONS

7.1.1 Inmarsat-B introduction

Inmarsat-B is the digital replacement of Inmarsat-A (which was discontinued 31 December 2007). Inmarsat–B equipment has the capability of providing telephone and telex communications. In addition, it provides medium speed (9.6 kb/s) fax and data services, and also high speed communication services up to 128 kb/s are available, including video. There is no in-built Enhanced Group Call receiver, but an add-on EGC receiver is possible, however, most vessels would use Inmarsat-C for receiving EGC.

7.1.2 Inmarsat Fleet77 introduction

Fleet77 offers high speed mobile ISDN and IP mobile packet data, including access to email and the internet and an advanced voice distress safety system. Inmarsat Fleet77 provides enhanced data capabilities including 64 - 128 kb/s data, mobile packet data services (MPDS), Integrated Services Digital Network (ISDN) and networking capability. Fleet77 does not support telex, but using Internet-based providers, it is possible to send messages to telex terminals. This type of terminal is generally preferred by vessel operators over Inmarsat-B now, due to increased functionality (apart from not supporting telex).

7.1.3 Directional antenna

Because of the range of communications provided by Inmarsat–B/Fleet77 equipment and the consequent requirement for wide radio spectrum bandwidth and high power, it is necessary for the transmitted energy to be concentrated to a narrow beam by the use of a dish antenna. This antenna is protected by a fibreglass housing known as a radome.

7.1.4 Antenna stabilisation

It is essential that the dish antenna associated with Inmarsat–B/Fleet77 equipment remains pointing at the satellite during all the usual motions of a ship at sea. This is achieved by mounting the antenna on a multi–axis platform which is stabilised against pitch, and roll motions, and against yawing and course changes. The latter are assisted by an input from the ship's gyro compass to the stabilisation mechanism.

The antenna, stabilisation mechanism, antenna control electronic and the UHF transmit/receive equipment are usually referred to as the 'above deck equipment' or ADE. Typical all-up mass of the ADE is 27 - 150 kg.

7.1.5 Below deck equipment

The below deck equipment consists of the actual satcom terminal, usually with a computer type monitor and keyboard attached, and peripherals such as telephones, facsimile machines and call alarms. Most systems support multiple extension telephones, and it is common practice to site one on the bridge, one in the radio room and one in the Master's office or cabin. Interfacing to the ship's internal telephone exchange is also possible with some terminals.

All systems modulate the signals from the below deck equipment at a VHF frequency, which is fed to the antenna radome via special low–loss coaxial cables. It is then up–converted at the radome to the final UHF transmit frequency for communications with the satellite. This arrangement avoids the high losses associated with feeding UHF signals over long cable runs, and allows the below deck equipment to be sited up to 100 m from the antenna system.

7.1.6 Terminal operation

At start up, the operator enters the ship's position and course into the terminal to the nearest degree. Software in the terminal calculates the satellites azimuth and elevation and drives the antenna to that position. Alternatively, the antenna can be directed to an azimuth and elevation to within a few degrees. Pointing information can also be derived from diagrams contained in the ALRS Volumes 1 and 5, and equipment handbooks. The ship terminal then locks on to the TDM (Time Division Multiplex) carrier relayed by the satellite from the Network Co-ordination Station (NCS).

Once the ship antenna has locked on to the satellite, most subsequent operations are performed automatically by the Land Earth Station (LES) and the ship terminal. The equipment automatically tracks the satellite, allowing for all vessel pitch/roll and course changes.

In the event of a shipboard power failure, it is possible that the dish antenna will require re–positioning when power is restored. Australian vessels should have an uninterruptible power supply (UPS) supplying power, where required, in order to maintain power to the antenna, and so no re-initialisation is required on loss of mains power. MSC Circ.130(75) requires that no re-initialisation be necessary for an Innmarsat ship earth after a 60 s loss of power when changing to the alternative source of supply.

Operators of Inmarsat–B/Fleet77 equipment should acquaint themselves with the procedures necessary to input direction (azimuth angle) and height (elevation angle) information in order to restore communications with the satellite. The operator 's manual for the equipment in use should be consulted. It may be faster to initially direct the antenna directly first, then rely on auto-acquisition modes, particularly if reflections from the ship's structure are encountered during the search.

7.1.7 Time Division Multiplex (TDM) channels

These channels are used for sending working channel assignment messages to mobiles from the NCS, which advise mobiles to change to other channels for the exchange of communications to and from a Land Earth Station, and other system 'housekeeping' tasks. After exchanging communications with land stations on working channels, all mobiles automatically return to the TDM channels and revert to standby condition.

7.1.8 Antenna siting and shadow sectors

Depending on the geographical position and orientation of the ship relative to the satellite, parts of the ship's superstructure or other large objects may obstruct the 'view' of the dish antenna to the satellite.

Careful attention must be paid to siting an Inmarsat–B/ Fleet77 dish antenna if shadow sectors are to be eliminated or minimised in all azimuths and elevations. Given the necessary distance separations from radar scanners and other communications antennae, the siting may become a challenge, requiring considerable ingenuity.

In general, obstructions within approximately 10 m of the dish antenna which cause a shadow sector of greater than 6 degrees in any azimuth down to an elevation of minus 5 degrees are likely to seriously degrade the performance of the equipment.

7.1.9 Use of Inmarsat-B and Fleet77 equipment in the GMDSS

An Inmarsat–B/Fleet77 Ship Earth Station is acceptable as part of the mandatory GMDSS equipment, providing it meets the following criteria:

- It is powered from three separate shipboard sources – from the main generating source, from the emergency generating source, and from a source which is independent of the ship's electrical system (see notes 1 and 2 below); and
- The antenna is located in such a position that it has an unobstructed 360 degree view, from minus 5 degrees to the zenith.

Note 1: Because the correct stabilisation of the dish antenna is dependent on an input from the ship's gyro compass, it also must be powered from the three separate sources.

Note 2: Older ships which do not carry an emergency generating source, are required to provide an independent source of considerably greater capacity than other vessels.

7.1.10 Radiation hazard

The concentrated beam of radio frequency radiation produced by an Inmarsat-B/Fleet77 antenna potentially can be harmful to humans. Extended exposure has been linked to neurological damage, cancer, birth defects and eye cataracts. Australian ships should carry warning notices and painted danger lines.

Figure 11 - Typical Inmarsat Fleet 77 installation

If work is to be performed within approximately 7 m and at just below, at the same level, or above the level of an Inmarsat-B/Fleet77 radome, the system must be shut down or the transmitter disabled.

Please note that the power densities at various distances marked on the radome required by IMO do not necessarily agree with Australian standards.

7.1.11 Reception of Maritime Safety Information by Inmarsat

The Inmarsat system provides for Maritime Safety Information (MSI) to be broadcast to ships using a method known as Enhanced Group Calling (EGC). Inmarsat–C equipment incorporates an EGC receiver.

7.1.12 Land Earth Stations offering Inmarsat-B and Fleet77 services

Details of Land Earth Stations providing Inmarsat B/Fleet77 services together with their identification numbers and charges for commercial communications may be found in the ITU *List of Coast Stations and Special Service Stations*. Service providers also provide charging details for their services, including via the Internet.

7.1.13 International ocean region codes

Withdrawal of ocean region codes: From midnight, 2400 h UTC, 31 December 2008, the four original Inmarsat ocean region codes of +871, +872, +873 (and +874) were discontinued.

In the past, it was necessary to know in which Inmarsat ocean region a ship was, e.g. the Pacific Ocean Region (+872) or Indian Ocean Region (+873). As from 1 January 2009, dialing +870 and the Inmarsat satellite network is sufficient to locate the Inmarsat terminal (except for Inmarsat-C).

Ocean Region Codes		
Region	Phone/ Fax	Telex/ Sat-C
Atlantic Ocean Region East (AOR-E)	870	581
Pacific Ocean Region (POR)	870	582
Indian Ocean Region (IOR)	870	583
Atlantic Ocean Region (AOR-W)	870	584

Table 6 - Ocean Region Codes

7.1.14 International telex service codes

Ship station operators using Inmarsat–B/Fleet77 terminals or Inmarsat-C terminals for passing commercial messages to shore–based telex subscribers should familiarise themselves with the international telex service codes.

A complete list of these codes is usually included in NBDP equipment manuals, Inmarsat equipment handbooks and ITU Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services (refer to Recommendation ITU-T F.60 contained therein).

7.2 INMARSAT-B SHIP EARTH STATIONS

Inmarsat–B offers high–quality voice, telex, medium and high–speed data and fax. When used in the GMDSS, power supply and siting requirements are as for Inmarsat Fleet77.

Inmarsat–B is capable of providing all the applications which were available via Inmarsat–A while being compatible with future developments in the space segment. Inmarsat-B is also capable of future enhancements to accommodate additional customer services that may be required, but these are normally achieved by upgrading to Fleet77.

7.3 INMARSAT-C SHIP EARTH STATIONS

7.3.1 Communication capability

Inmarsat–C is a two–way data messaging system based on digital technology that enables users to transmit and receive messages to and from other Ship Earth Stations as well as telex and data subscribers anywhere in the world.

Inmarsat-C does not provide voice communications.

The Inmarsat–C service operates on a store and forward basis. That is, unlike Inmarsat–B and Fleet77, there is no real–time connection between the transmitting and receiving stations. A message must be prepared by the operator prior to transmission. On command, the equipment will transmit that message in packets (or bursts) of data. The routine delivery time is dependent on message length but normally is between 2 min and 7 min. Once the message is successfully delivered, a delivery advice message will be sent to the mobile.

7.3.2 The Inmarsat-C system

The Inmarsat–C system uses four Network Coordination Stations (NCSs), one in each of the ocean regions, to monitor and control communications within that region. The network co-ordination stations are linked to Land Earth Stations (LES) by special satellite signalling links which are used to exchange vital system control and monitoring information.

Each NCS transmits continuously on a special satellite channel known as the NCS common channel. This channel is used for the broadcast of both system service and Enhanced Group Calling information to Ship Earth Stations.

However, before Inmarsat–C service is available to a Ship Earth Station (SES), it is necessary for that SES to be 'logged–in'. This simple operator procedure synchronises the SES receiver to the NCS common channel and informs the NCS that the SES is operational.

The SES equipment continuously monitors the NCS common channel when in the idle condition (that is when not performing other tasks).

By decoding and using the information available on the NCS common channel, the SES equipment can automatically:

- Gain information concerning an unoccupied communications channel for a required Land Earth Station (LES), perform the necessary change of communication channel and transmit a message through that LES; and
- Receive an alert that a LES has a message for it, perform the necessary change of communication channel to one appropriate to that LES and receive the message.

All broadcasts of maritime safety information (known as SafetyNET) and commercial information (known as FleetNET) using the Enhanced Group Calling system are made on the NCS common channel.

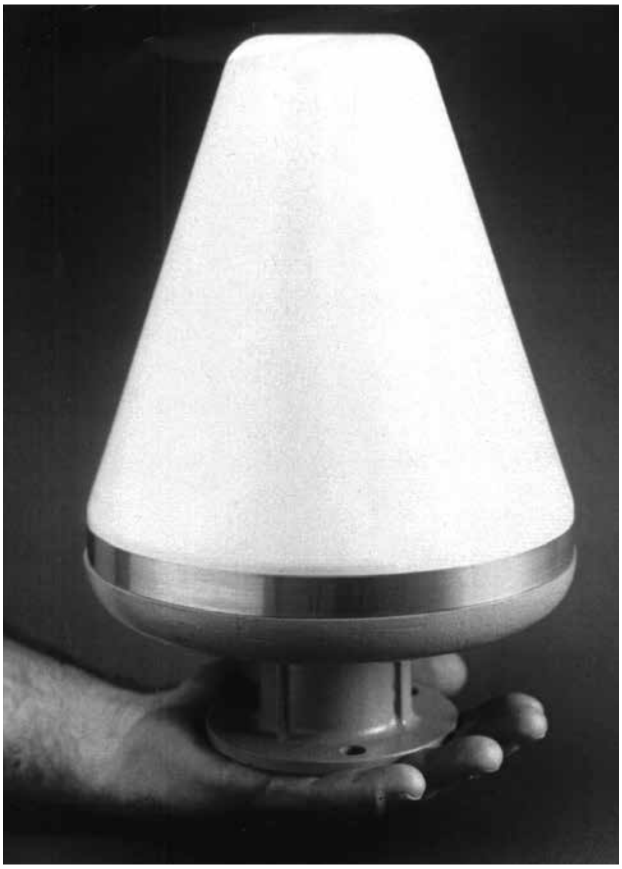


Figure 12 - Typical Inmarsat C antenna

7.3.3 Inmarsat-C ship earth station equipment

An Inmarsat–C SES system consists of an antenna, an electronics unit, a message processor, a visual display unit, a keyboard and a printer. The message processor usually contains a floppy disk drive for storing transmitted and received messages.

Due to the risk of computer virus infection, direct connection of Inmarsat-C systems to personal computers is not permitted on Australian GMDSS vessels.

Integrated Radiocommunication System (IRCS) GMDSS workstations can be connected to computers, provided they are protected against the effects of computer viruses (see IMO Res. A.811(19)).

Transmitted messages may be prepared by keyboard entry into the text editor, or transferred from any other administrative computer in use aboard the vessel.

It is possible to connect other input/output devices to the system. Inmarsat–C equipment carried on board most Australian vessels is often interfaced with GPS satellite navigation equipment to provide current position information in the event of distress.

A remote alarm is provided in the ship's wheelhouse to immediately alert the watch keeper to the reception of any distress or urgent messages broadcast by Enhanced Group Calling.

Facilities are also provided for initiating a distress alert from a remote location, such as the Master's office or (original) radio room. These facilities are known as Remote Distress Initiation Devices (RDIDs). An RDID is required to be fitted to each Inmarsat-C system on board an Australian GMDSS vessel.

7.3.4 Omni-directional antenna

Inmarsat–C has an advantage over Inmarsat–B/Fleet77 in that it requires a narrower bandwidth of radio spectrum to enable communications. As a consequence, relatively low power is necessary to communicate with the satellites and only a small, lightweight, omni-directional (radiating equally in all directions) antenna is required.

The omni-directional characteristics of the antenna mean that it requires no moving parts and can transmit and receive messages even when the vessel is pitching and rolling heavily. Stabilisation against yawing and course changes is not necessary.

The compact size of the antenna makes it simple to locate in a position where its view of the satellite will be unobstructed by parts of the ship's superstructure. However, any object within 1 m of the antenna which cause a shadow sector of greater than 2 degrees will seriously degrade the performance of the equipment.

Obstacles which appear in the fore and aft directions down to 5 degrees below horizontal, in the port and starboard directions, down to 15 degrees below horizontal must be taken into account.

7.3.5 Radiation hazard

The omni-directional characteristics of the Inmarsat C antenna mean that there is no concentration of radio frequency transmitted energy and any potential radiation hazard is minimised.
However:

Do not work within 1 m of an Inmarsat-C antenna.

7.3.6 Logging-in procedure

On initial switch–on, and whenever the equipment has been switched off, it is necessary for the operator of an SES to perform a log–in procedure to the NCS in the appropriate ocean region. This will result in the SES being registered with that NCS as an active terminal. The SES will be tuned into, and be monitoring, the NCS common channel for Enhanced Group Calling messages and system operation information for that ocean region.

As a vessel transits from one ocean region into another, it will become necessary to change the log–in. Some models of Inmarsat-C SES will automatically log–in when switched on. Some models of Inmarsat-C will also automatically attempt to log–in when changing ocean region.

A distress alert can be transmitted even if the SES is not logged–in.

7.3.7 Automatic scan and log-in

SES equipment has a facility known as automatic scan and log-in, which, when initiated, causes the equipment to scan through a list of preferred ocean regions, searching for the strongest NCS Common Channel signal. When the automatic scan facility finds a stronger NCS Common Channel signal than the current ocean region NCS Common Channel, it automatically performs a log-out from the current ocean region and performs a log-in to the strongest NCS signal.

When making a distress call, the Inmarsat-C system uses the NCS common channel for the ocean region that the equipment is currently logged into. To ensure that the SES equipment remains tuned to the current ocean region channel, the automatic scan function must be turned off, as distress messages cannot be sent when the equipment is scanning for a stronger NCS signal.

7.3.8 Logging-out procedure

If an SES is not expected to be used for a prolonged period (for example during refits or for extended periods alongside), the operator should perform a log-out.

The log–out advises the NCS that the SES is no longer operational. This information is passed by the NCS to all Land Earth Stations. This prevents messages being sent to that SES until it is logged–in again. Senders of messages to the logged–out terminal will be advised that their message cannot be delivered.

If the logging–out procedure is not performed before switch–off, the NCS data base will still show the status of the SES as active. The system will try to deliver messages to the SES, eventually ceasing the attempt. The result may be that messages are lost and the sender charged for the repeated attempts by the LES to deliver the messages.

7.3.9 Interface with ship's navigational equipment

Usually a shipboard Inmarsat–C terminal will be interfaced with the vessel's satellite navigation equipment to provide an accurate and current position for automatic transmission in a distress alert.

On ships where the Inmarsat-C equipment is not interfaced to electronic navigation equipment, or where external electronic position input is no longer available, it is essential that the ship's position, course and speed are entered manually at intervals not exceeding 4 h at sea.

The regular entry of position information to Inmarsat–C equipment is also vital to ensure that the integral Enhanced Group Calling (EGC) facility responds to Maritime Safety Information which is relevant to the ship's position.

7.3.10 Performance Verification Test (PVT)

A Performance Verification Test (PVT) (also known as a 'link test') is conducted when an Inmarsat–C SES is first commissioned. This test consists of a transmitted message, a received message, and a transmission and acknowledgment of a distress alert. A ship's operator may initiate a performance verification test (PVT) if there is concern about the condition of the equipment.

The PVT or 'link test' is performed automatically as soon as the mobile is switched on for the first time, and registers it on the network after being commissioned. A PVT can also be invoked from the mobile, and can be invoked from the operator interface at the LES. The test takes ten minutes or less. No other communications can be made during the PVT.

7.4 INMARSAT EGC RECEIVERS

7.4.1 Introduction

The Inmarsat system provides a service known as Enhanced Group Calling (EGC), which provides the broadcast of information to selected ships in an ocean region. All Australian GMDSS vessels carry an EGC facility for the reception of Maritime Safety Information through the Inmarsat system.

EGC capability is usually incorporated into Inmarsat–C equipment only. Manufacturers have developed special stand-alone Inmarsat EGC receivers, however, these are not widely available, nor are they fitted to any Australian GMDSS vessel. For these reasons, this section will concentrate on the EGC capability of Inmarsat–C equipment.

7.4.2 Types of EGC service available

Two types of EGC messages are available:

- SafetyNET*; and
- and FleetNET*.

SafetyNET – allows information providers authorised by the International Maritime Organization (IMO) to broadcast shore-to-ship maritime safety information.

**Note: SafetyNET and FleetNET are registered trademarks of Inmarsat.*

Authorised information providers include:

- Hydrographic offices, for navigational warnings;
- Meteorological offices for weather warnings and forecasts; and
- Rescue coordination centres, for shore to ship distress alert relays, search and rescue communications and other urgent information.

The IMO has selected Inmarsat's SafetyNET as one of the primary means of promulgating Maritime Safety Information for the GMDSS. Australian GMDSS vessels are required to carry an EGC receiving facility.

FleetNET – allows registered information providers to broadcast messages to selected groups of Ship Earth Stations. The selected SESs may belong to a particular fleet or flag, or be a registered subscriber to a commercial service.

Registered users of FleetNET may include:

- Shipowners, for the broadcast of fleet or company information;
- News subscriptions services, for the broadcast of news bulletins; and
- Governments, for the broadcast of messages to a particular country's ships.

** SafetyNET and FleetNET are registered trademarks of Inmarsat*

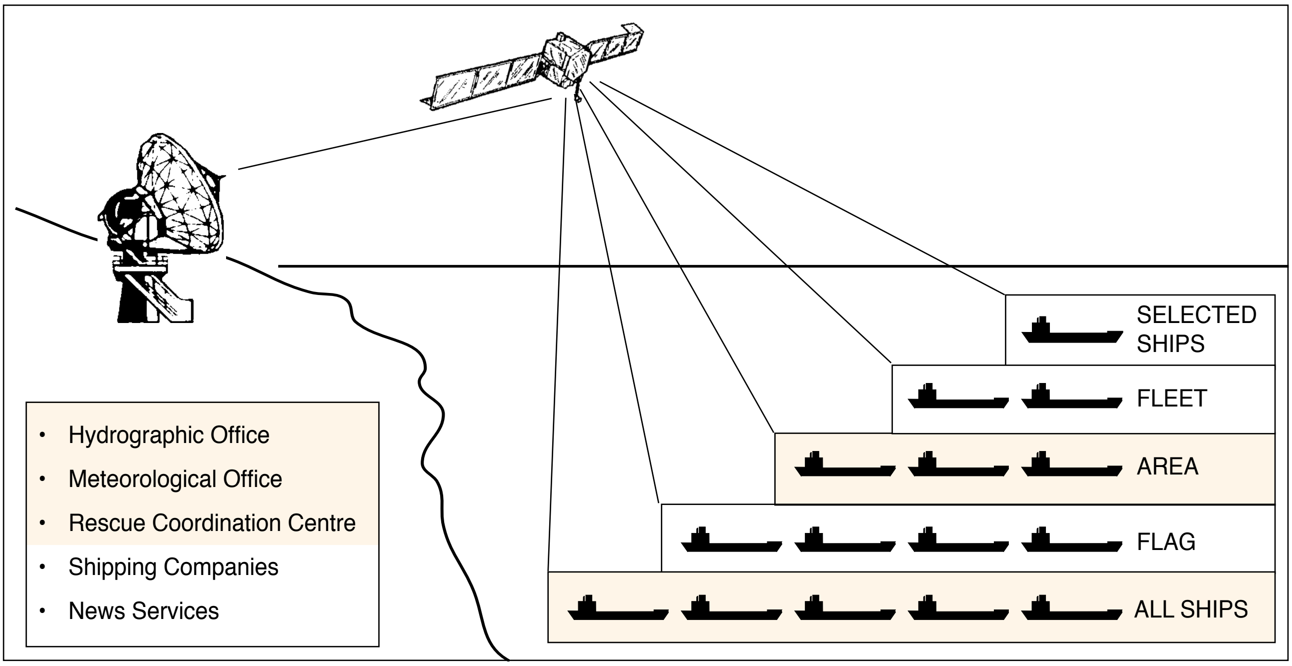


Figure 13 - Basic concept of the Inmarsat Enhanced Group Call system (the shaded area indicates functions of the SafetyNET service)

7.4.3 Shipboard equipment

All Inmarsat–C SES equipment currently available has an integral EGC facility.

Some SES equipment can receive both incoming routine mail messages and EGC messages simultaneously. This equipment is termed a Class 3 SES. Most Australian ships carry Class 2 SES equipment which can only receive EGC messages when not engaged in normal mail transmission and reception. When engaged on these tasks the receiver is tuned to a Land Earth Station (LES) channel and not to the Network Coordination Station (NCS) common channel on which EGC broadcasts are made. During these brief periods an incoming EGC message will not be received. However, once the routine mail message is completed, the SES receiver will automatically re-tune to the NCS common channel and be free to receive any repeat of the EGC message.

The Inmarsat system provides a 6 min ‘echo’ (i.e. a repeat) of EGC traffic to allow vessels that may have been engaged in receiving or sending mail traffic to return to the NCS channel.

Class 2 Ship Earth Station equipment fitted to Australian GMDSS vessels offers the operator an “EGC only” or “exclusive EGC reception” mode which, if selected, means that the receiver is not available for normal mail reception because it logs out. On vessels where duplication of Inmarsat-C terminals is provided, dedication of one terminal to the task of EGC reception is recommended.

Ships selecting this option should ensure that their owners and agents are aware of the identity number of the terminal not dedicated to EGC reception, as any routine mail message addressed to the EGC dedicated terminal cannot be delivered.

Dedication to EGC reception will not affect a terminal’s capacity to transmit a Distress Alert.

7.4.4 Broadcasts of EGC messages

An EGC message, whether SafetyNET or FleetNET, is broadcast over an entire ocean region and is received by all Ship Earth Stations in that region which have their EGC facility tuned to the NCS common channel.

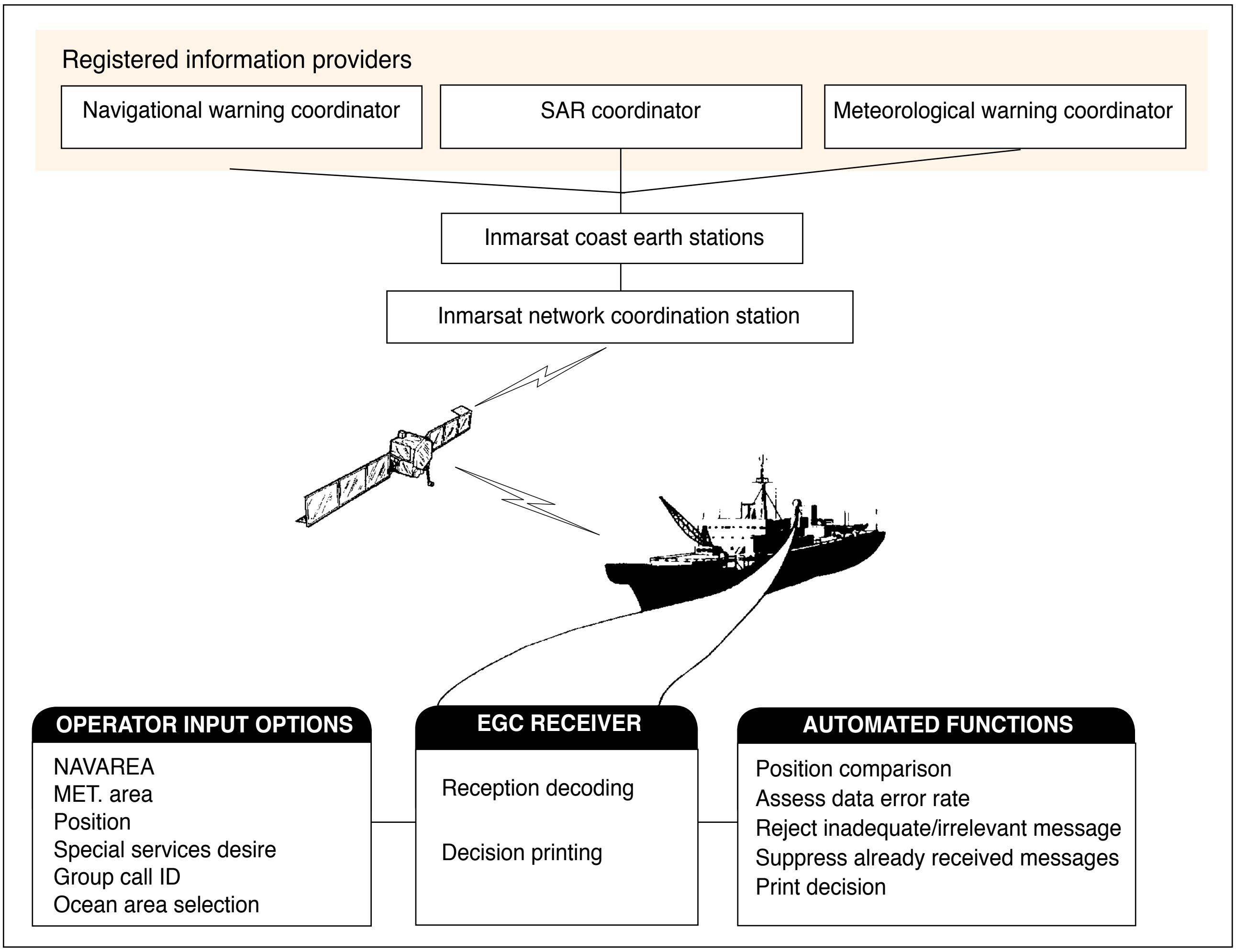


Figure 14 - International SafetyNET Service System Concept

However, the message is only accepted by those EGC receivers which are in the geographical area specified by the information provider, or have been programmed to accept that particular type of EGC message. All other EGC receivers reject the message.

EGC address selections that may be specified by an information provider are:

- Ships within a fixed, or uniquely defined, geographical area;
- Ships belonging to a particular fleet or flag;
- A particular ship; or
- All ships within an ocean region.

All EGC messages are uniquely coded. This allows the EGC facility to automatically suppress the storage and printing of messages that are broadcast more than once if the original message has been correctly received.

7.4.5 Broadcasts of SafetyNET Information

Information providers of Maritime Safety Information make use of the system's geographical area addressing capabilities. For example, EGC messages containing weather forecasts and NAVAREA warnings will normally be sent to fixed areas, and EGC messages concerning a local storm warning or a distress alert relay to a uniquely defined area.

The electronic decision made by a SES to accept or reject such messages relies solely on comparison with the geographical position data which resides in the memory of the EGC facility. Therefore it is essential that the EGC facility is continuously provided with correct ship's position information.

Ideally, this information should be provided by an interface with the ship's satellite position–fixing equipment. If an interface is not possible, the EGC facility should be manually updated at periods not exceeding four hours.

On the SES equipment carried aboard most Australian vessels, the position entered into the distress alert generator (either manually or electronically) also updates the EGC facility.

> Failure to update the EGC facility with ship's position within 12 h will result in the EGC receiver accepting all Maritime Safety Information for the entire ocean region regardless of geographical address.

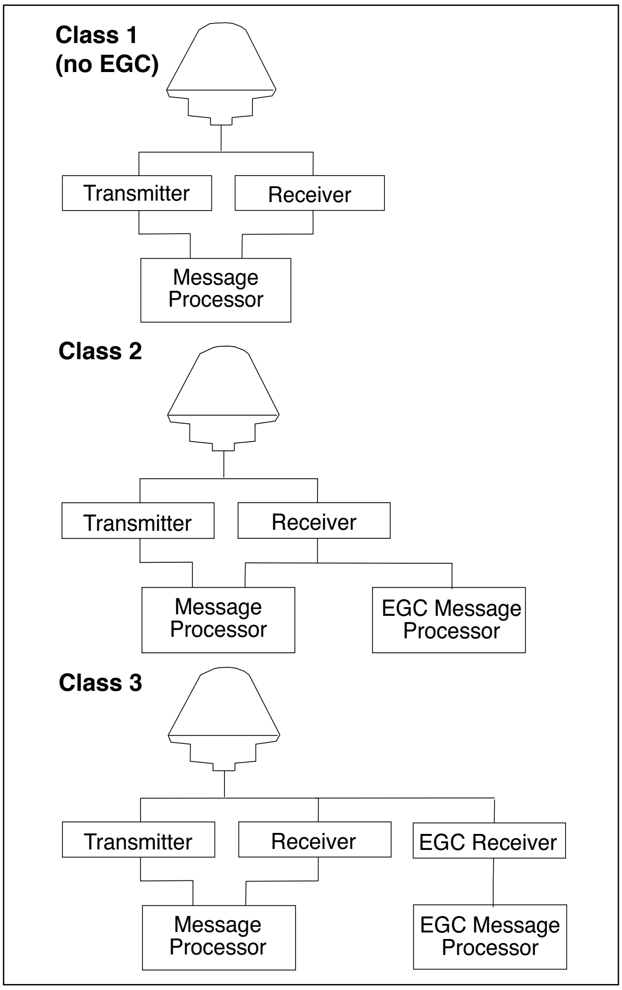


Figure 15 - Classes of mobile earth stations

7.4.6 Coastal warning service using EGC

In the GMDSS, weather and navigational warnings that concern coastal areas may be broadcast by two different methods – by the Inmarsat SafetyNET[2] EGC service, or by a short range system known as NAVTEX. Administrations will decide which of the two systems provides the most efficient method of promulgating this information for their area of responsibility.

It should be noted that with SES equipment carried by most Australian ships, the software concerning the Inmarsat SafetyNET EGC coastal warning service might be described as NAVTEX. Although under the concept of GMDSS, information which may be promulgated by the Inmarsat coastal warning service and the short range NAVTEX system is identical, the systems are different and should not be confused. Any references to NAVTEX in Australia should also be taken to mean Inmarsat's SafetyNET coastal warning service.

The arrangements for the Australian promulgation of MSI via Inmarsat EGC services are provided in Appendix 2 and Admiralty List of Radio Signals (ALRS), Volumes 3 and 5. ALRS are updated via Notices to Mariners.

[2]SafetyNET is a registered trademark of Inmarsat

7.4.7 Reception of shore to ship distress alert relays

The shipboard EGC facility ensures a very high probability of the receipt of a shore to ship distress alert relay from a rescue co-ordination centre. The receipt of such a message, or any EGC message encoded with a "distress" or "urgent" classification by the information provider, will be marked by visual and audible alarms to attract the attention of the bridge watchkeeper. These alarms are not self–cancelling – they must be reset manually.

7.4.8 Further information

Further information explaining how mariners can use the Inmarsat–C SafetyNET system and obtain MSI available at: www.inmarsat.com / Maritimesafety / snet.pdf? language=EN&textonly=False

In addition, a useful resource for Inmarsat information can be found at: www.inmarsat.com / Maritimesafety / default.html

7.5 LONG RANGE IDENTIFICATION AND TRACKING (LRIT)

The Long-Range Identification and Tracking (LRIT) system provides for the global identification and tracking of ships.

LRIT is not part of the GMDSS, but GMDSS equipment can be used for LRIT, if the equipment is LRIT compliant.

The obligations of ships to transmit LRIT information and the rights and obligations of SOLAS Contracting Governments and of Search and Rescue Services to receive LRIT information are established in chapter V of the *International Convention for the Safety of Life at Sea 1974* (SOLAS), Regulation 19-1.

The system requires vessels to automatically transmit their identity, position and date / time at 6 hourly intervals through a Communication Service Provider (CSP). The data is then sent to an LRIT Data Centre (DC) which is linked to the International Data Exchange (IDE). The Data Distribution Plan (DDP) is used to verify the requests for information.

LRIT came into force on 1 January 2008, with compliance by 30 June 2009. AMSA Marine Order 21 gives effect to LRIT. See also Marine Notice 5 / 2009.

LRIT is a maritime domain awareness (MDA) initiative to allow member States to receive position reports from vessels operating under their flag, vessels seeking entry to a port within their territory, or vessels operating in proximity to the State's coastline. MDA offers a range of benefits, including security, environment and safety / search and rescue benefits.

The LRIT regulation applies to the following ships engaged on international voyages:

- All passenger ships including high speed craft;
- Cargo ships, including high speed craft of 300 gross tonnage and above; and
- Mobile offshore drilling units.

Ships operating exclusively in Sea Area A1, and fitted with an Automatic Identification System (AIS) are exempt, while ships operating in Sea Area A2 which are not fitted with Inmarsat-C GMDSS are required to fit a dedicated LRIT terminal. Ships operating into Sea Area A4 require a dedicated LRIT terminal that operates in conjunction with an approved low-earth orbit communication service provider.

Ship LRIT equipment must be capable of being configured to transmit the following minimum information contained in an automatic position report (APR):

- The identity of the ship;
- The position of the ship; and
- The date and time of the position.

In addition, ship LRIT equipment must be able to respond to poll requests for an on-demand position report and be able immediately to respond to instructions to modify the APR interval to a maximum frequency of once every 15 min. APRs will be transmitted as a minimum four times per day (every 6 h) to a National Data Centre or to a Cooperative or Regional Data Centre nominated by the Maritime Administration / Flag Register (the "Flag").

Australia has contracted the services of a commercial data centre provider – PoleStar Global (www.polestarglobal.com). Australian registered vessels to which the LRIT regulation applies work with Polestar directly to ensure their six hourly reports are received and forwarded, as required, to the International Data Exchange. At the time of publication of this Handbook, platforms have been identified as suitable for LRIT include: Inmarsat-C, Inmarsat mini-C, Inmarsat D+ (and IsatM2M) and Iridium. The majority of ships required to participate in LRIT are already fitted with compatible Inmarsat-C systems. The technology used for LRIT may be reviewed at a future date, with an emphasis on making use of equipment carried under existing carriage requirements.

7.6 LRIT CONFORMANCE TESTING

All LRIT equipment aboard ship must be tested and then certified by an Application Service Provider (ASP) approved by the Flag State. If the testing is successful, an LRIT Conformance Test Report (CTR) is issued to the ship. The process for obtaining a CTR may vary from flag to flag, in some cases the CTR is ordered and paid for from the ASP, or from the flag.

Ships wishing to perform conformance testing should consult the ASP to determine the exact process the ASP uses. Usually, the ship is required to provide various ship identification details, and is given access to a web-based tool which guides the tester through the process. The minimum time period for the conformance testing is 72 h in order to ensure all test requirements are met. There is also guidance material on different ASP web sites to assist in the testing process and provide trouble shooting information should the unit fail all or part of the testing process.

In Australia, AMSA has identified three ASPs for testing. AMSA is not directly involved in the testing or conformance testing process. In some Flag States, the Flag State issues the CTR upon receiving it from the ASP.

Compliance with LRIT should be recorded on the Cargo Ship Safety Certificate (Form C) and the Record of Equipment for the Cargo Ship Safety Equipment Certificate (Form E), (Form P for a Passenger ship). A valid CTR is required prior to the issuing or endorsing of the Safety Radio Certificate and the Record of Equipment for the Safety Equipment Certificate.

At the time of publication of this Handbook, there is no requirement for conformance testing to be re-done annually.

In Australia, three ASPs have been approved (Marine Notice 5/2009 refers):

- Pole Star Space Applications Ltd (www.polestarglobal.com)
- Fulcrum Maritime Services Ltd (www.fulcrum-maritime.com)
- Securewest International Incorporated (www.securewest.com)

An Australian ship that carries full SOLAS certification, and does not undertake international voyages, is required to hold either:

- LRIT equipment and certification (as noted above); or
- LRIT exemption certificate, issued by AMSA.

Further information on LRIT in Australia can be found on the AMSA website at www.amsa.gov.au.

8 GMDSS MF, HF AND VHF EQUIPMENT

This chapter provides general guidance in the principles and operation of GMDSS MF, HF and VHF equipment. For specific operational instructions, please refer to the equipment's operator's manuals carried on board your vessel.

8.1 MF/HF TRANSCEIVERS

8.1.1 System overview

GMDSS MF/HF transceivers are a modular system comprising three units:

- **The Operator's Control Unit (OCU)** – provides control of all transceiver functions. Usually includes a keyboard for frequency selection, a digital frequency display and meter(s) for monitoring equipment performance;
- **The Transceiver Unit** – contains the transmitter and receiver electronics and control circuitry; and
- **The Antenna Tuning Unit (ATU)** – enables the signals from the transceiver to be coupled (tuned) to the antenna. Usually mounted externally, very close to the antenna.

It is quite common for these three units to be mounted up to 50 to 100 m apart.

8.1.2 Frequency selection

Frequency selection is usually accomplished with a numeric keyboard. The three principal methods of frequency selection are:

- **By ITU Channel number** – the equipment stores the frequency information for all ITU allocated radiotelephone and telex channels. These may be recalled from memory by entering the actual number, such as '404' or '1202';
- **By Memory Channel Location** – most transceivers offer a number of operator programmable channels. Recall of stored frequencies is simply a matter of entering the channel number, e.g. '12' for the 12 MHz distress frequency of 12 290 kHz, etc.; and
- **By Direct Keyboard Entry** – the transmit and receive frequencies must both be entered separately on the keyboard, in much the same way as using a pocket calculator.

8.1.3 Transmitter tuning

Before the equipment can be used, the antenna must be tuned to the transmitter. This function is automatic, and usually accomplished by a 'tune' button, or by depressing the 'push to talk' switch on the microphone or handset. This process must be repeated whenever a new transmit frequency is selected.

8.1.4 Emission class

The equipment provides controls for selection of the mode of transmission (see Section 2.7.2). SSB operation is usually referred to as 'USB' (upper sideband) or 'J3E', NBDP and DSC by either 'F1B', 'J2B' or 'Telex'.

8.1.5 Volume control

The volume control controls the volume level of the loudspeaker and is either a standard rotary knob, or two separate push buttons; one to increase, and the other to decrease the volume. For equipment fitted with telephone-style handsets, the earpiece volume is usually fixed, and cannot be altered.

8.1.6 Mute control

This control allows the operator to stop the constant background hiss from the receiver. On MF/HF equipment, the level of muting is usually pre–set and can only be turned off or on.

8.1.7 Clarifier or receiver fine tuning

Modern MF/HF equipment provides very accurate and stable frequency control. However, occasionally SSB signals will be received that are slightly off their correct frequency. The clarifier or fine tuning control varies the receiver frequency to allow off–frequency signals to be correctly received and understood. It does not affect the transmitter frequency.

8.1.8 RF gain control/AGC

The RF gain control adjusts the sensitivity of the receiver. It should normally be left set at maximum.

Most transceivers are fitted with an Automatic Gain Control (AGC) system. This automatically compensates for variations in received signal strength due to fading and interference. It should normally be left on.

8.1.9 Output power control

This controls the transmitter output power level. The minimum power necessary for reliable communications should normally be used.

8.2 VHF TRANSCEIVERS

8.2.1 System overview

VHF transceivers are commonly integrated into one small unit, containing all controls and electronics. The transmitters and receivers fitted in VHF transceivers are designed to be 'pre–tuned' to specially designed VHF antennas. Antenna tuning units are not used.

Some models of VHF transceivers offer remote control units for control of the equipment from other areas such as cargo control rooms, ship's offices, etc. In these type of installations, the bridge-mounted control unit has priority over all other units (it is known as the 'Master'), and is able to take control of the transceiver at any time.

8.2.2 Frequency selection

VHF transceivers provide selection of the 57 allocated VHF marine channels. Channel selection methods vary from keyboards to knobs and switches. Most units provide single button selection of channel 16, the radiotelephone distress and safety channel. Some also provide single button selection of channel 70, the DSC distress and safety channel (see Section 2.7.4).

8.2.3 On/off and volume control

Often these functions are combined into a single control. It is used to turn the equipment on or off, and to adjust the level of signals coming from the loudspeaker. For equipment fitted with telephone-style handsets, the earpiece volume is often fixed, and cannot be altered.

8.2.4 Squelch control

As with MF/HF transceivers, this control allows the operator to stop the constant and annoying background hiss or roar from the receiver. On VHF equipment it is usually an adjustable control. The correct setting is so that the hiss or roar cannot be heard but only just. Further operation of the control will progressively de–sensitise the receiver.

8.2.5 Output power control

As with MF/HF transceivers, this controls the transmitter output power level. On VHF marine equipment it may be marked "25 W/1 W" (25 watts or 1 watt) or "high/ low". It should normally be left set at 'low', unless communicating with a station at long range.

8.2.6 Dual Watch Control (DW)

This control permits the operator to keep a listening watch on two different VHF channels (usually channel 16 and one other).

8.2.7 International/USA control

This control may not be found on all VHF marine equipment. It is provided by the manufacturer to permit communications with stations in the USA which do not conform entirely to the international VHF channel plan. It is important that this control is kept in the "international" position at all times unless in the coastal waters of the USA.

8.3 WATCHKEEPING RECEIVERS

8.3.1 Introduction

The GMDSS regulations require ships to continuously monitor certain distress frequencies whilst at sea. Special dedicated receivers have been developed for this function. These receivers are fixed-tuned to the relevant distress frequency, and allow the ship's other receivers (incorporated in the MF/HF and VHF transceivers) to be used for non–distress purposes, such as public correspondence, etc.

Watchkeeping receivers are fitted with their own dedicated antennas.

The following sections describe the three types of watchkeeping receivers fitted to GMDSS vessels.

8.3.2 MF and HF DSC watchkeeping receivers

These receivers are designed to monitor the MF and HF DSC distress frequencies. As the DSC system is designed for the transmission of data signals only, DSC watchkeeping receivers are connected to a DSC modem (modulator–demodulator) – also known as a DSC Controller. This equipment decodes, processes and displays the digital signals. It also encodes them for transmission. Some manufacturers produce integrated MF/HF DSC watchkeeping receivers and modems in one chassis.

There are two types of MF/HF DSC watchkeeping receivers:

- MF only - monitors the 2 MHz DSC distress and safety channel of 2 187.5 kHz only.
- MF/HF - monitors all 6 MF/HF DSC distress and safety channels from 2 - 16 MHz.

MF only receivers are normally not fitted with any controls, apart from a power indicator.

MF/HF receivers can monitor up to 6 channels by scanning them in rapid sequence. The GMDSS regulations require that MF/HF DSC watchkeeping receivers be able to scan all channels within 2 seconds.

These receivers also incorporate facilities to control which channels are included in the scanning sequence (the 2 MHz and the 8 MHz channels cannot be switched out, and are always scanned). There is a visual indication of which channels are being scanned.

Some receivers also provide a small loudspeaker which may be switched on or off to verify the receiver's scanning performance.

8.3.3 VHF DSC watchkeeping receiver

These receivers are designed to monitor the VHF DSC distress channel, channel 70.

As with MF and MF/HF DSC receivers, VHF DSC receivers are connected to a modem to decode and display the digital information.

VHF receivers are normally only fitted with a power indicator. Some manufacturers combine the VHF DSC watchkeeping receiver and modem into one chassis.

9 EMERGENCY POSITION INDICATING RADIO BEACONS (EPIRBS)

This chapter provides general guidance in the principles and operation of Emergency Position Indicating Radio Beacons (EPIRBs). For specific operational instructions, please refer to the equipment operator's manuals carried on board your vessel.

9.1 EPIRBS

9.1.1 The EPIRB system

Emergency Position Indicating Radio Beacons (EPIRBs) are small, portable, battery powered radio transmitters that are both watertight and buoyant and transmit in the 406.0 – 406.1 MHz channel. EPIRBs are carried aboard merchant ships, some private vessels, commercial and military aircraft. They also transmit a distinctive swept audio tone signal on the international aeronautical distress frequencies of 121.5 MHz for homing purposes by search and rescue aircraft. Aircraft at 30 000 feet can detect the audio tone signals at approximately 200 n miles (refer to Section 9.2.2 for more details on 121.5 MHz signal).

EPIRBs can also transmit a GNSS position provided it is fed from an internal or external GNSS device. If an internal GNSS receiver is fitted, these are sometimes known as "G-PIRBs", but at the time of publication of this Handbook, were not mandatory on GMDSS vessels.

9.2 THE COSPAS-SARSAT SYSTEM

9.2.1 Introduction

Cospas-Sarsat was initially developed under a memorandum of understanding among agencies of Canada, France, the former Union of Soviet Socialist Republics and the United States of America, signed in 1979.

Cospas-Sarsat is a combined Russian-English acronym and means:

- COSPAS – Cosmicheskaya Sistyema Poiska Avariynich Sudov; and
- SARSAT – Search and Rescue Satellite Aided Tracking.

On 1 July 1988, the four partner States providing the space segment signed the International Cospas- Sarsat Programme Agreement, which ensures the continuity of the system and its availability to all States on a non-discriminatory basis. In January 1992, the Government of the Russian Federation assumed responsibility for the obligations of the former Union of Soviet Socialist Republics. A number of States, non-parties to the agreement, have also associated themselves with the programme.

Through their association with the programme, States contribute ground receiving stations that enhance Cospas-Sarsat distress alerting capabilities and/or participate in international Cospas-Sarsat meetings dedicated to the worldwide coordination of system operations and programme management.

The objectives of Cospas–Sarsat are to ensure the long–term operation of the system, provide distress alert and location information on a non–discriminatory basis and support the search and rescue objectives of the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO).

The system comprises of:

- A space segment operating in low–Earth orbit (LEO) and geostationary orbit (GEO);
- A ground segment consisting of satellite receiving stations, known as local user terminals (LUT), and data distribution centres, known as mission control centres (MCC); and
- Emergency radio beacons operating at 406 MHz, the characteristics of which comply with appropriate provisions of the International Telecommunication Union (ITU) and Cospas–Sarsat specifications.

Further information on the Cospas–Sarsat system can be found in the *Admiralty List of Radio Signals* (ALRS) Vol. 5, and at: www.cospas–sarsat.org/

9.2.2 Description of the system

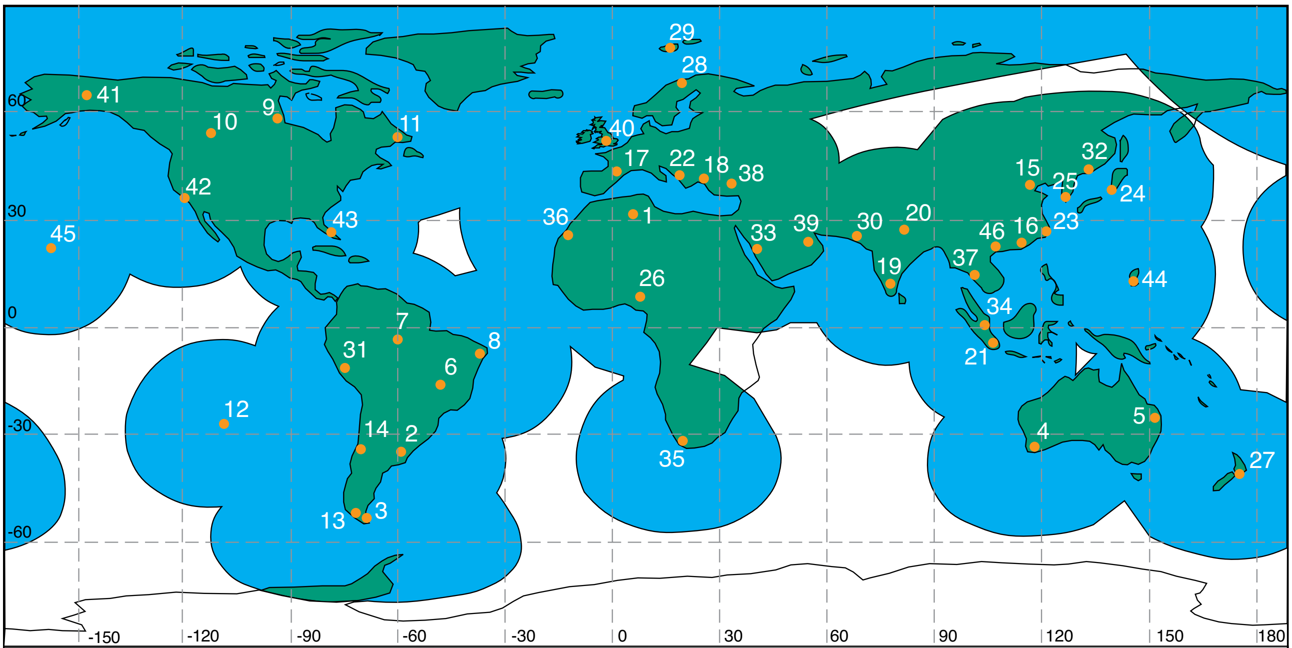
Search and rescue instruments provided by Canada and France are flown on the polar–orbiting satellites of the National Oceanic and Atmospheric Administration (NOAA) of the United States of America. This comprises the Sarsat portion of the Cospas–Sarsat space segment. The Russian Sterkh series of polar–orbiting satellites also carry the search and rescue instruments that make up the Cospas portion of the space segment. Additionally, search and rescue instruments are carried on the NOAA geostationary operational environmental satellites (GOES) series of satellites, the European Space Agency's (ESA) Meteosat Second Generation (MSG) meteorological satellites and on the Indian INSAT–3 series satellites.

These instruments are capable of detecting signals on the Earth's surface transmitted from distress beacons referred to as emergency locator transmitters (ELTs), emergency position–indicating radio beacons (EPIRBs) or personal locator beacons (PLBs). ELTs are used primarily on aircraft, EPIRBs on maritime vessels and PLBs by individuals on land.

ELTs, EPIRBs, and PLBs may operate on the 406 MHz frequencies with 121.5 MHz used for homing. The 406 MHz beacons transmit a digital code that contains information about the type of beacon. Each 406 MHz beacon in the world has a unique identifier. The unique identifier allows for additional information, the registration data, to be linked to each beacon. After receipt of ELT, EPIRB or PLB signals, the satellite relays the signals to the LUT.

From 1 February 2009, satellite detection of 121.5 MHz and 243 MHz distress beacons was discontinued.

Only 406 MHz distress beacon transmissions are detected by satellite, and the 121.5 MHz signal used only for aircraft homing on the 406 MHz beacon.



The Cospas-Sarsat LEOSAR system provides global coverage for 406 MHz beacons.
The blue region indicates the area where an over-flying satellite could be seen by a LEOLUT

1- Ouargla, Algeria
2- El Palomar, Argentina
3- Rio Grande, Argentina
4- Albany, Australia
5- Bundaberg, Australia
6- Brasilia, Brazil
7- Manaus, Brazil
8- Recife, Brazil
9- Churchill, Canada
10- Edmonton, Canada
11- Goose Bay, Canada
12- Easter Island, Chile
13- Punta Arenas, Chile
14- Santiago, Chile
15- Beijing, China *
16- Hong Kong, China *
17- Toulouse, France **
18- Penteli, Greece
19- Bangalore, India
20- Lucknow, India
21- Cengkareng, Indonesia
22- Bari, Italy
23- Keelung, Itdc *
24- Gunma, Japan
25- Incheon, Korea
26- Abuja, Nigeria
27- Wellington, New Zealand
28- Tromsoe, Norway
29- Spitsbergen, Norway
30- Karachi, Pakistan
31- Callao, Peru
32- Nakhodka, Russia
33- Jeddah, Saudi Arabia *
34- Singapore
35- Cape Town, South Africa
36- Maspalomas, Spain
37- Bangkok, Thailand *
38- Ankara, Turkey *
39- Abu Dhabi, UAE
40- Combe Martin, UK
41- Alaska, USA *
42- California, USA *
43- Florida, USA *
44- Guam *
45- Hawaii, USA *
46- Haiphong, Vietnam

Notes: * = Dual System
** = Dual System, which operates as one LEOLUT

Current as at April 2012.
Source: www.Cospas-Sarsat.org

Figure 16 - Satellite visibility for 406 MHz beacons

9.2.2.1 Modes of operation

The Cospas–Sarsat system provides two modes for the detection of beacon signals – the real time and the global coverage mode.

- Real Time Mode – in this mode, a repeater on board the satellite relays the EPIRB signals directly to ground, where it is received and processed by a LUT. If both a beacon and a LUT are simultaneously within view of a satellite, the EPIRB transmissions can be processed immediately.

  A satellite covers an area within approximately 2 000 km either side of its track over the ground. If a LUT is not within view of a satellite, the information from the EPIRB which is relayed to Earth is lost. This fact limits the detection and location of EPIRBs operating in the real time mode to particular geographical areas surrounding a LUT.

- Global Coverage Mode – in this mode, signals from an activated 406 MHz EPIRB are frequency and time–tagged and stored in the satellite's memory. As the satellite's path brings it into view of a LUT, information, including the beacon unique identifier, frequency of detection and time of detection, is continuously relayed down to the LUT.

  The global coverage mode is so described because it does not suffer the geographical limitations of the real time mode and allows detection and location anywhere on the Earth's surface. It is this fact that makes 406 MHz EPIRBs acceptable for the GMDSS.

The LUT, after computing the location of the emergency beacon using Doppler processing, transmits an alert message to its associated mission control centre (MCC). The MCC performs matching and merging of alert messages with other messages received, sorts the data geographically and subsequently transmits a distress message to another MCC, an appropriate search and rescue authority such as a national rescue coordination centre (RCC) or a foreign SAR point of contact (SPOC).

The Cospas–Sarsat distress alert formats received at an RCC are given in Appendix B, of the IAMSAR Manual, Vol II (See Section 13.2 of this Handbook).

9.2.3 Principle of location

The Cospas–Sarsat system employs Doppler shift principles, using the relative motion between a satellite and an activated beacon to calculate the location of that beacon. This technique produces a position line, upon which are two positions, one either side of the satellite's track over the ground. One is the actual position, and the other is the "mirror image" on the other side of the satellite's track. This ambiguity is resolved with a subsequent satellite pass.

The frequency time plot (Doppler Curve) in Figure 17 is representative of a signal heard by a LEO satellite passing over a stationary transmitter on the surface of the Earth. The point of inflection of the curve represents the point in time where the satellite was closest to the transmitter (TCA – Time of Closest Approach). The actual shape of the curve can be processed to indicate the distance the transmitter was from the satellite track.

Using this information, and by knowing where the satellite was at all times during the pass, it is possible to plot two lines which represent the distance from the satellite track where the transmitter could have been. Then knowing the time of closest approach of the satellite, it is a simple matter of drawing perpendicular lines from the point on the satellite track at TCA to the lines representing the distance between the transmitter and the satellite track. Where these lines intersect represent two possible locations for the transmitter, one being the actual location and the other being its mirror image. See Figure 18.

A subsequent satellite pass on a different satellite track can be used to resolve the ambiguity. An estimate of the true and image location can also be calculated by taking into account the Earth rotation when computing the Doppler solutions. However, this ambiguity resolution technique is dependent upon the stability of the transmitted frequency.

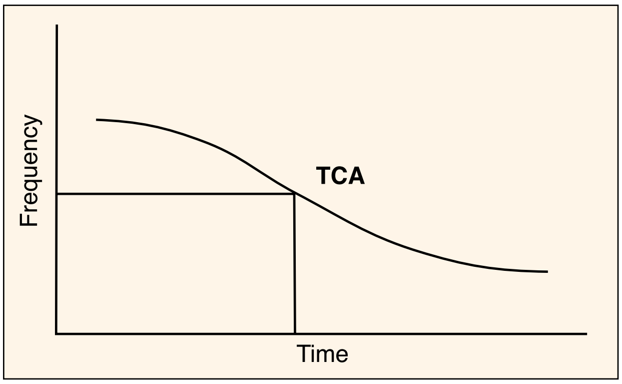


Figure 17 -Doppler Curve

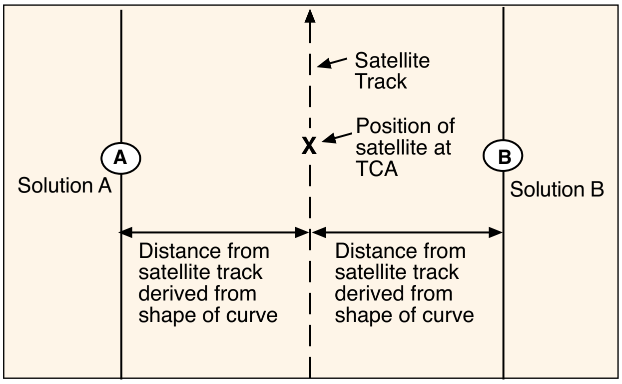


Figure 18 -Doppler Mirror Positions

As the 406 MHz beacons transmit a 5 W burst of data of approximately 0.5 s duration every 50 s (±5%), the higher peak power increases the possibility of detection by the satellite.

If the LUT receives limited bursts from the 406 MHz EPIRB then a Doppler position cannot be calculated but the identity information contained within the signal will be processed and transmitted to a RCC. With location protocol beacons this may include an encoded position.

9.2.4 System overview

A system overview is presented in Figure 19.

The Cospas–Sarsat space segment includes satellites in LEO and GEO. Satellites in LEO and their corresponding ground receiving stations are known as the LEOSAR system, while satellites in GEO and their corresponding ground receiving stations constitute the GEOSAR system. Figure 20 shows the relationship between the LEOSAR and GEOSAR orbits.

When the two systems are combined Cospas-Sarsat is able to provide a robust capability by providing:

- Global LEOSAR coverage;
- Near-instantaneous GEOSAR coverage;
- Independent LEOSAR Doppler positioning;
- High probability of detection/location with the LEOSAR system anywhere on land or at sea, even in situations where obstacles block the beacon transmission to a GEOSAR satellite; and
- High system capacity.

The satellites in the two types of orbit are considered complementary. While the geostationary satellites offer near-instantaneous detection of 406 MHz distress beacons, they do not provide Doppler locating capabilities and their field of view is limited to the area between 70° N and 70° S.

The LEO satellites provide global coverage and Doppler locating capabilities but have an inherent delay given their orbital characteristics and field of view.

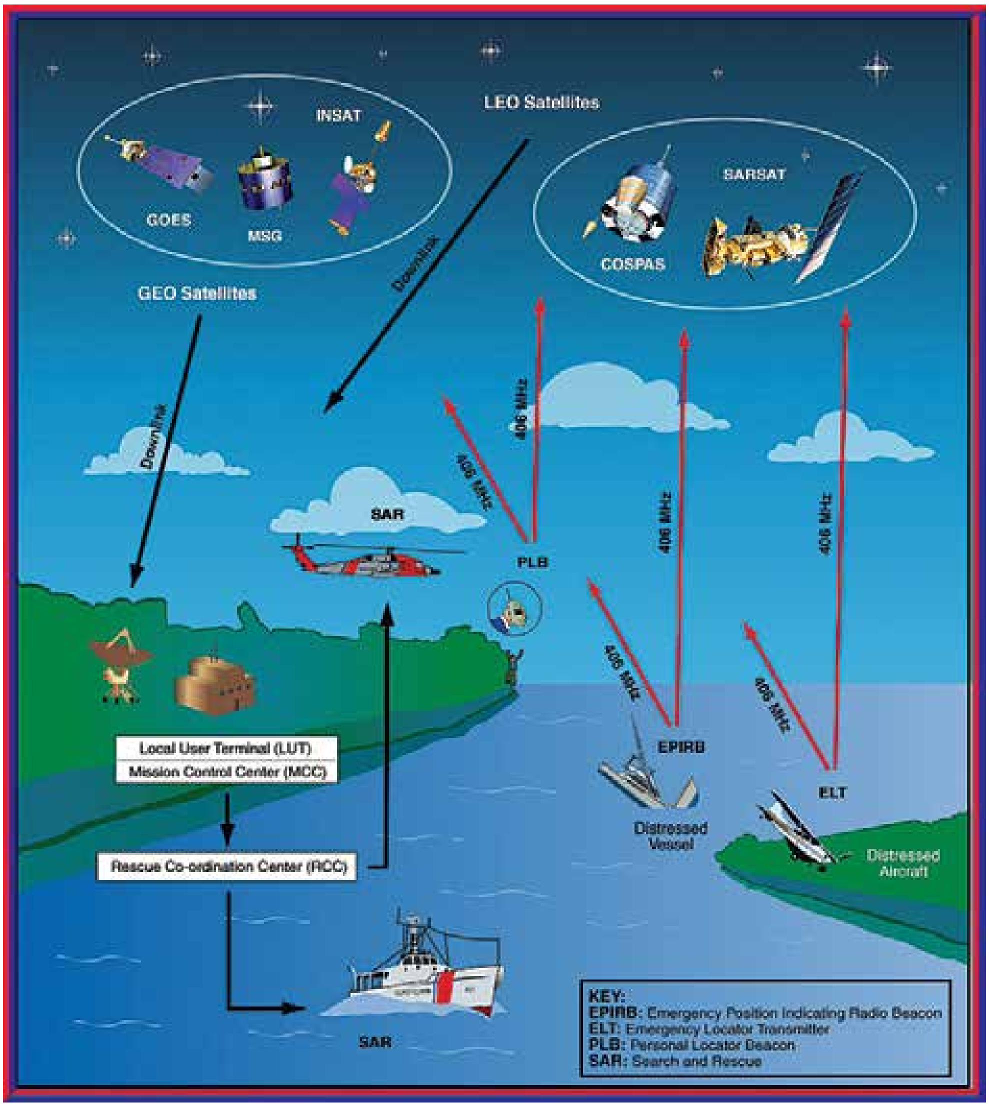


Figure 19 - Basic concept of the Cospas–Sarsat system

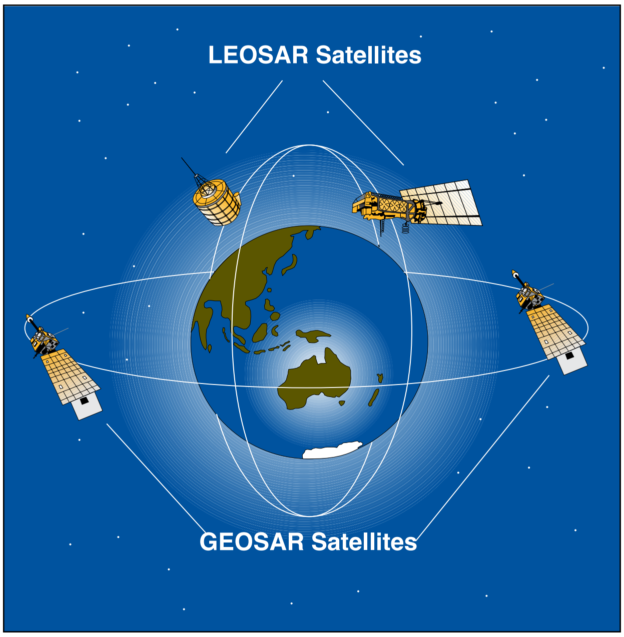


Figure 20 - LEOSAR and GEOSAR satellites

Cospas-Sarsat estimates that approximately 1.2 million (2013) 406 MHz distress beacons are currently in use worldwide. While many of those beacons are carried by aircraft and maritime vessels in response to national and international carriage requirements, a growing number are carried by non- mandated users.

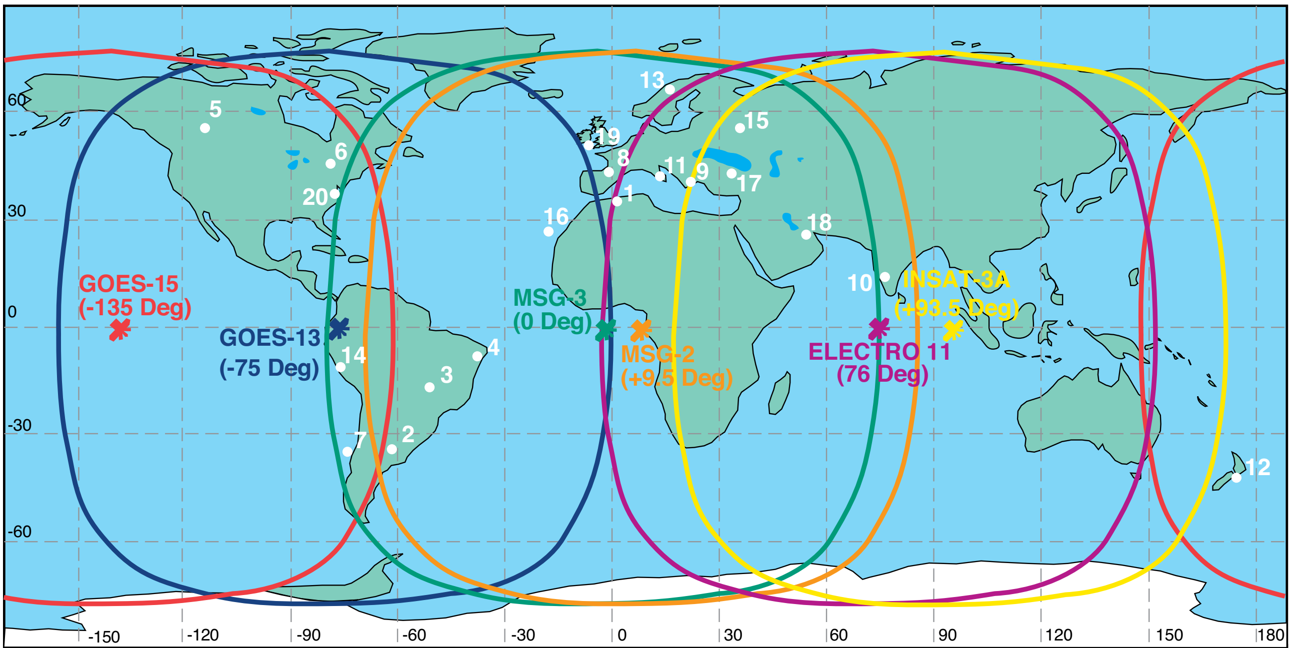
International emergency beacon carriage requirements are developed by the appropriate organs of ICAO and IMO. Annexes 6 and 10 of the ICAO *Convention on Civil Aviation* specify the 406 MHz ELT carriage requirements for aircraft that fall unser the Convention. A Cospas–Sarsat EPIRB operating at 406 MHz can be used to comply with IMO guidance that vessels covered by the *International Convention for the Safety of Life at Sea* (SOLAS) carry an EPIRB.

9.2.5 New developments

9.2.5.1 Space segment

The parties to the Cospas–Sarsat agreement continue to plan for the long–term operation of the LEOSAR space segment and the longer term operation of the GEOSAR system.

Future space segment plans include the study of placing search and rescue instruments in a mid-Earth orbit (MEO) on board global navigation satellite systems such as the United States Global Positioning System (GPS), Russian GLONASS and the proposed European Galileo system. Search and rescue instruments in that orbit could significantly enhance current operations.



1 - Algiers, Algeria
2 - El Palomar, Argentina
3 - Brasilia, Brazil
4 - Recife, Brazil
5 - Edmonton, Canada
6 - Ottawa, Canada
7 - Santiago, Chile
8 - Toulouse, France
9 - Penteli, Greece
10 - Bangalore, India
11 - Bari, Italy
12 - Wellington, New Zealand
13 - Fauske, Norway
14 - Callao, Peru
15 - Moscow, Russia
16 - Maspalomas, Spain
17 - Ankara, Turkey
18 - Abu Dhabi, UAE
19 - Combe Martin, UK*
20 - Maryland, USA

**The Combe Martin GEOLUT processes distress signals relayed by MSG-3. MSG-2 is in standby for use when needed.*

Figure 21 - 406 MHz GEOSAR Satellite Coverage and GEOLUTs
Current as at August 2013 - Source: www.Cospas-Sarsat.org

9.2.5.2 Distress beacons

In order to make effective use of search and rescue instruments in geostationary orbits, new 406 MHz distress beacons have been introduced with the capability to accept position information from internal or external navigation devices such as GPS receivers. This has the potential to provide near–instantaneous alerting and locating via the GEOSAR system.

GPS versus non-GPS beacons - A GPS equipped beacon has a location accuracy of 120 m and location is provided by geostationary satellites within minutes. Non-GPS beacons have a location accuracy of 5 km. The satellite system takes 90 min on average to calculate the initial position from a beacon which is not GPS equipment, but it may take up to 5 h depending on the conditions. Considering that EPIRBs can be deployed from small survival craft in poor sea conditions, from a SAR perspective, GPS-equipped EPIRBS are recommended.

9.2.5.3 121.5 MHz satellite alerting phased out

121.5 MHz distress beacons had serious limitations and used outdated technology. It was the source of a large number of false alerts and the absence of identification information significantly increases the workload of search and rescue services. That situation led to a request by IMO for termination of satellite processing of 121.5 MHz signals.

In 1999, the Council of ICAO adopted amendments to the annexes of the Convention on International Civil Aviation requiring all new aircraft from 2002 and all aircraft from 2005 under the jurisdiction of the Convention to carry an ELT operating at 406 MHz. The ICAO Council also agreed that Cospas–Sarsat processing of 121.5 MHz ELTs could be discontinued from 2008.

In response to the request of IMO and the decisions of ICAO, 121.5 MHz satellite alerting was terminated on 1 February 2009.

9.2.5.4 New frequency channels

The 406.0–406.1 MHz band has been set aside by ITU for low–power satellite emergency position–indicating radio beacons transmitting from the Earth to space. At present, Cospas–Sarsat distress beacons transmit at 406.025, 406.028, 406.037 and 406.040 MHz, thereby using only a portion of the 406.0-406.1 MHz band.

In anticipation of an increase in the number of 406 MHz distress beacon users due to the phasing out of 121.5 MHz satellite alerting and the potential impact on system capacity resulting from lack of frequency spreading, Cospas–Sarsat has prepared a comprehensive frequency management plan.

9.2.5.5 International 406 MHz registration database

The effectiveness of 406 MHz distress beacons is significantly improved when the beacons are properly registered and the registration information is available to search and rescue authorities. Search and rescue authorities have expressed concern that a number of national administrations do not have proper facilities to maintain and disseminate registration information.

In order to address those concerns, Cospas-Sarsat has made available the International Beacon Registration database (IBRD) system, operational from 16 January 2006 (www.406registration.com).

9.3 AUSTRALIAN AND NEW ZEALAND COSPAS-SARSAT GROUND SEGMENT

The Australian Maritime Safety Authority (AMSA) has established LUTs at Albany, Western Australia and Bundaberg, Queensland. These LUTs are connected to the MCC at the Rescue Coordination Centre (RCC) in Canberra. New Zealand has established a LEOLUT and two GEOLUTs at Wellington, which is also linked to the MCC in Canberra.

The LEOLUTs in Australia and New Zealand provide coverage of the Australian continent, the Tasman Sea and the surrounding oceans to a range of 900 km off shore in the real time mode (see Figure 17 and Figure 22). The Australian MCC is located within the RCC in Canberra, however some MCC's are located remotely from their associated RCC.

9.4 VESSEL IDENTIFICATION AND BEACON REGISTRATION

Every 406 MHz EPIRB has a unique identity code which is transmitted as part of its signal. This code indicates the particular vessel and the country of beacon registration. This code is programmed into the beacon by the supplier before it is installed on board a vessel. Theoretically, LUTs anywhere in the world receiving a distress alert and location from an activated 406 MHz EPIRB can identify the vessel in distress and its country of registration. This is a great advantage for search and rescue planning, as each national MRCC holds a record of vessel characteristics such as; description, number of crew, etc.

If the system is to work successfully, and for their own safety, it is mandatory that purchasers of 406 MHz EPIRBs register their beacons. The registration form for Australian country coded beacons is available from the Forms and Publications page on the AMSA web site: www.amsa.gov.au and a copy is provided in Appendix 9. It is recommended that a copy of the registration form as submitted to the relevant beacon registration authority is available on board for inspection. An extract from IMO Resolution A.814 (19), *Guidelines for Avoiding False Distress Alerts*, states:

"...ensure that encoded identities of satellite EPIRBs, which are used by SAR personnel responding to emergencies, are properly registered in a database accessible 24 hours a day or automatically provided to SAR authorities (masters should confirm that their EPIRBs have been registered with such a database, to help SAR services identify the ship in the event of distress and rapidly obtain other information which will enable them to respond appropriately); ..."

> The preferred method of registration is online at www.amsa.gov.au/beacons
>
> Australian purchasers who do not have access to the web can register by completing the registration form provided with the beacon and mail or fax it to the Beacon Registration Team at AMSA before their vessel takes to sea.

Failure to do so is an offence under Marine Orders. Purchasers of second-hand 406 MHz EPIRBs must also provide details to the database.

There is an international Beacon Registration Database for beacons coded to countries that do not have their own Registration Databases. AMSA manages the Australian Registration Database for all Australian registered 406 MHz distress beacons. Owners should register their beacons with AMSA to ensure the best possible response times if they have to activate their beacon.

The beacon registration database manager may be contacted on 1800 406 406 or (02) 6279 5041 or via email at ausbeacon@amsa.gov.au

9.5 HOMING BY SEARCH AIRCRAFT

The Cospas–Sarsat system provides an accuracy of approximately 3 n miles for 406 MHz beacons using Doppler processing. Once a general search area has been established, military or civilian aircraft with specialised direction finding equipment will be used to locate the EPIRB. All Cospas–Sarsat beacons fitted to Australian vessels also radiate on the 121.5 MHz, to allow this final homing by search aircraft.

9.6 EPIRB REQUIREMENTS FOR GMDSS VESSELS

Marine Orders made under the *Navigation Act 2012* require that every Australian GMDSS vessel shall be fitted with an EPIRB operating on 406 MHz (with 121.5 MHz for homing) into the Cospas–Sarsat satellite system (commonly known as a 406 MHz EPIRB).

The IMO EPIRB performance standard also includes the following requirements:

- electrical portions are watertight at a depth of 10 m for at least 5 min. Consideration should be given to a temperature variation of 45ºC during transitions from the mounted position to immersion. The harmful effects of a marine environment, condensation and water leakage should not affect the performance of the beacon;
- be automatically activated after floating free;
- be capable of manual activation and manual deactivation;
- be provided with means to indicate that signals are being emitted;
- be capable of floating upright in calm water and have positive stability and sufficient buoyancy in all sea conditions;
- be capable of being dropped into the water without damage from a height of 20 m;
- be capable of being tested, without using the satellite system, to determine that the EPIRB is capable of operating properly;
- be of highly visible yellow/orange colour and be fitted with retro-reflecting material;
- be equipped with a buoyant lanyard suitable for use as a tether, which should be so arranged as to prevent its being trapped in the ship's structure when floating free;

- be provided with a low duty cycle light (0.75 cd) "strobe light", active during darkness, to indicate its position to nearby survivors and to rescue units;
- not be unduly affected by seawater or oil or both;
- be resistant to deterioration in prolonged exposure to sunlight;
- be provided with a 121.5 MHz beacon primarily for homing by aircraft;
- the battery should have sufficient capacity to operate the satellite EPIRB for a period of at least 48 h;
- have local manual activation; remote activation may also be provided from the navigating bridge, while the device is installed in the float-free mounting;
- be capable, while mounted on board, of operating properly over the ranges of shock and vibration and other environmental conditions normally encountered above deck on seagoing ships;
- be designed to release itself and float free before reaching a depth of 4 m at a list or trim of any angle;
- manual distress alert initiation should require at least two independent actions;
- the satellite EPIRB should be so designed as to operate under any of the following environmental conditions:
  - ambient temperatures of -20ºC to +55ºC;
  - icing;
  - relative wind speeds up to 100 knots; and
  - after stowage, at temperatures between -30ºC and +70ºC.

EPIRBs, when taken to survival craft, are designed to be tethered to the survival craft by the tether provided, and float upright in the water, using the sea as a 'ground plane' for its antenna.

9.6.1 Additional EPIRBs on Australian ships

406 MHz beacons are also fitted in life-rafts on Australian ships (replacing the 121.5 MHz beacons). These 406 MHz beacons are usually 'Class 3' beacons, i.e. manually-activated, non-float free. Although not required to be individually registered to a vessel like the SOLAS distress beacons, each beacon has a unique manufacturers serialised number, and liferaft servicing agents advise AMSA of the Class 3 beacons in the liferafts of each particular ship, to aid search and rescue.

9.7 406 MHZ EPIRB OPERATION

A 406 MHz EPIRB is a small, self–contained, battery operated radio transmitter which is both watertight and buoyant. 406 MHz EPIRBs are mounted in a special float-free bracket on either the bridge wing, or the compass deck. The hydrostatic release in the bracket is designed to release the beacon when the bracket is submerged to a certain depth.

Operating procedures differ between models, however all beacons incorporate a multi–position switch that selects the following modes of operation:

- Off (or safe) – the beacon is switched off, and will not transmit;
- Armed (or auto) – the beacon will automatically switch on when it is released from the float free bracket by the hydrostatic release mechanism;
- On (or manual) – the beacon will switch on and transmit immediately; and
- Test – activates a built in self-test routine.

Note: Some manufacturers recommend using the TEST function sparingly to maintain the battery life. Testing therefore should be done in accordance with the manufacturer's user manual.

9.8 INADVERTENT ACTIVATION OF 406 MHZ EPIRBS

Every year valuable resources are wasted in locating EPIRBs which have been activated inadvertently. Masters and Officers need to be aware that even a single burst from a 406 MHz EPIRB can be detected instantaneously by the Cospas–Sarsat GEOSAR system which will result in an RCC being alerted.

To minimise the possibilities of accidental activation of a 406 MHz EPIRB, Masters and Officers of vessels are urged to pay particular attention to:

- The need to educate all crew members regarding the consequences of activation;
- The need to prevent interference by unauthorised persons; and
- The fact that a float–free EPIRB which has been "armed" will activate immediately on removal from its cradle (transportation away from the cradle must be made in the "safe" or "off" condition).

Should it be suspected that an EPIRB has been activated inadvertently, the Master or person responsible for the vessel must immediately advise the MRCC for their area of operation.

If this is unknown, then report the occurrence to RCC Australia. The world maritime search and rescue regions are published in Chapter 16 of Volume 5 of the ALRS. The information that should be reported should include:

- The time and position of the vessel when the beacon was known to be activated;
- The make and model of the beacon; and
- The circumstances surrounding the inadvertent activation.

Masters and Officers need to be aware of IMO Resolution A.814 (19) *Guidelines for Avoiding False Distress Alerts*.

9.9 SERVICING AND TESTING OF 406 MHZ EPIRBS

Marine Orders requires that a 406 MHz EPIRB is tested and, if necessary has its batteries replaced at intervals specified by the manufacturer. Hydrostatic releases must be replaced by their expiry dates. These are usually marked on the release mechanism.

EPIRBs and other portable electronics may use lithium-based battery packs:

- These should be disposed of correctly;
- Do not short circuit the battery;
- Do not incinerate;
- Do not throw into landfill;
- Do not throw overboard;
- If leaking, do not touch without protective gloves;
- Recycle only as directed; and
- If packing lithium packs for transport, observe the recommended methods.

Further information on servicing and testing of beacons are available at AMSA's web site: www.amsa.gov.au/beacons

9.10 TERMINATION OF INMARSAT-E/E+ EPIRBS

The Inmarsat-E or E+ EPIRB (also known as an "L band" EPIRB) utilised the Inmarsat geostationary satellite system. This service was discontinued from 1 December 2006 due to the high cost of maintaining a system that has not been widely adopted as an element of the GMDSS. MSC/Circ. 1171 refers. At the time of publication of this Handbook, although discontinued, reference is still made to these in SOLAS Chapter IV.

9.11 VHF DSC EPIRBS

9.11.1 Carriage of VHF DSC EPIRB in lieu of satellite EPIRB

The GMDSS regulations allow vessels trading exclusively within A1 areas to carry an EPIRB operating on VHF channel 70 in lieu of a 406 MHz EPIRB.

The VHF DSC EPIRB must be capable of transmitting a Distress Alert using digital selective calling techniques. In order that it may be located by searching ships and aircraft, the EPIRB must also be capable of transmitting X-band radar locating signals.

VHF DSC EPIRBs are not fitted to Australian GMDSS vessels, and are rarely if ever, used elsewhere.

9.12 EPIRBS FITTED WITH AIS BURST TRANSMITTERS

A proposed new variant of the 406 MHz EPIRB includes an AIS burst transmitter as an additional locating aid. The designation of this device is EPIRB-AIS. The AIS burst transmitter will operate in a similar way to an AIS-SART, transmitting an updated position via AIS. The IMO has stipulated that these devices must still include a 121.5 MHz homing beacon for aircraft (or suitably equipped ships).

Although an international numbering format for the numerical identities (MMSI) to be used for the AIS transmitter has been agreed (974xxyyyy), these devices have yet to be brought into service.

It has also been agreed that the associated text to be transmitted by the AIS transmitter in active mode is EPIRB-ACTIVE, and EPIRB-TEST in test mode.

10 SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS)

10.1 WHAT IS AIS?

AIS is included in the Safety of Life at Sea (SOLAS) Convention, and large ships began fitting AIS in July 2002. AIS transmits, automatically and at set intervals, dynamic information relating to the ship's course, speed and heading; static information related to the ship's name, length, breadth; and voyage-related details such as cargo information and navigational status (e.g. underway or at anchor).

Put simply, the Automatic Identification System (AIS) is a Very High Frequency (VHF) radio broadcasting system that transfers packets of data over the VHF data link (VDL) and enables AIS-equipped vessels and shore-based stations to send and receive identification information that can be displayed on a computer or chart plotter.

Especially when used with appropriate graphical displays, this information can help in situational awareness and provide a means to assist in collision avoidance. AIS transceivers can be found interfaced to radars and ECDIS (Electronic Chart Display and Information System) displays. When interfaced to a radar, AIS can be a source of target information, in addition to conventional ARPA (Automatic Radar Plotting Aid). AIS fitted to real (physical) aids to navigation such as floating buoys and beacons. AIS base stations can broadcast a non-physical "synthetic" AIS AtoN to appear at the location of a real (physical) AtoN on an AIS-enabled display system (e.g. AIS, ECDIS or radar). AIS base stations can also broadcast a non-physical "virtual" AIS AtoN at a particular location when no real (physical) AtoN exists.

Although AIS is not part of the GMDSS, it can be considered part of the GMDSS due to the advent of the AIS-SART (AIS Search and Rescue Transmitter), which can be used in lieu of a search and rescue radar transponder (SART), since 01 January 2010. AIS transceivers on ships also have a simple text communications capability called Short Safety-related Messaging (SSRM), but does not constitute a distress- alerting system, and uses the VHF maritime mobile band.

10.2 SYSTEM DESCRIPTION

Each AIS station consists of one VHF transmitter, two VHF receivers (AIS 1 and AIS 2), one VHF DSC receiver (CH.70), a standard marine electronic communications link and sensor systems. Timing and positional information comes from a Global Navigation Satellite System (GNSS) receiver.

10.3 TYPES AND CLASSES OF AIS

There are two classes of shipborne AIS – Class A and Class B. In addition, there are different types of AIS used for shore stations (AIS Base Stations), AIS aids to navigation (AIS AtoN), AIS on search and rescue aircraft and the AIS search and rescue transmitter (AIS- SART).

AIS Class A – Class A has been mandated by the International Maritime Organization (IMO) for vessels of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages, as well as passenger ships (more than 12 passengers), irrespective of size.

AIS Class B – Class B provides limited functionality and is intended for non-SOLAS vessels. It is not mandated by the International Maritime Organization (IMO) and has been developed for vessels such as work craft and pleasure craft.

AIS Base Station – Base stations are provided by an aids to navigation authority to enable the ship-to-shore/shore-to-ship transmission of information. Networked AIS Base Stations can assist in providing overall maritime domain awareness.

AIS Aids to Navigation (AtoN) – AIS AtoN provide an opportunity to transmit position and status of buoys and lights through the same VDL, which can then show up on the electronic chart or computer display.

AIS-SART – Search and Rescue Transmitters using AIS can be used to assist in determining the final locating of a vessel or life raft, as part of the Global Maritime Distress and Safety System (GMDSS).

AIS on Search and Rescue (SAR) Aircraft – Search and Rescue Aircraft may use AIS to assist in their operations.

Type of AIS station	MMSI format *
AIS Class A/B vessels	MIDXXXXXX or MIDXXX000 00MIDXX00
AIS Base Station	00MIDXXXX
Physical AIS aids to navigation (AtoN)	99MID1XXX
Virtual AIS aids to navigation (AtoN)	99MID6XXX
AIS on craft assoc. with parent ship	98MIDXXXX
AIS-SART	970XXYYYY
AIS Man Overboard (Devices)	972XXYYYY
EPIRB-AIS (EPIRBs fitted with AIS)	974XXYYYY
AIS on SAR aircraft	111MIDXXX
* based on Rec. ITU-R M.585-6	

Table 7- Types of AIS Stations and MMSI Format

10.4 HOW IT WORKS

AIS works in an autonomous and continuous mode, no matter where the vessel is located – the high seas, coastal waters or inland waterways. AIS uses a time-division multiple access (TDMA) scheme to share the VHF frequency, also known as the VHF Data Link (VDL).

There are two dedicated frequencies used for AIS: AIS 1(161.975 MHz, previously known as channel 87B) and AIS 2 (162.025 MHz, previously known as channel 88B). Each frequency of the VDL is divided into 2250 time slots that are repeated every 60 s, and the AIS units send packets of information which are transmitted on these slots. At the same time, every AIS vessel in range is listening to the timeslots, and can receive the information.

For example, the system operates by a ship determining its geographical position with an Electronic Position Fixing Device which is fed into the AIS (or, in the case of AIS Class B, integral to the AIS unit). The AIS station then transmits this position, combined with ship identity and other ship data via the VHF radio link to other AIS-equipped ships and AIS base stations that are within radio range. In a similar fashion, the ship when not transmitting, receives corresponding information from all ships and base stations that are within radio range. The content of what is transmitted is determined by the message type. At present there are 25 identified AIS message types.

There are different technical means of transmitting in these slots. AIS Class A uses a self-organized approach (STDMA or SOTDMA) while AIS Class B units may use a carrier-sense approach (CSTDMA) as well as SOTDMA. Base stations use fixed slots (known as FATDMA) while AIS Aids to Navigation have an option to use FATDMA or a random access process called RATDMA, depending on the type of unit.

Messages are packed in slots that are accurately synchronised using GNSS timing information. Each station determines its own transmission schedule (slot), based upon data link traffic history and knowledge of future actions by other stations. A position report from one AIS station fits into one of 2250 time slots established every 60 s. This is shown in Figure 22.

10.5 FUNCTIONALITY AND CAPABILITY

The IMO Performance Standard for AIS requires that the system should be capable of operating:

- In the ship–to–ship mode, to assist in collision avoidance;
- As a means for littoral States to obtain information about a ship and its cargo; and
- As a VTS tool, i.e. ship–to–shore (traffic management).

This functionality is further expanded in the Performance Standard to require the capability of:

- Operating in a number of modes:
  - An "autonomous and continuous" mode for operation in all areas. This mode should be capable of being switched to/from one of the following alternate modes by a competent authority;
  - An "assigned" mode for operation in an area subject to a competent authority responsible for traffic monitoring such that the data transmission interval and/or time slots may be set remotely by that authority; and
  - A "polling" or controlled mode where the data transfer occurs in response to interrogation from a ship or competent authority.
- Providing information automatically and continuously to a competent authority and other ships, without involvement of ship's personnel;
- Receiving and processing information from other sources, including from a competent authority and from other ships;
- Responding to high priority and safety related calls with a minimum of delay; and
- Providing positional and manoeuvring information at a data rate adequate to facilitate accurate tracking by a competent authority and other ships.

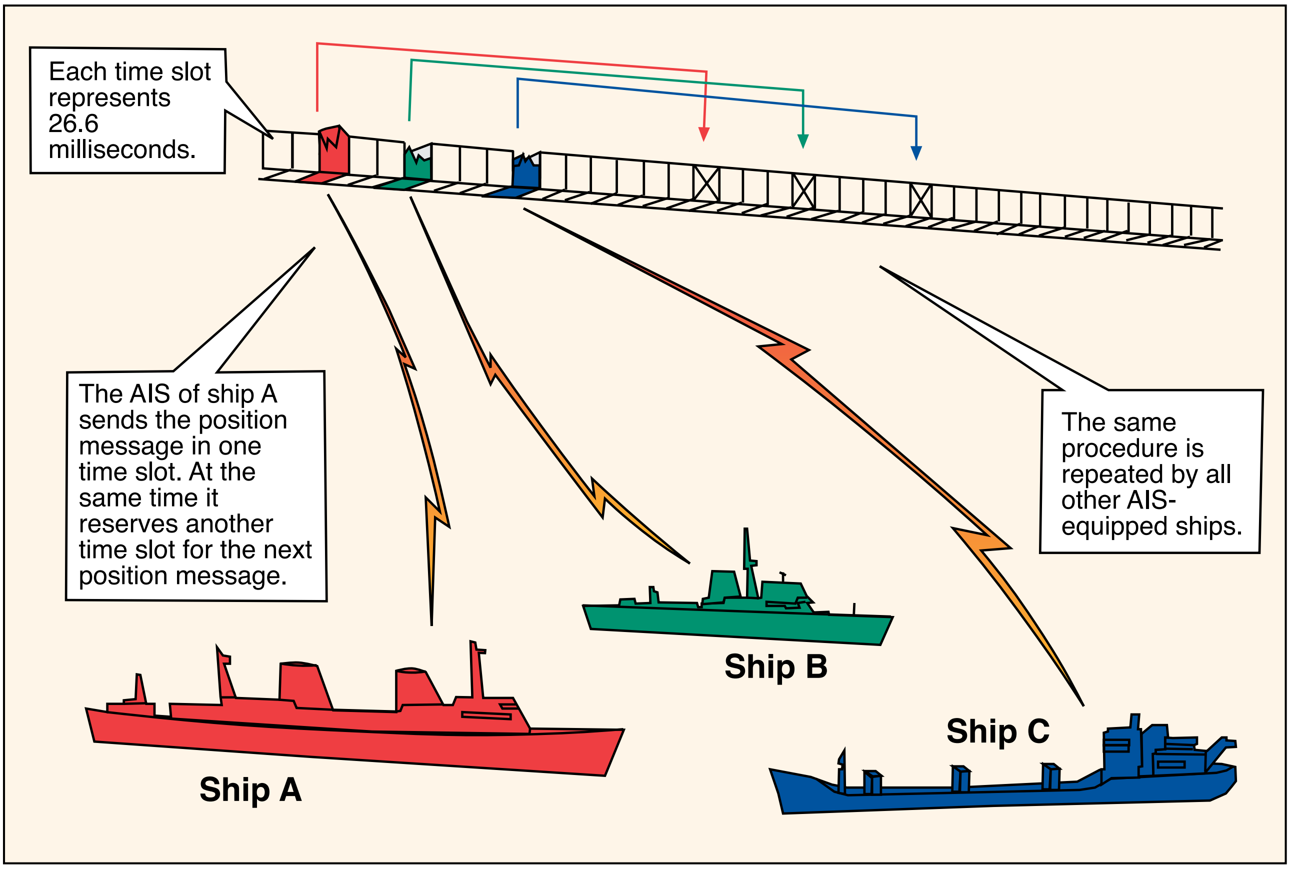


Figure 22 – Principles of SOTDMA

10.5.1 Main component parts of a Class A shipborne AIS station

GNSS Receiver – A GNSS receiver supplies the time reference to the AIS station to ensure all transmissions are synchronized.VHF Transmitter/Receiver – There is one VHF transmitter and two VHF receivers for TDMA operation. The VHF transmits and receives the radio signals that form the data links that interconnect the AIS station to each other. Data is transmitted and received in short time slots (26.76 ms) by the VHF radio.

DSC VHF Receiver – The DSC receiver is fixed to channel 70 to receive channel management commands for regional area designation. The DSC receiver can also be used for limited DSC polling. When replying to DSC polling, the common VHF transmitter is used.

AIS VHF Antenna - is a vertical polarized omni-directional antenna, and its location is critical to the success of the installation. The antenna should be installed away from interfering high power energy sources like radar and other antennas, and be located so that its omni-directional properties are not impeded. Likewise the connecting cable should be kept as short as possible to minimize attenuation of the signal.

Controller – The control unit is the central intelligence of the AIS station. It manages the time slot selection process, the operation of the transmitters and receivers, the processing of the various input signals and the subsequent distribution of all of the output and input signals to the various interface plugs and sockets, and the processing of messages into suitable transmission packets.

Built in Integrity Test (BIIT) – the BITT controls continuously integrity and the operation of the unit. This runs continuously, and if any failure or malfunction is detected that will significantly reduce integrity or stop operation of the AIS, an alarm is initiated. In this case the alarm is displayed on the minimum keyboard and display (MKD) unit and the alarm relay is set “active”. The alarm relay is deactivated upon acknowledgement either internally by means of minimum display and keyboard or externally by a corresponding acknowledgement sentence.

Signal Interface Connectors – In order to be able to transmit all the information included in a position report, the AIS station has to collect information from various ship sensors. There are also interfaces for connection to external display systems.

Minimum Keyboard and Display (MKD) – an MKD unit is mandatory on Class A mobile stations: The MKD has the following functions:

- Configures and operates the equipment;
- Shows as a minimum three lines of information;
- Inputs all data via an alphanumerical keyboard;
- Displays all received vessels bearing, range and names; and
- Indicates alarm conditions and means to view and acknowledge the alarm.

The MKD has a wider application, which may be used to input voyage-related data, i.e. cargo category, maximum present static draught, number of persons onboard, ETA and navigational status.

The MKD may:

- Input static information such as:
  - MMSI number;
  - IMO number; and
  - Ship's callsign, name, length and beam.
- Display safety-related messages; and
- Input safety-related messages.

10.6 MESSAGE TYPES AND FORMATS

AIS employs the principle of using a ship's speed and manoeuvring status as a means of governing information update rates and ensuring the appropriate levels of positional accuracy for ship tracking. This is shown in Table 3. A similar process is applied to the content of ship information messages to ensure that the data being transferred is not encumbered with static or low priority information.

The different information types, identified as "static", "dynamic" or "voyage-related" are valid for a different time periods and thus require a different update rate.

Information in the various message types includes:

- Static information: Every 6 min and on request:
  - MMSI;
  - IMO number (where available);
  - Call sign & name;
  - Length and beam;
  - Type of ship; and
  - Location of the position–fixing antenna on the ship (aft of bow / port or starboard of centreline).

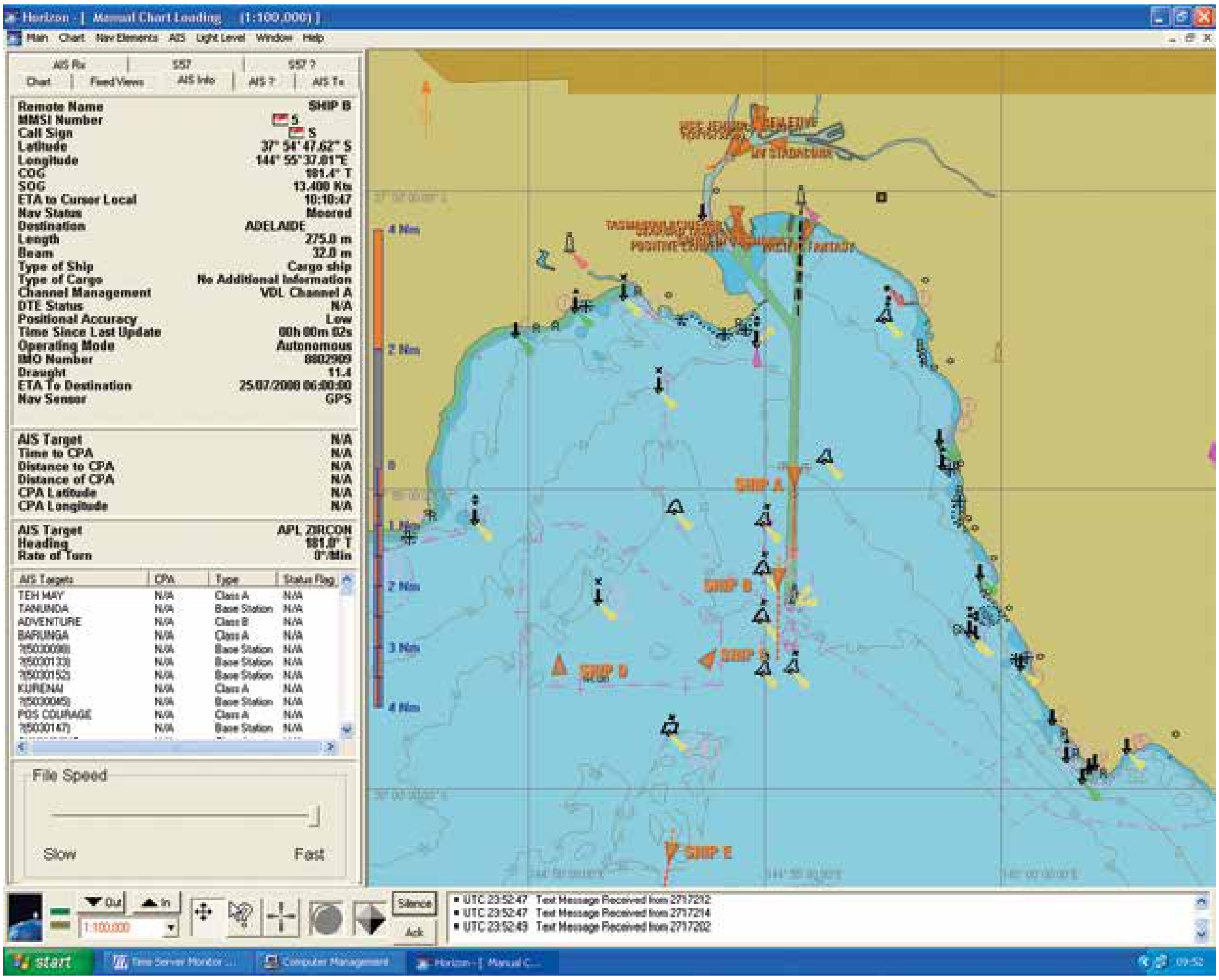


Figure 23 – Screen capture of AIS data

- Dynamic information: Dependant on speed and course alteration (see Appendix 8)
  - Ship's position with accuracy indication and integrity status;
  - Position time stamp (in UTC);
  - Course over ground (COG);
  - Speed over ground (SOG);
  - Heading;
  - Navigational status (e.g. at anchor, underway, aground, etc. – this is input manually); and
  - Rate of turn (where available).
- Voyage–related information: Every 6 min, when data is amended, or on request
  - Ship's draught;
  - Hazardous cargo (type);
  - Destination and ETA (at master's discretion); and
  - Route plan (waypoints).
- Short safety–related messages;
  - Free–format text message – sent as required.

10.7 DISPLAY REQUIREMENTS

If there is navigational equipment capable of processing and displaying AIS information such as ECDIS, radar or an integrated system, then the AIS Class A mobile system may be connected to that system via the AIS Presentation Interface (PI). The PI (input/output) needs to meet the requirements of relevant IEC standards (latest edition of IEC 61162). At present, there are a number of AIS units that use the Minimum Keyboard Display (MKD) which provides text based or basic graphic display elements.

The revised IMO radar performance standards (IMO Resolution MSC.192(79) 2004), states that all new radars fitted to ships after July 2008 must be able to display AIS targets. As AIS will be displayed on radar, and may also be displayed on Electronic Chart Display and Information Systems (ECDIS), it is unlikely that the MKD will evolve, and it is more likely that radar and ECDIS will be used to display AIS data.

10.8 BENEFITS AND ERRORS OF AIS

AIS has many benefits that can assist in enhancing situational awareness and supporting safety of navigation and protection of the environment both ashore and afloat. These include:

- Range and ability to 'see' around corners – AIS uses the VHF band, which is not restricted to line- of-sight operation;
- Information on course and intentions of other vessels – AIS provides heading of a vessel, which may be difficult to assess by radar or other means and can also provide rapid indication in change of heading or course;
- Extended data fields – the static and voyage-related data can help clarify intentions, although this could also be misleading if data is not up to date;
- Identification of vessels – AIS provides a name/call sign / MMSI to assist with positive identification of another vessel;
- DGPS corrections – these may be transmitted from an AIS Base Station over the VDL;
- Short safety related messages (SSRM) – capability to send and receive short text messages related to safety matters, i.e. bridge-bridge communication or shore-to-ship messaging (but not a distress alerting mechanism). SSRMs can be addressed to an individual station or to all ships. They content of these messages is intended to relate to the safety of navigation (e.g. the sighting of an iceberg or a buoy not on station). The maximum length of a single message is 162 characters, but they should be kept as short as possible to reduce the load on the VDL. Great care must be taken to avoid relying on such messages when a close quarters situation is developing, since there is no guarantee that receiving vessels will be able to readily display such messages.
- Application-Specific Messages (formerly known as Binary Messages) – these provide a data communications mechanism suitable for computer systems that may be connected to an AIS transceiver aboard a ship (such as an ECDIS) or from AIS aids to navigation, or from AIS base station. AIS Application-Specific Messages can be addressed or broadcast.

From 2004, for four years (as described in SN/Circ.236), seven messages were trialled for international use, meteorological and hydrological data, dangerous cargo, fairway closed, tidal window, extended ship state and voyage-related data, number of persons on board and AIS target (virtual).

In 2010, the IMO decided to revoke SN/Circ.236 as from 1 January 2013, and replace it with SN.1/Circ.289, which has 14 messages as follows: meteorological and hydrological data, dangerous cargo, tidal window, extended ship static and voyage-related data, number of persons on board, VTS-generated/Synthetic targets, clearance time to enter port, marine traffic signal, berthing data, weather observation from ship, area notice, environmental, route information and text description. Within each of these messages a large amount of data can be encoded.

There are also a number of common errors and drawbacks of AIS:

- It is common to see incorrect data entry in some AIS data fields which are manually inserted by the ship, or incorrectly programmed at installation or during maintenance. These fields are called the voyage-related and static data fields;
- AIS relies on vessels using an accurate (or at least common) source of positional data that will fail if that positioning system fails (i.e. GNSS; datum); and
- Display systems using only the MKD are quite limited, and AIS may not be used to full advantage.

It is also important to remember that not all ships carry AIS, especially other non-SOLAS work craft or pleasure craft, and warships (at their discretion to fit and use). Also, as noted in the IMO Resolution, it is possible that a Master of a vessel may have turned off the AIS if he/she considers it essential for the safety of the vessel.

10.9 DESTINATION CODE TO BE USED IN AIS

In IMO SN/Circ.244, IMO recommends the manually-entered 'Destination' field in the AIS voyage-related data field should be coded not in plain text, but in accordance to the UN/LOCODE (location code) or UNCTAD LOCODE for the destination port. UNCTAD LOCODEs can be found in the Admiralty *List of Radio Signals, Volume 6*, under each port.

Australian examples include:

AU SYD (Sydney);

AU MEL (Melbourne);

AU NTL (Newcastle);

AU JOV (Jabiru Terminal, Timor Sea);

AU HBA (Hobart);

AU LST (Launceston);

AU ADL (Adelaide);

AU FRE (Fremantle);

AU BNE (Brisbane); and

AU DRW (Darwin).

Note the space after the 'AU'.

Overseas examples include:

BD CGP (Chittagong);

IN BOM (Bombay);

NZ AKL (Auckland);

NZ BLU (Bluff);

HK HKG (Hong Kong);

CN SHA (Shanghai); and

JP YOK (Yokohama).

10.9.1 Use of AIS in MASTREP

From 1 July 2013, under the Modernised Australian Ship Tracking and Reporting System (MASTREP), ships are required to report via AIS. AIS data transmissions include both static and dynamic data which provides timely, detailed information while eliminating manual reporting obligations. Refer to 13.5 for more information.

10.10 CONTRIBUTION OF AIS

The AIS station, with its ability to exchange large blocks of information at high data rates, offers a new tool to enhance the safety of navigation and efficiency of shipping traffic management. In the ship-to- ship mode AIS is being used to assist in situational awareness and as another tool to aid in collision avoidance.

Coastal ship reporting systems, VTS and ports are significant beneficiaries of this wealth of near real time ship data, with many countries implementing AIS base station coverage in an integrated manner for vessel tracking. The AIS data transfer also provides the means for a wide range of maritime regulatory, traffic monitoring, administrative and logistical management activities that can be exploited to advantage by the maritime industry. The IMO Guidelines for the Onboard Operational Use of Shipborne AIS, IMO Assembly Resolution A22/Res.917 are also listed in Appendix 8.

10.11 ANNUAL TESTING OF AIS

SOLAS Chapter V, Regulation 18.9 states:

"The automatic identification system (AIS) shall be subjected to an annual test. The test shall be conducted by an approved surveyor or an approved testing or servicing facility. The test shall verify the correct programming of the ship static information, correct data exchange with connected sensors as well as verifying the radio performance by radio frequency measurement and on-air test using, e.g. a Vessel Traffic Service (VTS). A copy of the test report shall be retained on board the ship."

Message ID	Name	Description	M/B*
1	Position report	Scheduled position report; Class A shipborne mobile equipment)	M
2	Position report	Assigned scheduled position report; (Class A shipborne mobile equipment)	M
3	Position report	Special position report, response to interrogation; (Class A shipborne mobile equipment)	M
4	Base station report	Position, UTC, date and current slot number of base station	B
5	Static and voyage related data	Scheduled static and voyage related vessel data report; (Class A shipborne mobile equipment)	M
6	Binary addressed message	Binary data for addressed communication	M/B
7	Binary acknowledgement	Acknowledgement of received addressed binary data	M/B
8	Binary broadcast message	Binary data for broadcast communication	M/B
9	Standard SAR aircraft position report	Position report for airborne stations involved in SAR operations, only	M
10	UTC/date inquiry	Request UTC and date	M/B
11	UTC/date response	Current UTC and date if available	M
12	Addressed safety related message	Safety related data for addressed communication	M/B
13	Safety related acknowledgement	Acknowledgement of received addressed safety related message	M/B
14	Safety related broadcast message	Safety related data for broadcast communication	M/B
15	Interrogation	Request for a specific message type (can result in multiple responses from one or several stations)	M/B
16	Assignment mode command	Assignment of a specific report behaviour by competent authority using a Base station	B
17	DGNSS broadcast binary message	DGNSS corrections provided by a base station	B
18	Standard Class B equipment position report	Standard position report for Class B shipborne mobile equipment to be used instead of Messages 1, 2, 3	M
19	Extended Class B equipment position report	Extended position report for class B shipborne mobile equipment; contains additional static information	M
20	Data link management message	Reserve slots for Base station(s)	B
21	Aids-to-navigation report	Position and status report for aids-to-navigation	M/B
22	Channel management	Management of channels and transceiver modes by a Base station	B
23	Group assignment command	Assignment of a specific report behaviour by competent authority using a Base station to a specific group of mobiles	B
24	Static data report	Additional data assigned to an MMSI Part A: Name Part B: Static Data	M/B
25	Single slot binary message	Short unscheduled binary data transmission (Broadcast or addressed)	M/B
26	Multiple slot binary message with Communications State	Scheduled binary data transmission (Broadcast or addressed)	M/B
27	Position report for long-range applications	Scheduled position report; (Class A shipborne mobile equipment outside base station coverage)	M

Table 8 - AIS Message IDs

*M = transmitted by mobile, B = transmitted by base station

11 SURVIVAL CRAFT RADIO EQUIPMENT

This chapter provides general guidance in the principles and operation of GMDSS equipment for use in survival craft. For specific operational instructions, please refer to the equipment operator's manuals carried on board your vessel.

11.1 SEARCH AND RESCUE RADAR TRANSPONDERS (SARTS)

11.1.1 Description

Search and Rescue Radar Transponders (SARTs) are the main means in the GMDSS for locating ships in distress or their survival craft, and their carriage on board ships is mandatory. The SART is a small, battery powered, omni–directional radar receiver and transmitter. They may also be incorporated into a float–free satellite EPIRB. The batteries fitted to a SART allow operation in the standby condition for at least 96 h, plus a further 8 h whilst being interrogated.

11.1.2 Purpose and method of operation of a SART

A SART operates in the 9 GHz (3 cm or 'X-band') radar frequency band and, on receiving a signal from a ship or aircraft radar, transmits a series of response (homing) signals. The SART can be activated manually or automatically (in some cases) so that it will thereafter respond when interrogated. The method of using and activating SARTs varies over the type available, but instructions are marked on the sides of all SARTs.

These response signals will be seen on the ship or aircraft radar screen as a line of 12 dots (0.64 n miles apart) extending approximately 8 n miles outward from the SART's position along its line of bearing. This unique radar signal is easily recognised and allows the rescue vessel or aircraft to locate the survival craft. As the SART becomes closer, another 12 dots are produced, also 0.64 n miles apart (see Section 11.1.4).

A SART will not respond to 3 GHz radar (also referred to as 10 cm or 'S-band') radar.

11.1.3 Indication of operation and interrogation

On activation the SART will provide a visible and / or audible indication of its correct operation. It will also provide an indication when it is being interrogated by radar signals from a searching ship or aircraft.

11.1.4 Location distances

A SART should respond when interrogated by a shipborne X-band radar with a scanner height of 15 m within 8 n miles. A SART should also respond when interrogated by a compatible X-band radar fitted to an aircraft operating at a height of 3 000 feet at a distance of at least 30 n miles.

As height is the key to improving the distance that a SART will respond to a radar signal, survivors should endeavour to mount the SART as high as possible in a lifeboat or life raft, by lashing it to an oar, etc. Some models of SART incorporate mounting poles for this purpose. The vertical polar diagram of the antenna and the characteristics of the device will permit the SART to respond to radars under heavy swell conditions. SART transmission is substantially omni-directional in the horizontal plane.

11.1.5 Location errors

When a SART is being interrogated by a search radar, the SART's receiver is sweeping the radar band continuously, search for radar signals. Once interrogated (or triggered) by an X-band radar in range, the sweeps becomes alternately slow and fast. As all marine radars do not operate on exactly the same frequency within the 9 GHz radar band, there may be a small delay in SART response as the SART receiver locks onto the searching radar signal. Once the SART receiver has locked onto the searching radar, there is also a delay as the SART switches from receive to transmit mode, and it continues to sweep.

When the range closes so that the fast sweeps responses are seen, the first dot of the SART response displayed will be no more than 150 m distant from the true location of the SART.

When the range is such that only the slow sweep responses are seen (range approximately greater than 1 n mile), the first dot of the SART response displayed will be as much as 0.64 n miles beyond the true position of the SART.

11.1.5.1 Operating radar for SART detection

IMO Safety of Navigation Circular 197 provides guidance on using X-band radar for the detection of SARTs. This Circular is included as Appendix 12.

11.1.6 GMDSS carriage requirement

The GMDSS regulations require vessels between 300 and 500 GRT to carry one SART (or AIS-SART). Vessels over 500 GRT must carry two.

The SART(s) or AIS-SART(s) must be stowed in locations from where they can be rapidly placed in survival craft. Most Australian GMDSS vessels have SARTs stowed on the bridge, near the bridge wing doors. Alternatively, they may be stowed in survival craft.

11.1.6.1 Passenger ships

One SAR locating device (i.e. SART or AIS-SART) on each side of the ship capable of being rapidly placed in any survival craft.

11.1.6.2 Ro-ro passenger ships

Liferafts carried on ro-ro passenger ships are to be fitted with additional SAR locating devices (i.e. SART or AIS-SART) in the ratio of one for every four liferafts. The SAR locating device must be mounted inside the liferaft in accordance with provision 32.2.5 of Marine Order 25 (which gives effect to SOLAS III/26.2.5). Containers of liferafts fitted with SAR locating devices must be clearly marked.

11.1.7 Free-fall lifeboats

If the vessel carries at least two SAR locating devices (i.e. SART or AIS-SART), one shall be stowed in a free-fall life-boat, and one located in the immediate vicinity of the navigation bridge.

11.1.7.1 High speed craft

Under the High Speed Craft (HSC) Code, on passenger high speed craft and cargo high speed craft over 500 GRT must have one on each side of the vessel.

11.1.7.2 Radar reflectors

Where the International Life-saving Appliance (LSA) Code lists a radar reflector, a SAR locating device may be carried instead of the radar reflector.

11.1.7.3 Servicing

Australian Marine Orders made under the *Navigation Act 2012* require that a radar transponder must be inspected, tested and have its batteries replaced at intervals specified by its manufacturer. Aboard ship, each SART shall be examined at least once a month to check how secure it is its mounting and for signs of damage. It is not necessary to test the SART aboard ship routinely (refer to Section D of the AMSA GMDSS Radio Log).

11.1.8 Anti-collision radar transponders

Some manufacturers are producing an anti–collision radar transponder.

Such equipment is not a part of the GMDSS.

However, an anti–collision radar transponder may prove attractive to the operators of small vessels. For example, a yacht carrying such a transponder will have the means to provide a radar indication to larger vessels of its presence. It will also alert the yachtsman to the fact that a large vessel is in its vicinity.

An anti–collision radar transponder will produce a line of five dots on the interrogating vessel's radar screen, extending outwards for approximately one n mile from the transponder's position along its line of bearing.

11.1.9 Radar Target Enhancers (RTE)

Small craft sometimes install additional anti-collision devices called radar target enhancers (RTE)s, which may be a passive reflector-type or active devices. Active devices receive an interrogating radar pulse, amplify and stretch the pulse, and re-transmit it, resulting in an increased, or at least more consistent 'paint' on other vessels' radar display/s. IMO recommends against RTEs which produce a radar image which does not relate to the size of the vessel.

11.2 AIS-SEARCH AND RESCUE TRANSMITTERS (AIS-SARTS)

Since 1 January 2010, AIS – Search and Rescue Transmitters can be carried in lieu of Search and Rescue Radar Transponders on vessels subject to the 1974 SOLAS Convention.

11.2.1 Purpose and method of operation of an AIS-SART

The AIS-SART is designed to transmit AIS messages that indicate the position, static and safety information of a unit in distress. An AIS-SART has an integral position source (e.g. a GPS receiver) and accordingly, AIS stations receiving the AIS-SART signal are able to display the range and bearing to the AIS-SART.

AIS-SARTs can only be detected by AIS installations. They cannot be interrogated, and transmit autonomously once activated. AIS-SARTs use the Self-organizing Time Division Multiple Access (SOTDMA) protocol in the similar way to a Class A mobile AIS station.

An AIS-SART is designed to be deployed in a similar way to a SART in that it is designed to operate from a survival craft at a height of 1 m above sea level. It may be fitted as an integral part of a survival craft, and can be manually activated or de-activated. Automatic activation may be provided. It is supplied with a buoyant lanyard of highly visible yellow/orange colour to secure it to the survival craft.

Figure 24 - A typical AIS-SART

11.2.2 Indication of operation

An AIS-SART is to be equipped with a means which is either visual or audible, or both visual and audible, to indicate correct operation locally and be provided with test facilities for all functionalities using specific test information. An indication will be provided to show that the AIS-SART has been activated, is undergoing test and has completed test. There will also be an indication of the position fixing system status when the AIS-SART is activated.

The pre-set broadcast messages of SART TEST or SART ACTIVE should be seen as text adjacent to an AIS-SART target symbol on AIS installations fitted on vessels or shore stations in VHF reception range of the unit in distress, and is to be clearly distinguished from an AIS installation (i.e. a ship, AIS AtoNs, etc). In ships fitted with an AIS MKD (Minimum Keyboard and Display), the text only will be seen, together with range and bearing.

11.2.3 Detection distances

Detection range of an AIS-SART 1 m above the sea surface by a Class A mobile AIS station antenna at 15 m above the sea surface over water is be at least 5 n miles, but have been found to be 9.5 n miles in tests. Detection ranges are much greater from aircraft, and tests have shown detection of an AIS-SART from a fixed wing aircraft at 115 - 129 n miles (at 20 000 feet), 81 - 95 n miles (at 10 000 feet), 60 n miles (at 5 000 feet) and 25 n miles (at 1 000 feet).

11.2.4 AIS-SART unique identification

An AIS-SART, being an AIS transmitter, has a unique identifier, (an MMSI) using the format 970xxyyyy, where xx is the manufacturer ID from 01 to 99 and yyyy is the sequence number assigned by the manufacturer from 0000 to 9999. (The manufacturer ID xx = 00 is reserved for test purposes.) The MMSIs of AIS-SARTs are not recorded by the ITU or rescue authorities, nor are they tied to a particular ship.

Once programmed by the manufacturer it shall not be possible for the user to change the unique identifier.

See Appendix 13 for further information issued by the IMO (SN.1/Circ.322) on display of AIS-SARTs, AIS-MOB devices and EPIRB-AIS devices.

11.2.5 AIS-SART symbol

The IMO agreed symbol for an AIS-SART is shown below:

Topic: AIS Search and Rescue Transmitter (AIS-SART)

Symbol: 

Description: A circle containing a cross drawn with solid lines

11.2.5.1 Shipboard Indication of AIS-SART

The symbol above will not be displayed on older AIS or ECDIS displays. In these cases, the symbol will be a ship symbol without a name, together with range and bearing. As the firmware/software of the AIS and ECDIS is updated, the agreed symbol will be displayed. Irrespective of what is displayed, the MMSI beginning with 970 will be displayed and there will be an associated text message 'SART ACTIVE' or 'SART TEST' displayed as appropriate. On an ECDIS, the symbol should be 5 mm in diameter and coloured red.

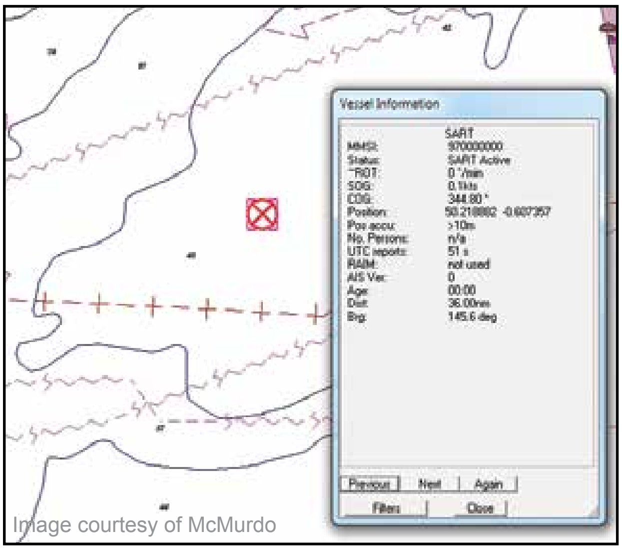


Figure 25 - AIS-SART indication on chart display

11.2.6 ACTIVE mode operation

The AIS-SART will have two modes when activated: ACTIVE or TEST. (References to 'Messages' refer to AIS Messages defined in Recommendation ITU-R M.1371).

In Active mode, messages are transmitted in a burst of 8 messages once per minute. The duration of the burst is 14 s (beginning to end). A burst consists of 8 messages, split between AIS 1 and AIS 2. Only one burst is necessary to be detected from time to time for a rescue vessel to locate the AIS-SART. The multiple messages are designed to maximise detection in a seaway.

The position shall be determined every minute.

The AIS-SART will start transmitting within 1 min after activation. If the position is unknown, a default position will be used (+91; +181). If time is not established, operation will commence unsynchronised but shall begin synchronised transmission with correct position within 15 min.

If the AIS-SART cannot obtain time and position within 15 min, the AIS-SART shall attempt to obtain one for at least 30 min in the first hour and at least 5 min in each subsequent hour.

Message 1 (Position Report) is transmitted with the Navigational Status set to 14 (SART ACTIVE).

Message 14 (Broadcast safety related message) is transmitted with the text 'SART ACTIVE'.

Message 14 is transmitted every 4 minutes, and replaces one of the position reports on both channels. So, in a burst of 8 messages, the first 4 messages will be position reports, then 2 messages of 'SART ACTIVE', then 2 messages of position reports. This sequence is then repeated.

If position and time synchronisation is lost, the AIS-SART continues to transmit with the last known position and indicates that the position system is inoperative.

11.2.7 TEST mode operation

In TEST mode, the AIS-SART will broadcast Message 14 with the text 'SART TEST'. The operation can be summarised in sequence as below:

- In test mode, there shall be only one burst of 8 messages, 4 on each channel.
- The first and last messages of the sequence will be Message 14 with the text 'SART TEST'.
- The remaining messages will be Message 1 with Navigational Status set to 15 (Undefined).
- The test messages shall be transmitted in one burst after position, SOG (speed over ground), COG (course over ground) and time are available.
- If the AIS-SART does not acquire position, SOG, COG and time within 15 min it will transmit anyway, but with appropriate default values (i.e. lat = 91, long = 181, COG and SOG = unavailable, time=position system inoperative)
- After the test transmission burst has completed, the test facility will reset automatically.

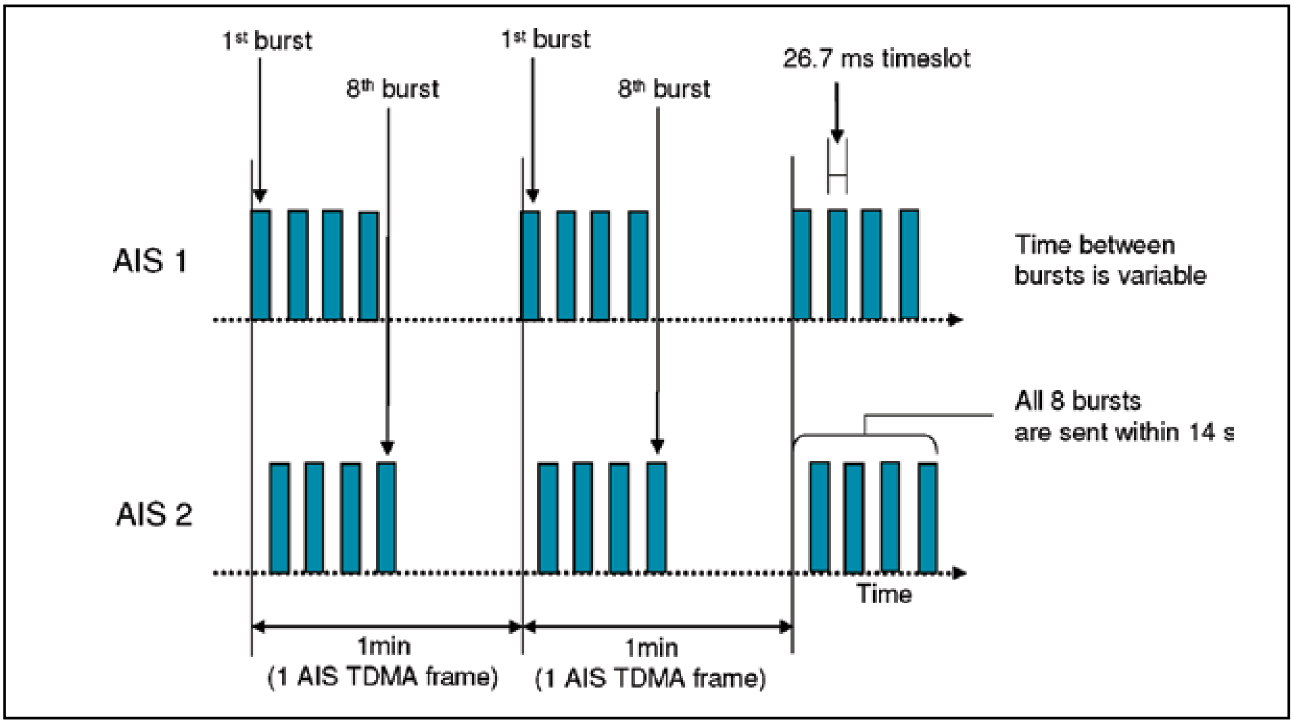


Figure 26 - AIS-SART transmit burst sequence in Active Mode

11.2.7.1 AIS-SART carriage requirements

GMDSS carriage requirement for AIS-SARTs are the same as for SARTs, in that they can be used in lieu of (radar) SARTs.

11.2.7.2 Physical requirements

The environmental and basic requirements are rugged and similar to a SART. It is to be watertight to a depth of 10 m for 5 min, float (not necessarily in an operating position), survive a drop into water from 20 m, not be unduly affected by seawater or oil and be of a highly visible yellow / orange colour, etc.

Nominal radiated transmit power of an AIS-SART shall be 1 W, and each transmission shall alternate between the frequencies of AIS 1 and AIS 2.

The AIS-SART should have sufficient battery capacity to operate for 96 h (-20°C to +55°C).

The unit will be have a durable label with brief operating and test instructions, expiry date (battery replacement date) for the primary (i.e. non-rechargeable) battery used, and the unique identifier (MMSI).

11.2.7.3 Routine testing of AIS-SARTs

AMSA recommends testing of AIS-SARTs be done sparingly, in order to prolong battery life, avoid mis-activation and confusion. If testing is required in port, the port authorities should be informed prior to activation, who can also confirm successful testing. The AIS-SART should be physically examined at least once / month with a view to ensure is no obvious physical damage, battery expiry date and the support cradle is intact.

11.3 PORTABLE TWO WAY SURVIVAL CRAFT VHF RADIOTELEPHONE APPARATUS

11.3.1 Introduction

Portable two way VHF radiotelephone equipment is used for communications between survival craft and rescue vessels. It may also be used for onboard communications on channels 15 and 17. Newer models automatically reduce the power to 1 W when these channels are selected. The equipment typically comprises a small hand-held transceiver with integral antenna.

11.3.2 IMO performance standards

The equipment should comprise at least:

- A transmitter and receiver;
- An antenna which may be fixed or mounted separately; and
- A microphone with a PTT and loudspeaker.

The equipment should:

- Be capable of being operated by unskilled personnel;
- Be capable of being operated by personnel wearing gloves for immersion suits;
- Be capable of single–handed operation except for channel selection;
- Withstand drops on to a hard surface from a height of 1 m;
- Be watertight to a depth of 1 m for at least 5 min;
- Maintain watertightness when subjected to a thermal shock of 45 deg C under conditions of immersion;
- Not be unduly affected by seawater, or oil, or both;
- Have no sharp projections which could damage survival craft;
- Be capable of operating in the ambient noise level likely to be encountered on board ships or in survival craft;
- Have provisions for its attachment to the clothing of the user;
- Be resistant to deterioration by prolonged exposure to sunlight;
- Be either of a highly visible yellow / orange colour or marked with a surrounding yellow / orange marking strip;
- Be capable of operation on the frequency 156.800 MHz (VHF Ch. 16) and on at least one additional channel;

  Note: Australian ships require channels 6, 13, 16 and 73 at least.
- Be fitted with channels for single–frequency voice communication only (i.e. duplex channels not allowed);
- Be provided with an on / off switch with a positive visual indication that the radiotelephone is switched on;
- Be provided with a manual volume control by which the audio output may be varied;
- Be provided with a squelch (mute) control and a channel selection switch:
  - Channel selection should be easily performed and the channels should be clearly discernible.
  - Channel indication should be in accordance with Appendix 18 of the ITU *Radio Regulations*.
  - It should be possible to determine that channel 16 has been selected in all ambient light conditions.
- Be operational within 5 s of switching on; and
- Not be damaged by the effects of open–circuiting or short–circuiting the antenna.

Output power/sources of energy

The effective radiated power should be a minimum of 0.25 W. Where the effective radiated power exceeds 1 W, a power reduction switch to reduce the power to 1 W or less is required. When this equipment provides for on–board communications, the output power should not exceed 1 W on these frequencies.

The source of energy should be integrated in the equipment and may be replaceable by the user. In addition, provision may be made to operate the equipment using an external source of electrical energy.

Equipment for which the source of energy is intended to be user–replaceable should be provided with a dedicated primary battery for use in the event of a distress situation. This battery should be equipped with a non–replaceable seal to indicate that it has not been used.

The primary battery should have sufficient capacity to ensure 8 h operation at its highest rated power with a duty cycle of 1:9. This duty cycle is defined as 6 s transmission, 6 s reception above squelch opening level and 48 s reception below squelch opening level.

Primary batteries should have a shelf life of at least 2 years, and if identified to be user–replaceable should be of a yellow or orange colour or marking.

Batteries not intended for use in the event of a distress situation should be of a colour or marking such that they cannot be confused with batteries intended for such use.

Brief operating instructions and expiry date for the primary batteries should be clearly indicated on the exterior of the equipment.

11.3.3 Equipment Operation

The equipment is operated in the same fashion as any hand held (or 'walkie-talkie') type unit. Controls are provided for volume, squelch and channel operation. Transmission – reception is controlled by a 'push-to-talk' switch located on the side of the unit.

11.3.4 Carriage Requirements

GMDSS vessels over 500 GRT are required to carry three portable survival craft VHF transceivers. Vessels of 300–500 GRT carry two. They are usually stored on or near the navigating bridge, for easy transport to survival craft. As the equipment uses re–chargeable batteries, the transceivers are stored in a 'drop in' type of battery charging cradle.

11.4 MARITIME SURVIVOR LOCATING SYSTEMS ('MAN OVERBOARD DEVICES')

These 'MSLS' or 'MOB' devices and systems are intended for very short-range crew retrieval applications. The MSLS is designed to allow for self help from the vessel or organisation where there is a risk of crew falling overboard by sounding an alert from the onboard receiver.

They are not part of the GMDSS, but may use frequencies which can be detected by both GMDSS vessels and non-GMDSS vessels.

11.4.1 VHF DSC-based 'MOB' devices

One example is a device transmitting on VHF Ch.70 using DSC, having an integral GNSS receiver, and transmits periodically, an automated Distress-priority alert and DSC message with the associated text 'MAN OVERBOARD'. The DSC message contains the GNSS position and time, which will be displayed on the vessel's VHF DSC receiver.

AS/NZS 4869.1 describes MSLS systems operating on 121.5 MHz and AS/NZS 4869.2 describes MSLS systems operating on frequencies other than 121.5 MHz. Both are authorized for use in Australian and New Zealand territorial waters.

Variants of this equipment may be found in other countries, but this section will focus on devices which use VHF Ch.70 DSC, and what the AS/NZS 4869.2 standard calls a Type A MSLS – a low power battery operated transmitter is carried or worn by persons at risk of falling overboard. A receiver on the parent vessel continuously monitors the system's designated frequency. If an incident occurs the transmitter involved is activated and the received signal initiates an alarm and may in some cases also be used for homing purposes to guide rescuers back to the casualty.

In Australia, until July 2012, these devices used a numerical identifier of the format 5038XXXXX, where x could be any number between 0 and 9.

Since July 2012, these devices use an international format 972xxyyyy for both DSC and AIS-based man overboard units, where x and y can be any number between 0 and 9, as specified in Recommendation ITU-R M.585. In this format, the 'xx' is a 2-digit code assigned to manufacturer(s) and 'yyyy' is a serial number assigned by the manufacturer. Once 'yyyy' reaches '9999', the manufacturer restarts the numbering sequence from '0000' again. There is no registration database kept for these devices nationally or internationally.

The units may also be fitted with an alerting light flashing at not-less than 20 flashes/min. If fitted, the light shall be capable of operating at least 6 h, which is also the main battery operation requirement. It may also be capable of being water activated.

The transmitter duty cycle

- When activated, no transmission is to occur for the first 20 s, but can occur between 20 s and 30 s.
- Then an initial DSC alert the message MAN OVERBOARD is transmitted (symbol 110) and type of subsequent communication 'No information' (symbol 126) which indicates that no subsequent communications will follow.
- As soon as a GPS position is available (to be less than 10 minutes), this position is transmitted.
- (if no position is obtained, the position field shall be filled with the digit 9 and the time field with the digit 8)
- After the first transmission with a position is sent, the message will be repeated at the rate of at least one report every 5 min for a period of 30 min. After 30 min has elapsed, the duty cycle shall change to 10 minutes, and will continue until the battery is exhausted of the MSLS is switched off.
- MSLS transmitter using DSC on VHF Ch.70, the transmitter duty cycles shall be randomly selected times of between 4.9 and 5.1 min and 9.9 and 10.1 minutes respectively.

The above mode is known as 'Open-loop', in that the DSC alert is broadcast to all ships in VHF range. However, in some countries these devices may operate in 'Closed-loop' mode, meaning that the MSLS broadcasts to the parent vessel only for the first 5 or 10 minutes, then goes to 'Open-loop' mode to all stations. MSLS of this type may also be programmed as members of a group, by using the group MMSI format specified in Recommendation ITU-R M.585. This allows a group of ships to monitor MSLS by programming the group ID into their VHF DSC transceivers.

Current IMO DSC procedures require that ships are NOT to relay a VHF DSC distress alert. Ships are also not to acknowledge a VHF DSC distress alert via DSC, except in special circumstances, as detailed in COMSAR/Circ. 25, and a relevant extract from the COMSAR/Circ. 25 is shown below:

Note 1 – Appropriate or relevant RCC and/or Coast Station shall be informed accordingly. If further DSC alerts are received from the same source and the ship in distress is beyond doubt in the vicinity, a DSC acknowledgement may, after consultation with an RCC or Coast Station, be sent to terminate the call.

Note 2 – In no case is a ship permitted to transmit a DSC distress relay call on receipt of a DSC distress alert on either VHF channel 70 or MF channel 2 187.5 kHz.

Ship stations in receipt of a distress alert or a distress call shall, as soon as possible, inform the master or person responsible for the ship of the contents of the distress alert. As with all distress alerts, the master of a vessel or person responsible for the vessel is to decide whether it is able to render assistance.

Image courtesy of Mobilarm

Figure 27 - Maritime survivor locating device (Man Overboard Device) using VHF Ch.70 DSC

11.4.2 VHF AIS-based 'MOB' devices

A number of devices used as Man Overboard Devices (Maritime Survivor Locating Systems/Devices) use AIS technology based on the burst transmissions defined in Annex 9 of Recommendation ITU-R M.1371. Early versions of these devices have the maritime identity of the format 970xxyyyy, but newer units starting from 2011, use the format 972xxyyyy, (see footnote 1 below the Table), which has been internationally agreed in Recommendation ITU-R M.585-6, Annex 2, Section 2.

There is currently no AS/NZS standard for these devices, but they should be certified by a competent testing house that they are sufficiently compliant with the IEC 61097-14 for the purpose it is intended, or fully compliant with overseas standards, such as RTCM 11901.1 (June 2012). Additional overseas standards for these devices are under development.

11.4.3 Diver locating devices

Some diver locating devices use technology based on burst transmissions defined in Annex 9 of Recommendation ITU-R M.1371, in a similar way to Man Overboard devices. The International Maritime Organization (NAV 58) has agreed that diver locating devices used for routine diver operations should not operate on the international AIS frequencies 161.975 MHz (AIS 1) or 162.025 MHz (AIS 2).

AIS 1 and AIS 2 should only be used when a diver is in a non-routine situation. The associated text transmitted in a non-routine diver situation should be MOB ACTIVE (or MOB TEST in test mode). The maritime identifier in this situation should be the same as for MOB devices: e.g. 972xxyyyy, as described above.

12 THE NAVTEX SYSTEM

This chapter provides general guidance in the principles and operation of the GMDSS NAVTEX system and equipment. For specific operational instructions, please refer to the equipment operator's manuals carried on board your vessel.

12.1 INTRODUCTION

12.1.1 System overview

The NAVTEX system provides the automatic dissemination of local Maritime Safety Information (MSI) by Narrow Band Direct Printing (NBDP) operating in the Forward Error Correction (FEC) broadcast mode (see Section 0 for more details on FEC operation). Depending on the geographical features of its area of responsibility (in main, the length of coastline), the NAVTEX system may be chosen by Administrations as an alternative to providing such information by the Inmarsat-C EGC service.

The system provides navigational safety information, weather warnings and forecasts relevant to vessels within specified coastal areas.

Range is generally within 300 – 400 n miles.

12.1.2 Areas of coverage

Due to its large length of coastline and the limited communications range of the NAVTEX frequencies, Australia has no plans to provide a NAVTEX service. Coastal MSI is disseminated by Inmarsat EGC. The NAVTEX system is presently used by countries in Asia, the Middle East, Europe and North America.

12.1.3 Frequencies used

Broadcasts of local MSI by land stations operating in the NAVTEX service are made on the (MF) frequency of 518 kHz. A second NAVTEX (MF) frequency of 490 kHz is available for national language broadcast. The (HF) frequency of 4 209.5 kHz is also allocated for nation NAVTEX transmissions. There is also provision for transmissions on other nationally assigned frequencies for national transmissions, which also be in language other than English. Some of these are on 424 kHz (refer to ALRS for details).

12.1.4 Some indicator characters

Each class of NAVTEX message carries a different subject indicator character allowing a shipboard operator to program a NAVTEX receiver to reject certain classes of message is not required.

Navigational warnings, meteorological warnings, and search and rescue information cannot be rejected by an operator.

Subject indicator characters used in the NAVTEX system are:

A Navigational warnings
B Meteorological warnings
C Ice reports
D Search and rescue information, and pirate attack warnings
E Meteorological forecasts
F Pilot service messages
G AIS
H LORAN messages
I Spare
J GNSS messages
K Other electronic navaid messages (messages concerning radio navigation services)
L Navigational warnings - additional to 'A'
V Special services – allocation by the NAVTEX panel
W Special services – allocation by the NAVTEX panel
X Special services - allocation by the NAVTEX panel
Y Special services – allocation by the NAVTEX panel
Z No messages on hand

Subject indicators A, B, D and L cannot be rejected by the receiver and will always be printed.

12.1.5 Format of a NAVTEX message

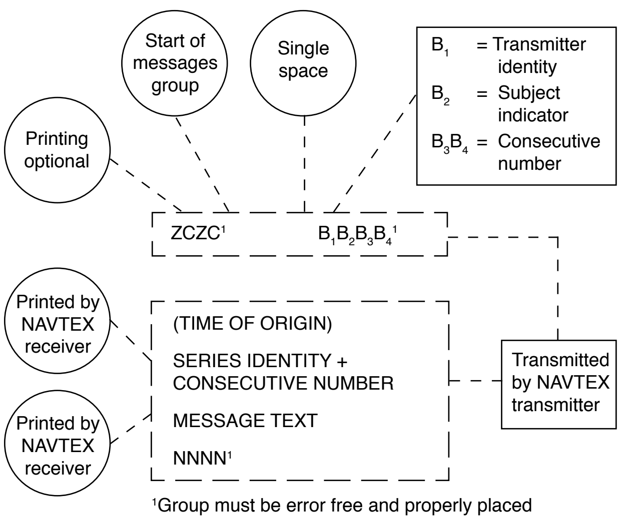


Figure 28 - Format of NAVTEX Message

12.1.6 Broadcast schedules

As there is only one frequency presently used for NAVTEX transmissions, mutual interference between stations is avoided by a time sharing arrangement. In general, each NAVTEX station in an area is allocated a designated 10 min period every 4 h to make its broadcasts.

Details of NAVTEX stations and their allocated broadcasting times may be found in the *List of Coast Stations and Special Service Stations* published by the International Telecommunication Union (ITU) or the Admiralty List of Radio Signals. Generally, NAVTEX information is broadcast in the English language.

NAVTEX messages are given priorities of VITAL, IMPORTANT and ROUTINE.

VITAL – Transmitted on receipt (subject to not causing interference to other stations).

IMPORTANT – Next available time slot.

ROUTINE – At the normal allocated time slot.

Messages numbered 01 to 99 if previously received without too many errors will not be reprinted. SAR messages will have the number 00 and always be reprinted whether received previously or not. Most

NAVTEX receivers also delete any messages between 60 and 72 h old.

12.2 SHIPBOARD EQUIPMENT

12.2.1 NAVTEX receivers

To receive NAVTEX broadcasts, a ship must be equipped with a dedicated NAVTEX receiver tuned to 518 kHz. Once switched on and programmed, the receiver will provide fully automatic operation and broadcasts will not be missed even if the bridge watch keeper is busy with other duties. Messages are received in printed form on a paper roll, and on recent models, displayed electronically with local storage.

A spare quantity of paper rolls must be kept on board, if the NAVTEX receiver requires it.

12.2.2 Station identification

Coast stations transmitting NAVTEX messages are assigned a single alphabetical letter identification code letter (called a B1 character or Transmitter Identification Character), based upon the principles outlined in the ALRS Volume 5, Figure X. NAVTEX receivers allow the operator to select or reject individual stations by their identification code letter.

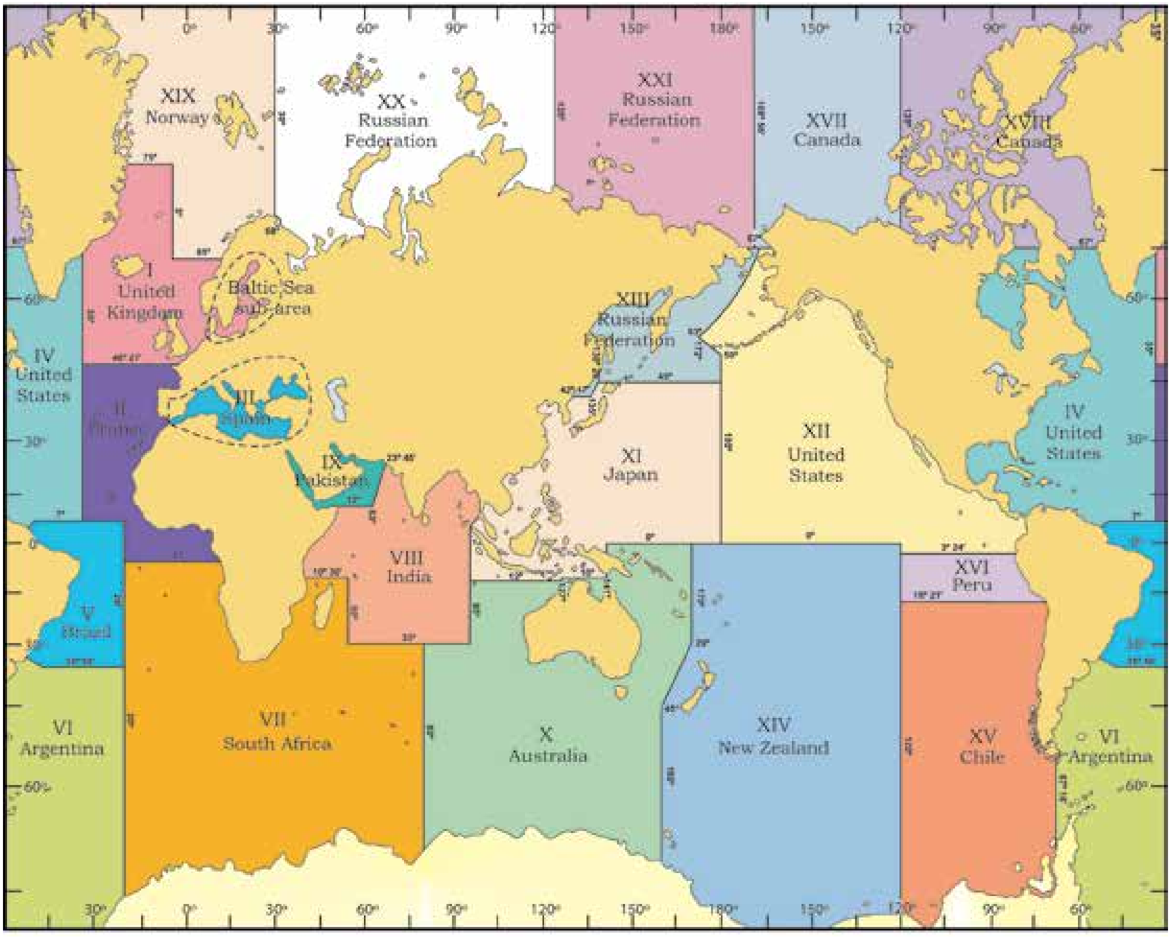


Figure 29 - NAVAREAS of the World-Wide Navigational Warning Service (WWNWS)

13 SEARCH AND RESCUE (SAR) OPERATIONS

13.1 SHORE BASED SAR NETWORK

13.1.1 Communications links

To exploit the full advantages of the globally integrated GMDSS satellite and terrestrial communications network necessitates the establishment of an efficient communications network between Maritime Rescue Coordination Centres (MRCCs). In addition, each MRCC is equipped with communication links with the associated Land Earth Station(s), Coast Radio Station(s) and COSPAS-SARSAT ground station(s).

The interconnecting links between MRCCs will usually use the public switched telecommunications network for telephone, facsimile, and data communications. Some MRCCs may also be provided with an Inmarsat ship earth station.

13.1.2 SAR coordination

SAR action in response to any distress situation will be achieved through cooperation among SAR Administrations. The MRCC nearest the distress incident will normally acknowledge the distress alert and assume responsibility for SAR coordination. A good explanation of the international SAR system is contained in the *Admiralty List of Radio Signals*, Volume 5.

13.1.3 Coordination of distress traffic

The MRCC which is responsible for controlling the search and rescue operation will also be responsible for co-ordinating the distress traffic relating to that incident, or may appoint another station to do so.

13.2 THE IAMSAR MANUAL

The International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) jointly publish the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR). The Manual comes in three volumes:

Volume I 'Organization and Management' discusses the global SAR system concept, establishment and improvement of national and regional SAR systems and cooperation with neighbouring States to provide effective SAR services.

Volume II 'Mission Coordination' assists personnel who plan and co-ordinate SAR operations and exercises.

Volume III 'Mobile Facilities' is intended to be carried aboard rescue units, aircraft, and vessels to help with performance of a search, rescue, or on–scene coordinator function and with aspects of SAR that pertain to their own emergencies.

Volume III of the IAMSAR Manual is recommended for carriage by all SOLAS vessels.

13.3 ON-SCENE COMMUNICATIONS

13.3.1 On-scene communications

On–scene communications are those between the ship in distress, other ships and aircraft involved in the incident, and the on–scene coordinator (OSC). Control of these communications is the responsibility of the on–scene coordinator.

Simplex frequencies (i.e. transmission and reception on the same frequency) will be used in order that all stations concerned may share information concerning the distress incident.

For the same reason, where NBDP is used, the broadcast (forward error correction or FEC) mode should be selected.

13.3.2 Frequencies for on-scene communications

The choice of frequencies for on–scene communications is the responsibility of the on–scene coordinator.

Preferred radiotelephony frequencies for on–scene communications are VHF channel 16 (156.80 MHz) and 2 182 kHz.

Ship to ship on–scene communications may also use NBDP on 2 174.5 kHz in the broadcast (forward error correction) mode.

In addition to VHF channel 16 and 2 182 kHz, the frequencies of 3 023 kHz, 4 125 kHz, 5 680 kHz, 121.5 MHz, 123.1 MHz, and VHF channel 6 (156.30 MHz) may be used between ships and aircraft. Passenger ships are required to carry equipment providing operation on the VHF aeronautical air / sea frequencies of 121.5 MHz and 123.1 MHz from the position from which the ship is normally navigated.

Normally, once a frequency (or frequencies) has been chosen, a continuous loudspeaker or, in the case of NBDP, a teleprinter watch will be maintained by all participating stations on that frequency or frequencies.

13.4 LOCATING AND HOMING SIGNALS

13.4.1 Locating signals

Locating signals are radio transmissions intended to facilitate the finding of a ship in distress or the location of survivors. These signals include those transmitted by the ship in distress, by survival craft, by searching ships primarily and by survival craft radar transponders (SARTs).

13.4.2 Frequency bands for locating and homing signals

Locating/homing signals may be transmitted in the frequency bands:

117.975 to 126 MHz
(EPIRBs homing frequency 121.5 MHz)

156 to 174 MHz
(EPIRBs operating on VHF Channel 70)

161.975 and 162.025 MHz (AIS-SARTs)

406 to 406.1 MHz (406 MHz EPIRBs)

9.2 to 9.5 GHz (X band radar and SARTs)

13.4.3 Homing signals

Homing signals are those locating signals which are transmitted by a ship in distress, or by survival craft, for the purpose of providing searching ships and aircraft with a signal that can be used to determine the bearing of the transmitting station.

Homing signals include the 121.5 MHz component of transmissions from a 406 MHz EPIRB.

13.5 SHIP REPORTING SYSTEMS

13.5.1 Transition of AUSREP to MASTREP

The Australian Ship Reporting System (AUSREP) has transitioned to the Modernised Australian Ship Tracking and Reporting System (MASTREP), as prescribed in *Marine Order 63 (MASTREP) 2013*, from 1 July 2013.

AUSREP commenced in 1973 in line with Australia's obligations under the International Convention for the Safety of Life at Sea (SOLAS) as a ship reporting system and is operated by the Australian Maritime Safety Authority (AMSA) through the Australian Rescue Coordination Centre (RCC Australia) in Canberra.

For 40 years AUSREP has served the needs of both Australia and mariners, but over that time requirements have changed and on 1 July 2012 AUSREP commenced the transition to MASTREP. In the first phase of the transition, Australia introduced requirements allowing for the use of Automatic Identification System (AIS) technology, which automates ships' positional reporting, increasing the timeliness and accuracy of data and allows coverage of a greater number of ships operating within the Australian search and rescue region.

In phase two, which commenced on 1 July 2013, MASTREP replaced AUSREP as Australia's internationally recognised ship reporting system. Ships are required to report via AIS but are no longer required to submit Sailing Plans and Final Reports as AIS data transmissions include both static and dynamic data which provides timely, detailed information while eliminating manual reporting obligations.

13.5.2 MASTREP application and obligation to report

Application

The AUSREP area and the MASTREP area are the same and requirement to report applies to the each of the following vessels while in the MASTREP area:

- A regulated Australian vessel; or
- A foreign vessel from its arrival at its first port in Australia until its departure from its final port in Australia.

Domestic commercial vessels fitted with GMDSS and AIS are also encouraged to participate in the system as MASTREP assists AMSA in carrying out its search and rescue activities.

Obligation

Position Reports are to be transmitted by AIS. The master of a ship, to which Regulation 19.2.4 of Chapter V of SOLAS applies, must ensure the ship is fitted with a system to automatically transmit the following information:

- Identity;
- Type;
- Position;
- Course;
- Speed;
- Navigational status; and
- Safety related information.

As per regulation 19.2.4.7 of Chapter V of SOLAS, AIS must be operated taking into account the guidelines for the onboard operational use of shipborne AIS adopted by IMO Resolution A.917(22)as amended by IMO Resolution A.956(23).

The master of a ship must report any malfunction of the ship's AIS equipment to RCC Australia in accordance with Section 186 of the *Navigation Act 2012*.

Further information and guidance on the ship reporting requirements is outlined in the MASTREP Quick Reference Guide. Copies of the MASTREP Guide can be accessed from the AMSA website: www.amsa.gov.au or from RCC Australia directly.

RCC Australia contact details

(Full details are provided in the IAMSAR Manual, the MASTREP booklet and REEFVTS User Manual)

Rescue Coordination Centre Australia (RCC Australia) 24 h emergency contact telephone numbers:

1800 641 792 (Maritime)

1800 815 257 (Aviation)

MMSI: 005030001

13.5.3 The REEFREP system

The Great Barrier Reef and Torres Strait Ship Reporting System (REEFREP) was established in 1996 to improve the safety and efficiency of shipping traffic transiting the region.

REEFREP provides the REEF Vessel Traffic Service (REEFVTS) with information about a ship, its characteristics, and intended passage. This information, together with the monitoring and surveillance systems used by REEFVTS, assists with the proactive monitoring of a ships transit through the Great Barrier Reef and Torres Strait.

REEFVTS is operated under joint arrangement between the Australian Maritime Safety Authority (AMSA) and Maritime Safety Queensland (MSQ). Its purpose is to:

- make navigation in Torres Strait and the inner route of the Great Barrier Reef safer by working with shipping to give the best possible information on potential traffic conflicts and other navigational information.
- minimise the risk of maritime accidents, and therefore avoid the pollution and damage which such accidents can cause to the marine environment in the Great Barrier Reef and Torres Strait.
- assist with quick response if a safety or pollution incident does occur.

It is manned on a 24 h basis from the VTS Centre, situated at Townsville on the Queensland coast.

Main features of the system

A ship must send the following reports to REEFVTS at the time / place specified:

- Pre-Entry Position Report - at least 2 h prior to entering the REEFVTS Area;
- Entry Report and Route Plan Report on entering the REEFVTS Area; and
- Final Report (FR) on leaving the REEFVTS Area or arrival at an Australian port.

Additional Reports must be sent to REEFVTS where applicable:

- Intermediate Position Reports where Sat C is not available;
- Route Deviation Report; and
- Defect Report.

Inmarsat-C is the preferred option for Automated Position Reporting and transmission of Ship Information Services. Messages to REEFVTS sent by Inmarsat-C will be reverse charged to REEFVTS if ships use special access code (SAC) 861 via POR LES 212.

Ships are provided with Ship Traffic Information on the position, identity and intentions of other traffic including Maritime Safety Information which identifies hazards or other factors (e.g. defective aid to navigation).

REEFVTS may also provide navigation assistance to an individual ship to assist on-board decision-making, where information available to REEFVTS suggests a ship may be standing into shallow water, or is deviating from a recommended route.

Full details are included in the REEFVTS User Guide which is available from REEFVTS or on the AMSA website (www.amsa.gov.au).

REEFVTS Contact Details

Telephone +61 1300 721 293

Facsimile +61 7 4721 0633

Email: reefvts@vtm.qld.gov.au

Vessels required to participate in the REEFREP system

The following categories of ships are required to report to REEFVTS under REEFREP:

- All ships of 50 metres or greater in overall length;
- All oil tankers, liquefied gas carriers, chemical tankers or ships coming within the INF Code, regardless of length; and

- Ships engaged in towing or pushing where it, or the ship being towed or pushed is a ship described in a) or b) or where the overall length of the tow is or exceeds 150 metres.

The overall length of the tow is measured from the stern of the towing vessel to the after end of the tow.

13.5.4 The AMVER system

The Automated Mutual–assistance Vessel Rescue (AMVER) system, operated by the United States Coast Guard, is a voluntary global ship reporting system used worldwide by search and rescue authorities to arrange for assistance to persons in distress at sea. Merchant vessels of all nations making offshore voyages are encouraged to send movement reports and periodic position reports to the AMVER centre at Coast Guard New York, via selected radio stations or the Inmarsat system.

Information from these reports is entered into a computer which generates and maintains dead reckoning positions for vessels while they are within the plotting area. Characteristics of vessels which are valuable for determining SAR capability are also entered into the computer from available sources of information. Appropriate information concerning the predicated location and SAR characteristics of each vessel known to be within the area of interest is made available upon request to recognised SAR agencies of any nation, or person in distress, for use in an emergency. Predicted locations are only disclosed for reasons connected with maritime safety.

13.5.5 Other ship reporting systems

Other ship reporting systems in accordance with SOLAS, include the Japan Ship Reporting System (JASREP), China Ship Reporting System (CHISREP), South Korea Ship Reporting System (KOSREP), France (SURNAV) and many others. Details of these are published in the *Admiralty List of Radio Signals*, Volume 6.

14 GMDSS DISTRESS URGENCY AND SAFETY COMMUNICATIONS PROCEDURES

This Chapter provides an overview of the procedures to be used for emergency communications to and from GMDSS vessels.

It should be noted that no provision of this Chapter or the ITU *Radio Regulations* prevents the use by a ship in distress of any means at its disposal to attract attention, make known its position and obtain help.

Similarly, no provision of this chapter, or the ITU *Radio Regulations*, prevents the use by ships engaged in search and rescue operations of any means at their disposal to assist a ship in distress.

14.1 GENERAL

14.1.1 Transmission of a distress alert by a ship

A distress alert indicates that a mobile unit or person is threatened by grave and imminent danger and requires immediate assistance.

A distress alert has absolute priority over all other transmissions.

A distress alert may be a digital selective call (DSC) transmitted by terrestrial communications (MF, HF or VHF), a distress message format transmitted by Inmarsat communications or a distress call transmitted by voice.

The signal from an activated satellite EPIRB is also regarded as a distress alert.

14.1.2 Authority to transmit a distress alert

A distress alert may only be sent on the authority of the Master or person responsible for the safety of the ship.

14.1.3 Information contained in a distress alert

The distress alert must provide the identification of the ship in distress and its position.

The distress alert may also contain information regarding the nature of the distress, the type of assistance required, the course and speed of the ship, the time that this information was recorded and any other information which might facilitate rescue.

14.1.4 Receipt of a distress alert by a ship

A ship's operator receiving a distress alert, must, as soon as possible, inform the Master or person responsible for the safety of the ship of the contents of the distress alert.

Any station receiving a distress alert must immediately cease any transmission capable of interfering with distress traffic.

14.1.5 Obligation to acknowledge receipt of a distress message

Ship stations which receive a distress message from another ship which is, beyond any possible doubt, in their vicinity should immediately acknowledge receipt.

However, in areas where reliable communications with a coast station are practicable, ship stations should defer this acknowledgment for a short interval to allow the coast station to acknowledge.

Ship stations which receive a distress message from another ship which, beyond any possible doubt, is not in their vicinity should defer their acknowledgment to allow ships nearer to the distressed ship to acknowledge without interference.

14.1.6 Shore to ship distress alert relays

A Maritime Rescue Coordination Centre (MRCC) which receives a distress alert will initiate the transmission of a shore to ship distress alert relay addressed, as appropriate, to all ships, ships in a particular area or to a specific ship. The distress alert relay will be transmitted by the Inmarsat EGC system and also via DSC and radiotelephone communications.

The distress alert relay will contain the identification of the ship in distress, its position and all other information which might facilitate rescue.

A distress relay or a distress acknowledgement can only be sent on the authority of the Master or person responsible for the safety of the ship.

14.1.7 Transmission of a distress alert by a ship not Itself in distress

A ship which learns that another ship is in distress should initiate and transmit a distress alert relay on its behalf in the following circumstances:

- When the ship in distress is not itself in a position to transmit a distress alert, and
- When the Master or person responsible for the ship not in distress considers that further help is necessary.

See also Section 14.10.6

A ship station transmitting such a distress alert relay must indicate that it is not itself in distress. Satellite and/or terrestrial communications may be used by the ship transmitting the distress alert relay.

14.2 GENERAL INMARSAT DISTRESS, URGENCY AND SAFETY PROCEDURES

14.2.1 Introduction

The Inmarsat system provides priority access to satellite communications channels in emergency situations.

Each ship earth station (SES) is capable of initiating a "request message" with distress priority. This is automatically recognised and a satellite channel assigned immediately. In the event of all satellite channels being busy with routine communications, one of them will be pre-empted and allocated to the ship earth station which initiated the distress priority call.

The English language is used for international maritime distress messages.

14.2.2 Routeing of distress alerts

The distress priority applies not only with respect to allocation of satellite channels but also to automatic routeing of the alert to the appropriate rescue authority. Each Land Earth Station (LES) is required to provide reliable telecommunications connections with an associated MRCC.

Australia's LES located in Perth has dedicated connections to the RCC in Canberra.

14.2.3 MRCCs

A MRCC is equipped with specialised facilities to organise and co-ordinate search and rescue activities. MRCCs are connected by international telecommunications networks to MRCCs located in other parts of the world. Many are also equipped with Inmarsat terminals to provide direct communications to ships in the event of failure of communications to the associated Inmarsat LES.

14.2.4 Initiation of a distress alert

Initiation of a distress alert from most ship earth stations is made simple by the provision of a distress button(s) or, in some cases, the input of a brief keyboard code. This simple operation provides an automatic, direct and assured connection to the MRCC associated with the LES which has been contacted. The need for the operator to enter the telephone or telex number (if used) of the MRCC is thus avoided. The establishment of the connection is completely automatic and should take only a few seconds.

14.3 INMARSAT-B / FLEET77 SHIP EARTH STATIONS

14.3.1 Generation of distress alerts

The issue of an Inmarsat–B / Fleet77 distress alert by a ship may be made by using either the telex (Inmarsat-B only) or telephony communication channels.

If a distress alert is issued on a telex channel, the ship's operator should pause until receiving the answerback of the MRCC, then type essential details of the distress including the ship's callsign, name, position, nature of distress and type of assistance required.

A distress alert issued on a telephony channel will be automatically routed to the LES's associated MRCC. The process usually takes less than 1 min. On being connected to the duty officer at the rescue co–ordination centre, the ship's operator should clearly state details of the distress, using the voice MAYDAY procedures described later in this Chapter.

14.4 INMARSAT 505 EMERGENCY CALLING (FLEETBROADBAND)

Note: Inmarsat FleetBroadband ship earth stations are not GMDSS approved as yet but this is being sought prior to the closure of the Inmarsat B service on 31 December 2014.

(Please see note on inside front cover)

Inmarsat has recently introduced a new non-GMDSS service called 505 Emergency Calling. It is intended as a free-of-charge service for smaller vessels that do not require GMDSS-compatible equipment. It can only be used via FleetBroadband 500, 250 and 150 terminals. 505 calls can only be made whilst there is an IP (Internet Protocol) connection, not an ISDN connection.

It is a short code dialling facility that provided direct access to maritime relief. In time of distress a seafarer dials 505 (selected for its similarity to SOS) to contact a Maritime Rescue Coordination Centre (MRCC). At the time of publication of this Handbook, this service is NOT GMDSS-compliant and GMDSS-compliant equipment should be used in the first instance if fitted. At the time of publication of this Handbook, there are three MRCCs strategically selected in the world which have agreed to participate in this service: RCC Australia (Canberra, Australia), JRCC Norfolk (Virginia, USA) and JRCC Den Helder (Netherlands).

14.5 INMARSAT-C SHIP EARTH STATIONS

Reference should be made to specific manufacturers' instructions on how to send both pre–programmed distress alerts and detailed distress messages.

14.5.1 Generation of distress calls

An Inmarsat–C ship earth station allows an operator to send two different types of distress call – a brief distress alert, or a detailed message with distress priority.

Both types of distress call are automatically routed through a LES to its associated MRCC. Initially, the brief distress alert should be sent and, if time permits, a detailed distress priority message should follow.

The brief distress alert only requires the operation of one or two controls and results in a distress message containing the following pre–programmed information being transmitted:

- The identity of the ship earth station;
- The nature of the distress (chosen from a menu or "maritime unspecified" if not chosen); and
- The ship's position, course and speed (from the most recent entry to the equipment).

A distress alert may be initiated even when a SES is engaged in sending or receiving a message. Routine communications will be abandoned immediately and the distress alert transmitted.

If an acknowledgment is not received from both the LES and the MRCC within 5 min, the distress alert should be repeated. Some SES equipment provides its own indication to the operator that the distress alert is being transmitted and of its receipt at the LES.

A detailed distress message may be typed into the equipment using the text editor facility in the same way as a normal message. However, distress priority must be selected by the operator before transmission.

14.5.2 Routeing of a distress calls

Some ship earth station equipment will send a distress alert to the "preferred LES" (a stored entry in the distress message generator) or, if this entry has not been made, to the LES most recently in communication with the ship earth station.

Other types of ship earth station require the operator to select a LES through which to send a distress alert or call. This should be the nearest LES to the distressed vessel. If a LES is not specified either by the equipment or the operator, the distress alert will be routed via the network co-ordination station (NCS) and may result in an unnecessary delay.

14.5.3 Position information

Usually a shipboard Inmarsat–C terminal will be interfaced with the vessel's satellite navigator to provide an accurate and current position for automatic transmission in a distress alert.

On ships where this interfacing is not possible, it is essential that the ship's position, course and speed are entered manually at intervals not exceeding 4 h.

The regular entry of position information to Inmarsat–C equipment is also vital to ensure that the integral enhanced group calling (EGC) facility responds to maritime safety information which is relevant to the ship's position.

14.5.4 Remote Distress Initiation Devices (RDIDs)

All Inmarsat–C equipment is required to be fitted with a device for generating a distress alert from a position remote from which the vessel is normally navigated. This equipment is known as a Remote Distress Initiation Device (RDID), and is usually installed in either the Master's cabin, or a suitable remote location. Upon activation of the RDID, the Inmarsat–C equipment will transmit a pre–programmed distress alert, as described in Section 14.5.1.

14.5.5 Generation of urgency messages

Current software fitted to Inmarsat–C equipment does not provide for transmission of 'safety' priority messages, only Distress, Urgent and Routine.

Note: These are the accepted terms, however some manufacturers may use 'Distress', 'Routine' and 'Non–urgent'. These relate to 'Routed directly to SAR', 'Forwarded immediately' and 'Delayed forwarding' respectively. Urgent priority messages must be composed with the text editor, in the same way as a routine call, and urgent priority selected before transmission.

14.5.6 Two digit service codes

A range of special safety and general maritime services, known as the 2–digit 'service' codes special access codes or short address codes (SAC) may be available through some LESs. These are summarised as follows:

Service	2 Digit Code
Automatic calls	00
Maritime enquiries	31
Medical advice	32
Technical assistance	33
Time and charges at end of call	37
Medical assistance	38
Maritime assistance	39
Sending weather reports	41
Sending nav. reports	42
Position reports	43

It should be noted that these services are not available through all Land Earth Stations.

Note: Due to the merger between Xantic and Stratos Global, a rationalisation of Inmarsat-C infrastructure at Perth LES occurred from 1 March 2007. At the time of publication of this Handbook, the Perth POR and IOR channel units are remotely controlled from Burum (Netherlands).

The host called LES 22 is no longer available or selectable via Inmarsat-C. AMSA Maritime Safety Information is being sent via a host called LES 12 (Burum). This means logging into 212 (POR) or 312 (IOR). There has been no change to the SAC arrangements regarding Inmarsat-B/Fleet77/M/mini-M, etc.

14.6 GENERAL DSC DISTRESS, URGENCY AND SAFETY PROCEDURES

14.6.1 Introduction

A DSC distress alert will always include the ship's last known position and time (in UTC). This information may be included automatically by the ship's navigational equipment, or it may be entered manually by the operator. DSC controllers have provision for interfacing to ships navigational equipment (GPS, etc.), for the automatic updating of position and time information.

If the ship's DSC controller is not connected to electronic navigation equipment the ship's position and time (in UTC) must be entered manually at least every 4 h whenever the ship is at sea (SOLAS IV/Reg. 18).

Even if the DSC controller is connected to an electronic navigation system, it is strongly recommended that the accuracy of the position and time displayed on the controller is verified at least once a watch.

This position and time information is transmitted with a distress alert, so it must be as accurate as possible at all times. You may not have time to update it during a distress situation.

As with Inmarsat-C systems, DSC equipment offers the user the options of either sending a pre-programmed distress message by operating a single button or composing a message with the equipment. All DSC systems operate on a 'menu' arrangement which allows the operator to choose from a fixed selection of distress scenarios.

In order to increase the probability of a DSC distress alert being received, all MF/HF controllers automatically repeat a DSC distress alert either 5 times on a single frequency (single frequency call attempt) or the operator may initiate up to 6 consecutive DSC distress alerts are spread over 6 DSC distress frequencies (multi-frequency call attempts). The process of sending a DSC distress using the single frequency call attempt or the multi-frequency call attempt, or a combination of the two, is given in Section 14.8.2. Stations should be able to receive acknowledgements continuously on all distress frequencies.

To avoid call collision and loss of acknowledgements, call attempts will be repeated after a random delay of between 3.5 and 4.5 min, unless stopped by switching off the transceiver, receiving an acknowledgement via DSC or when DSC equipment is rendered unserviceable due to sinking.

On VHF DSC only a single DSC distress call is used since there is only one VHF DSC frequency (Ch.70).

Procedures for MF/VHF and HF DSC operation are covered in the following sections.

14.7 MF/VHF DSC AND RADIOTELEPHONE DISTRESS URGENCY AND SAFETY PROCEDURES

14.7.1 General

MF and VHF DSC is designed for ship to ship and local ship–shore alerting.

Once a DSC alert has been transmitted on the MF and/or VHF DSC channel the station in distress should then change to the radio–telephone distress frequency for the band in use and send a voice MAYDAY message after a brief pause to allow other stations to receive the DSC alert. Do not wait for acknowledgment by other stations on the DSC channel.

A ship sending a 2 MHz DSC distress alert on 2 187.5 kHz will use 2 182 kHz as the radiotelephone channel. In the case of a VHF DSC alert on Channel 70, Channel 16 is used.

Following a DSC distress alert sent on 2 187.5 kHz, radiotelephone distress traffic may be conducted on 2 182 kHz using J3E emission (single sideband suppressed carrier).

Radiotelephony transmissions are prohibited on VHF marine Channel 70.

14.7.2 Distress procedures using voice after the DSC alert

The procedures are:

- Tune the transmitter to the DSC distress channel (2 187.5 kHz on MF, channel 70 on VHF);
- If time permits, key in or select on the DSC equipment keyboard:
  - The nature of distress;
  - The ship's last known position (latitude and longitude);
  - The time (in UTC) the position was valid;
  - Type of subsequent distress communication - telephony (most equipment defaults to this mode); in accordance with the DSC equipment manufacturers instructions.
- Transmit the DSC distress alert.
- Prepare for the subsequent radiotelephone distress traffic by tuning the transmitter and the radiotelephony receiver to the distress traffic channel in the same band, i.e. 2 182 kHz on MF, channel 16 on VHF. (The 2 182 kHz 2-tone alarm, if fitted, may be used to attract attention).
- Send the following spoken message on the radiotelephone channel:

Distress Call

Distress Signal (x3)	MAYDAY MAYDAY MAYDAY
Words 'this is'	THIS IS
Name of vessel (x3)	WILTSHIRE WILTSHIRE WILTSHIRE
Callsign or other identification	VJEK
MMSI (if the initial alert has been sent by DSC)	503123000

Distress Message

Distress signal	MAYDAY
Name of vessel	WILTSHIRE
Callsign or other identification	VJEK
MMSI (if the initial alert has been sent by DSC)	503123000
Position	POSITION 5 MILES EAST OF GREEN CAPE
Nature of Distress	ON FIRE OUT OF CONTROL
Other Information	VESSEL IS A GAS TANKER, CREW TAKING TO LIFEBOATS
To Signify End of Message	OVER

14.7.2.1 Distress calls on VHF Ch.16 (156.8 MHz)

These shall be given in the following form:

- The distress signal MAYDAY, spoken three times;
- The words THIS IS;
- The name of the vessel in distress, spoken three times;
- The call sign or other identification; and
- The MMSI (if the initial alert has been sent by DSC)

14.7.2.2 Acknowledgement of radiotelephony

When acknowledging by radiotelephony the receipt of a distress alert or a distress call, the acknowledgement should be given in the following form:

- The distress signal MAYDAY;
- The name followed by the call sign, or the MMSI or other identification of the station sending the distress message;
- The words THIS IS;
- The name and call sign or other identification of the station acknowledging receipt;
- The word RECEIVED; and
- The distress signal MAYDAY.

14.7.3 Reception and acknowledgment of DSC distress alerts

DSC distress alerts received on 2 187.5 kHz or VHF channel 70 are normally acknowledged by radiotelephony on 2 182 kHz or channel 16.

Acknowledgment of a DSC distress alert by the use of a DSC acknowledgment message is normally made by coast stations only.

A ship receiving a distress alert on any DSC channel should immediately listen on the associated radiotelephone distress frequency (see Appendix 1) for the voice MAYDAY message from the ship in distress.

Ships receiving a DSC distress alert from another ship should defer the acknowledgement of the distress alert for a short interval if the ship is within an area covered by one or more coast stations. This gives the coast station the time to acknowledge the DSC distress alert first.

Acknowledge the receipt of the distress alert by transmitting the following by radiotelephony on the distress traffic frequency in the same band in which the DSC distress alert was received, i.e. 2 182 kHz on MF, channel 16 on VHF:

- The distress signal MAYDAY;
- The name, callsign or MMSI of station sending distress message;
- The words THIS IS
- The name and call sign of the station acknowledging receipt;
- The word RECEIVED; and
- The distress signal MAYDAY.

As soon as possible after this acknowledgment a ship station should transmit the following information:

- Its position; and
- The speed at which it is proceeding and the approximate time it will take to reach the distress scene.

Example of acknowledgment of receipt of a distress message by a ship station (transmitted in response to the distress call and message given in Section 14.7.2):

Distress Signal	MAYDAY
Name of station sending distress message	WILTSHIRE
Callsign (or other identification)	VJEK
MMSI (if the initial alert has been sent by DSC)	503123000
Words 'this is'	THIS IS
Name	LAKE BARRINE
Callsign or other identification	VLLB
MMSI	503543000
Words 'Received Mayday'	RECEIVED MAYDAY MY POSITION 20 NAUTICAL MILES EAST OF GREEN CAPE PROCEEDING AT 15 KNOTS ESTIMATE AT YOUR POSITION IN ONE HOUR
To signify end of message	OVER

A DSC acknowledgment message should only be sent on MF or VHF DSC if attempts to contact the vessel in distress via radiotelephone on 2 182 kHz or VHF channel 16 have failed and the vessel in distress continues to send DSC distress alerts on 2 187.5 kHz or VHF channel 70.

Details of all DSC alerts received must be passed to the Rescue Coordination Centre Canberra (or the MRCC for your area of operation) via Inmarsat-C as soon as possible. The message should include:

- Frequency or channel on which you received the DSC alert.
- MMSI (DSC identification number) or name of vessel in distress.
- Position, time and nature of distress received in the message.
- Position of your vessel.
- Your actions and intentions.

14.7.4 Transmission of a distress alert by a station not Itself in distress

A station in the mobile or mobile-satellite service which learns that a mobile unit is in distress (for example, by radio or by observation) shall initiate a distress alert relay or a distress relay on behalf of the mobile unit in distress once it has ascertained that any of the following circumstance apply:

a. On receiving a distress alert or call which is not acknowledged by a coast station or another vessel within 5 min; or

b. On learning that the mobile unit in distress is otherwise unable or incapable of participating in distress communications, if the master or other person responsible for the mobile unit not in distress considers that further help is necessary.

The distress relay on behalf of a mobile unit in distress shall be sent in a form appropriate to the circumstances using either a distress call relay by radiotelephony, an individually addressed distress alert relay by DSC, or a distress priority message through a ship earth station.

A station transmitting a distress alert relay in accordance with the above shall indicate that it is not itself in distress.

A distress alert relay sent by DSC should use the call format, as found in the most recent versions of Recommendations ITU-R M.493 and ITU-R M.541, and should preferably be addressed to an individual coast station or rescue coordination centre.

Vessels making a distress alert relay or a distress call relay should ensure that a suitable coast station or rescue coordination centre is informed of any distress communications previously exchanged.

However, a ship shall not transmit a distress alert by DSC on the VHF or MF frequencies on receipt of a distress alert sent by DSC by the ship in distress.

If the circumstances exist, e.g. as in b) above, the DSC distress relay alert is transmitted as follows:

- Tune the transmitter to the DSC distress channel (2 187.5 kHz on MF, channel 70 on VHF).
- Select the distress relay call format on the DSC equipment.
- Key in or select on the DSC equipment keyboard:
    - All Ships Call (VHF), Geographic Area Call (MF/HF) or the 9-digit identity of the appropriate coast station;
    - The 9–digit identity of the ship in distress, if known;
    - The nature of distress;
    - The latest position of the ship in distress, if known;
    - The time (in UTC) the position was valid, if known;
    - Type of subsequent distress communication (telephony).
- Transmit the DSC distress relay call;
- Prepare for the subsequent distress traffic by tuning the transmitter and the radiotelephony receiver to the distress traffic channel in the same band, i.e. 2 182 kHz on MF and channel 16 on VHF, while waiting for the DSC distress acknowledgment.

14.7.5 Acknowledgment of a DSC distress relay alert received from a coast station

Coast stations will, after having received and acknowledged a DSC distress alert, normally retransmit the information received as a DSC distress relay call, addressed to all ships.

> Ships receiving a distress relay call transmitted by a coast station should acknowledge the receipt of the call by radiotelephony on the distress traffic channel in the same band in which the relay call was received, i.e. 2 182 kHz on MF or channel 16 on VHF.

The acknowledgment is transmitted as follows:

"MAYDAY" - The 9-digit identity or the call sign or other identification of the calling coast station;

"THIS IS" - The 9-digit identity or call sign or other identification of own ship;

"RECEIVED MAYDAY"

14.7.6 Acknowledgment of a DSC distress relay alert received from another ship

Ships receiving a distress relay alert from another ship shall follow the same procedure as for acknowledgment of a distress alert.

COMSAR/Circ. 25 contains a flow diagram indicating the actions to be taken on receipt of a MF or VHF DSC distress alert (see Figure 30).

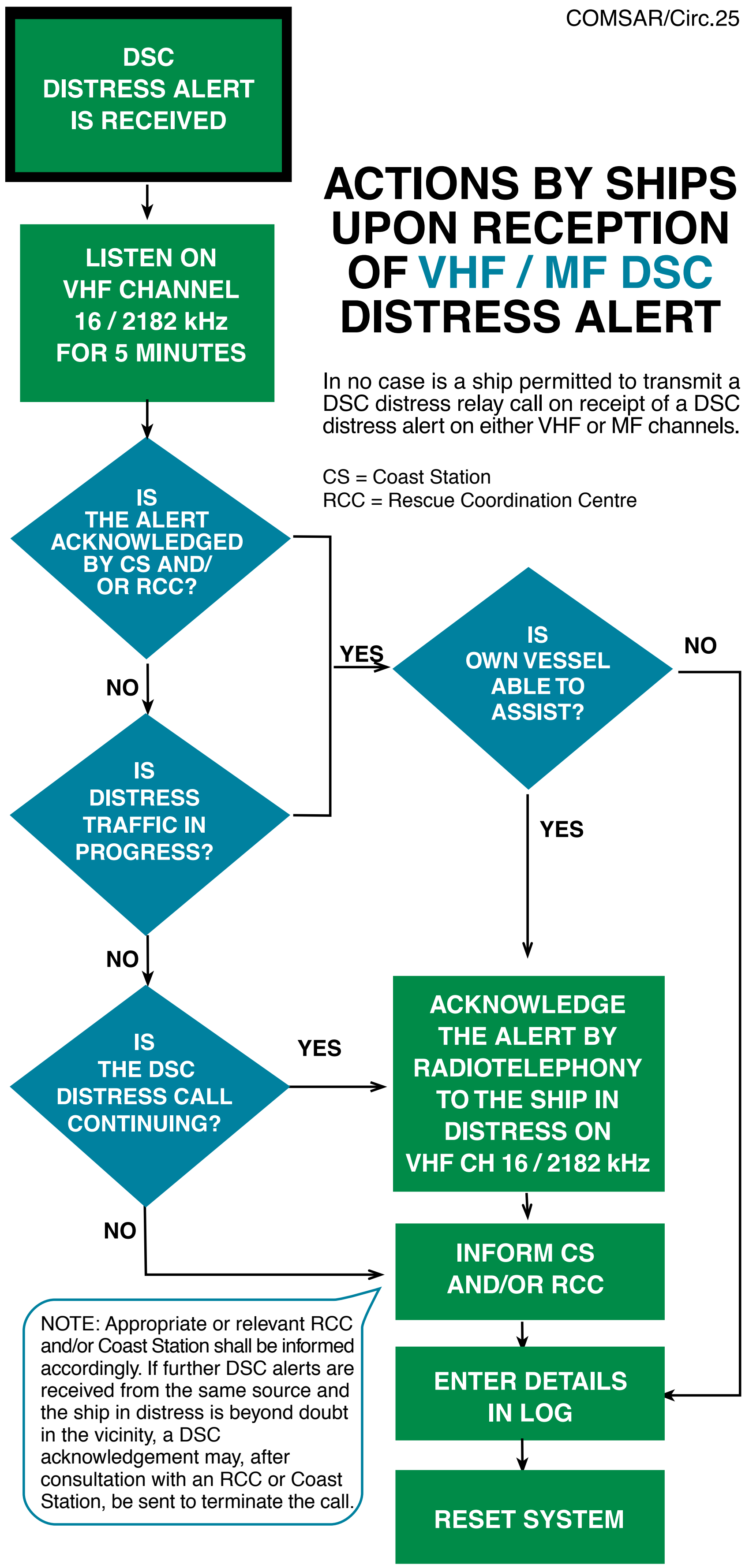


Figure 30 – Action on receipt of a MF or VHF DSC distress alert

14.7.7 Urgency procedures

Transmission of urgency messages is carried out in two steps:

- Announcement of the urgency message; and
- Transmission of the urgency message.

The announcement is carried out by transmission of a DSC urgency call on the DSC distress and safety channel (2 187.5 kHz on MF, channel 70 on VHF).

The urgency message is transmitted on the radiotelephone distress channel (2 182 kHz on MF, channel 16 on VHF).

The DSC urgency announcement may be addressed to all stations or to a specific station. The frequency on which the urgency message will be transmitted shall be included in the DSC urgency announcement.

The transmission of an urgency message is carried out as follows:

- Tune the transmitter to the DSC distress and safety channel (2 187.5 kHz on MF, channel 70 on VHF);
- Key in or select on the DSC equipment keyboard in accordance with the DSC equipment manufacturer's instructions:
  - All Ships Call or the 9 digit identity of the specific station;
  - The category of the call (urgency);
  - The frequency or channel on which the urgency message will be transmitted;
  - The type of communication in which the urgency message will be given (radiotelephony).
- Transmit the DSC urgency announcement.
- Tune the transmitter to the frequency or channel indicated in the DSC urgency announcement.
- Transmit the urgency message as follows:

  "PAN PAN" - Repeated 3 times;

  "ALL STATIONS"
  or Called Station - Repeated 3 times;

  "THIS IS" - The 9 digit identity and the call sign or other identification of own ship;

  - The text of the urgency message.

14.7.8 Reception of an urgency message

Ships receiving an urgent priority DSC message should NOT acknowledge receipt via DSC but should tune their MF/HF or VHF transceiver to the frequency nominated in the DSC message and await the voice urgency message.

14.7.9 Transmission of safety messages

Transmission of safety messages are carried out in two steps:

- Announcement of the safety message; and
- Transmission of the safety message.

The announcement is carried out by transmission of a DSC safety announcement on the DSC distress and safety channel (2 187.5 kHz on MF, channel 70 on VHF). The safety message is normally transmitted on the radiotelephone distress channel in the same band in which the DSC call was sent, i.e. 2 182 kHz on MF, channel 16 on VHF.

The DSC safety call may be addressed to all ships or to a specific station.

The frequency on which the safety message will be transmitted is included in the DSC announcement.

The transmission of a safety message is thus carried out as follows:

- Tune the transmitter to the DSC distress and safety channel (2 187.5 kHz on MF, channel 70 on VHF).
- Select the appropriate calling format on the DSC equipment (all ships, area call or individual call) in accordance with the DSC equipment manufacturer's instructions.
- Key in or select on the DSC equipment keyboard:
  - specific area or 9 digit identity of specific station, if appropriate;
  - the category of the call (safety);
  - the frequency or channel on which the safety message will be transmitted;
  - the type of communication in which the Safety message will be given (radiotelephony);
- Transmit the DSC safety announcement;
- Tune the transmitter to the frequency or channel indicated in the DSC safety announcement;

- Transmit the voice safety message as follows:

"SECURITE"	- Repeated 3 times;
"ALL STATIONS" or Called Station	- Repeated 3 times;
"THIS IS"	- The 9 digit identity and the call sign or other identification of own ship;
	- The text of the urgency message.

14.7.10 Reception of a safety message

Ships receiving a safety priority DSC message should NOT acknowledge receipt via DSC but should tune their MF/HF or VHF transceiver to the frequency nominated in the DSC message and await the voice message.

14.8 HF DSC PROCEDURES

14.8.1 Introduction

HF DSC is primarily designed for long range ship to shore alerting. HF DSC distress alerts are normally directed to coast stations.

The DSC distress alert should as far as possible include the ship's last known position and the time (in UTC) it was valid. If the position and time is not inserted automatically from the ship's navigational equipment, it should be inserted manually.

The SOLAS regulations require ships equipped with HF DSC facilities to also be provided with NBDP.

The operator is thus able to choose either NBDP or radio–telephone as the mode to be used for communications subsequent to the DSC alert.

The practicalities of a distress situation dictate that it would be far simpler to communicate with other stations using radiotelephone, rather than having to type on a telex keyboard.

It is recommended that Australian GMDSS vessels fitted with HF DSC facilities select "J3E" (radiotelephone) as the mode to be used for ongoing communications when setting up a distress priority alert on their DSC controller.

14.8.2 Ship to shore distress alert

Choice of HF band

As a general rule the DSC distress channel in the 8 MHz maritime band (8 414.5 kHz) may in many cases be an appropriate first choice for distress transmissions.

Transmission of the DSC distress alert in more than one HF band will normally increase the probability of successful reception of the alert by coast stations.

DSC distress alerts may be sent on a number of HF bands in two different ways:

a. **Either by transmitting the DSC distress alert on one HF band, and waiting a few minutes for receiving acknowledgment by a coast station; if no acknowledgment is received within 5 min, the process is repeated by transmitting the DSC distress alert on another appropriate HF band etc.; or**

b. **By transmitting the DSC distress alert on a number of HF bands with none or only very short pauses between the calls, without waiting for acknowledgment between the calls.**

It is recommended to follow procedure a) in all cases, where time permits to do so. This will make it easier to choose the appropriate HF band for commencement of the subsequent communication with the coast station on the corresponding radiotelephone or NBDP distress channel.

Transmitting the alert:

- Tune the transmitter to the chosen HF DSC distress channel (4 207.5, 6 312, 8 414.5, 12 577 or 16 804.5 kHz);
- Follow the instructions for keying in or selection of relevant information on the DSC equipment keyboard as described in the MF/VHF section;
- Select the appropriate mode for subsequent communications; and
- Transmit the DSC distress alert.

14.8.3 Preparation for the subsequent distress traffic

As HF DSC is primarily a ship–shore alerting technique, vessels sending DSC distress alerts should normally wait for a DSC acknowledgment message from a coast radio station before transmitting the radiotelephone or NBDP distress traffic.

If method b) described in Section 14.8.2 has been used for transmission of DSC distress alert on a number of HF bands:

- Take into account in which HF band(s) acknowledgment has been successfully received from a coast station; and
- If acknowledgments have been received on more than one HF band, commence the transmission of distress traffic on one of these bands, but if no response is received from a coast station then the other bands should be used in turn.

14.8.4 Distress traffic via NBDP after the DSC alert

The procedures described in Section 14.7.2 are used when the distress traffic on HF is carried out by radiotelephony.

The following procedures shall be used in cases where the distress traffic on HF is carried out by NBDP:

The Forward Error Correction (FEC) mode is normally used unless specifically requested to do otherwise. All messages shall be preceded by – at least one carriage return – line feed – one letter shift – the distress signal MAYDAY.

The ship in distress should commence the distress NBDP traffic on the appropriate distress NBDP traffic channel as follows:

- Carriage return, line feed, letter shift;
- The distress signal "MAYDAY";
- The words "THIS IS";
- The 9-digit identity and callsign or other identification of the ship;
- The ship's position if not included in the DSC distress alert;
- The nature of distress;
- Any other information which might facilitate the rescue; and
- The word "OVER".

14.8.5 Actions on reception of a DSC distress alert on HF from another ship

Acknowledgment of a HF DSC distress alert by the use of a DSC acknowledgment message is normally only made by coast stations on the HF channels.

Ships receiving a DSC distress alert on HF from another ship shall not acknowledge the alert, but should:

- Watch for reception of a DSC distress acknowledgment from a coast station.
- While waiting for reception of the DSC distress acknowledgment from a coast station prepare for reception of the subsequent distress communication by tuning the HF radio communication receiver to the relevant distress traffic channel in the same HF band in which the DSC distress alert was received, observing the following conditions:
  - **If radiotelephony mode ('J3E') was indicated in the DSC alert**, the HF radio communication equipment should be tuned to the radiotelephony distress traffic channel in the HF band concerned;
  - **If NBDP mode ('F1B') was indicated in the DSC alert**, the HF radio communication equipment should be tuned to the NBDP distress traffic channel in the HF band concerned. Ships able to do so should additionally watch the corresponding radiotelephony distress channel.

If the DSC distress alert was received on more than one HF band the radiocommunication equipment should be tuned to the relevant distress traffic channel in the HF band considered the most suitable. If the DSC distress alert was received successfully on the 8 MHz band this band may in many cases be an appropriate first choice.

Although HF DSC distress relays are primarily used by coast stations. However, if it appears that no coast station is taking action, a ship can relay a distress alert in accordance with COMSAR/Circ. 25 (Figure 31).

If a ship hears:

- no distress traffic between the ship in distress and a coast station on the radiotelephone or NBDP channel for the band in use, and
- no DSC acknowledgment message is received from another ship or coast station within 5 min;

Then a ship receiving a HF DSC distress alert, should:

- transmit a HF DSC distress alert relay message addressed to an appropriate DSC-equipped coast station on the same frequency as the original DSC distress alert.
- Inform the nearest MRCC by whatever means available.

If no contact with a coast station is achieved on the initial frequency, select another suitable frequency and re-send.

IN THESE CIRCUMSTANCES DO NOT SEND A DSC DISTRESS ALERT RELAY MESSAGE ADDRESSED TO ALL STATIONS – such messages serve only to create congestion and confusion on the DSC channels.

14.8.6 Transmission of DSC distress relay alert

Tune the transmitter to the relevant DSC distress channel. Follow the instructions for keying in or selection of call format and relevant information on the DSC equipment keyboard.

Transmit the DSC distress relay alert.

14.8.7 Acknowledgment of a HF DSC distress relay alert received from a coast station

Ships receiving a DSC distress relay alert from a coast station on HF, addressed to all ships within a specified area, should NOT acknowledge the receipt of the relay alert by DSC, but by radiotelephony or NBDP on the distress traffic channel in the same band in which the DSC distress relay alert was received.

Figure 31 summarises the actions to be taken on receipt of an HF DSC distress alert.

14.8.8 Urgency messages

Transmission of urgency messages on HF should normally be addressed either to all ships within a specified geographical area or to a specific coast station.

Announcement of the urgency message is carried out by transmission of a DSC call with category urgency on the appropriate DSC distress channel.

The transmission of the urgency message itself on HF is carried out by radiotelephony or NBDP on the appropriate distress traffic channel in the same band in which the DSC announcement was transmitted.

Procedure:

- Choose the HF band considered the most appropriate, taking into account the position of the ship and time of the day. In many cases the 8 MHz band may be an appropriate first choice;
- Tune the HF transmitter to the DSC distress channel in the chosen HF band;
- Key in or select call format for either geographical area call or individual call on the DSC equipment, as appropriate;
- In the case of an area call, key in the specification of the relevant geographical area;
- Follow the instructions for keying in or selection of relevant information on the DSC equipment keyboard, including type of communication in which the urgency message will be transmitted (radiotelephony or NBDP);
- Transmit the DSC announcement;

  If the DSC announcement is addressed to a specific coast station, wait for DSC acknowledgment from the coast station. If acknowledgment is not received within a few minutes, repeat the DSC call on another HF frequency deemed appropriate.
- Tune the HF transmitter to the distress traffic channel (telephony or NBDP) indicated in the DSC announcement.

If the urgency message is to be transmitted using radio-telephony, follow the procedure described in Section 14.7.7.

14.8.8.1 Urgency DSC by NBDP

If the urgency message is to be transmitted by NBDP, the following procedure is used:

- Use the Forward Error Correction (FEC) mode unless the message is addressed to a single station whose NBDP identity number is known.
- Commence the telex message by:
  - At least one carriage return, line feed and letter shift (usually automatic);
  - The urgency signal "PAN PAN" three times;
  - The words "THIS IS";
  - The 9 digit identity of the ship and the callsign or other identification of the ship; and
  - The text of the urgency message.

Announcement and transmission of urgency messages addressed to all HF equipped ships within a specified area may be repeated on a number of HF bands as deemed appropriate in the actual situation.

14.8.9 Reception of an urgency message

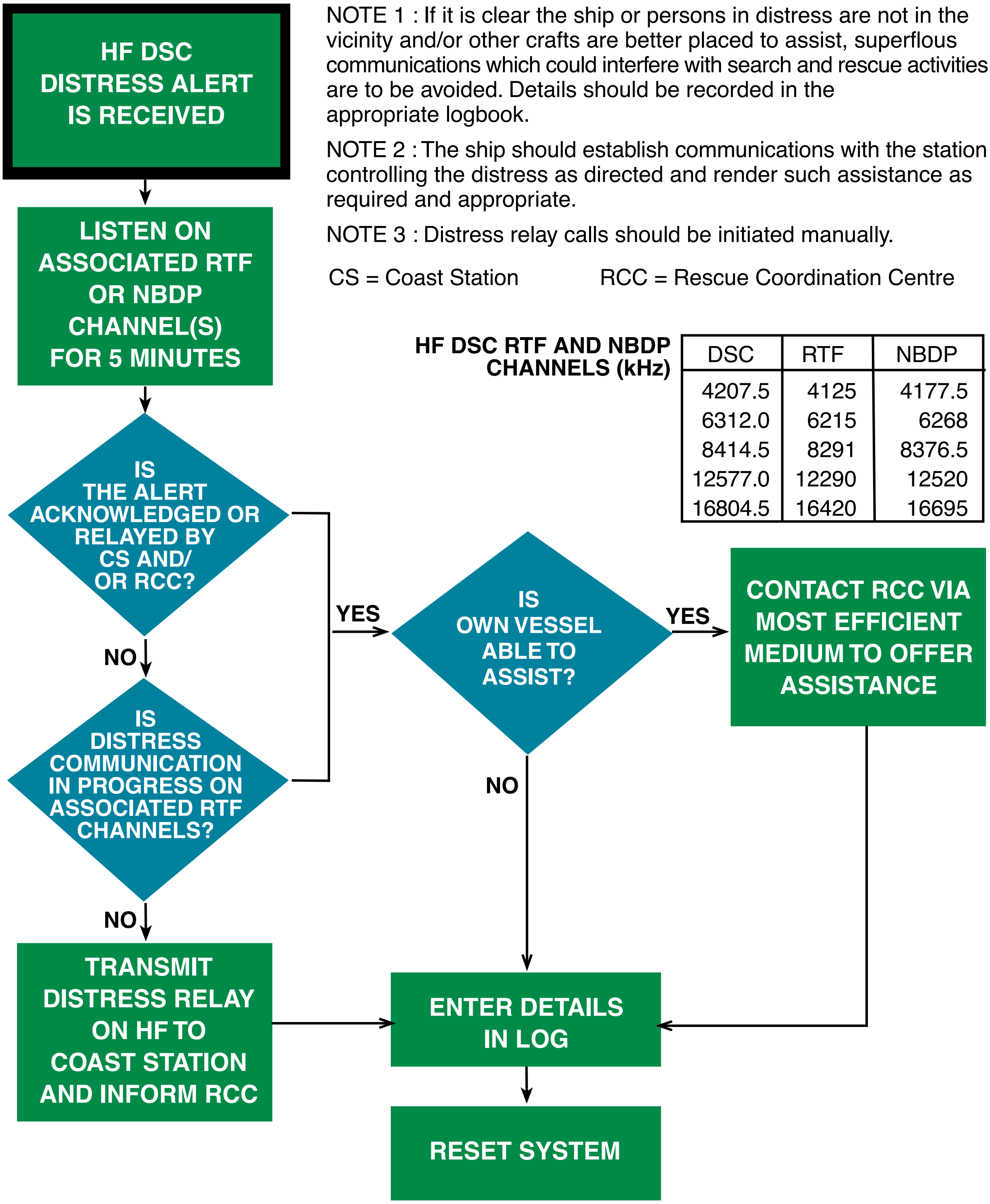
Ships receiving an urgent priority DSC message should NOT acknowledge receipt via DSC but should tune their HF transceiver to the frequency nominated in the DSC message and await the voice urgency message.

14.8.10 Safety messages

The procedures for transmission and reception of DSC safety announcements and for transmission of the safety message are the same as for urgency messages, except that:

- In the DSC announcement, the category SAFETY is used; and
- In the safety message, the safety signal "SECURITE" is used instead of the urgency signal "PAN PAN".

ACTIONS BY SHIPS UPON RECEPTION OF HF DSC DISTRESS ALERT



NOTE 1 : If it is clear the ship or persons in distress are not in the vicinity and/or other crafts are better placed to assist, superflous communications which could interfere with search and rescue activities are to be avoided. Details should be recorded in the appropriate logbook.

NOTE 2 : The ship should establish communications with the station controlling the distress as directed and render such assistance as required and appropriate.

NOTE 3 : Distress relay calls should be initiated manually.

CS = Coast Station RCC = Rescue Coordination Centre

HF DSC RTF AND NBDP CHANNELS (kHz)

DSC	RTF	NBDP
4207.5	4125	4177.5
6312.0	6215	6268
8414.5	8291	8376.5
12577.0	12290	12520
16804.5	16420	16695

Figure 31 - Action on receipt of an HF DSC distress alert

14.9 DSC, NBDP AND R/T DISTRESS AND SAFETY SHORE FACILITIES IN AUSTRALIA

14.9.1 Introduction

Terrestrial GMDSS radio services are provided on behalf of the Australian Maritime Safety Authority by Kordia Solutions Pty Ltd. These Digital Selective Calling (DSC) stations are located in Charleville, Queensland (26 19.50S, 146 15.49E) and Wiluna, Western Australia (26 20.27S, 120 33.24E) (see Figure 7 on page 14).

14.9.2 DSC Watchkeeping

The Charleville and Wiluna stations maintain continuous watch on the 4, 6, 8, 12 and 16 MHz DSC distress and safety channels, however voice frequencies are not monitored.

14.9.3 NBDP working

The Charleville and Wiluna stations are equipped for operation on any of the 4, 6, 8, 12 and 16 MHz NBDP distress and safety channels.

14.10 RADIOTELEPHONY COMMUNICATIONS WITH NON-GMDSS SHIP STATIONS

14.10.1 Procedures

The following radiotelephony procedures are used when communicating with non–GMDSS vessels on 2 182 kHz. They are also used when communicating with other GMDSS vessels on any of the radiotelephony distress channels subsequent to a DSC distress alert.

14.10.2 Distress message acknowledgment

Non–GMDSS vessels will use the voice procedures outlined in Section 14.7.2 to send distress messages.

The voice procedures outlined in Section 14.7.3 must be used to acknowledge the call.

Ships receiving a voice MAYDAY message from another ship should defer acknowledgment for a short interval, if the ship is within an area covered by one or more coast stations, in order to give the coast station time to acknowledge the distress message first.

14.10.3 Distress traffic

Distress traffic consists of all communications relating to the immediate assistance required by the ship in distress, including search and rescue and on–scene communications.

> The distress signal MAYDAY must be used at the beginning of each message during radio telephony distress traffic.

14.10.4 Control of distress traffic

The control of distress traffic is the responsibility of the ship in distress. However, this station may delegate the control of distress traffic to a ship or coast station.

The ship in distress or the station in control of distress traffic may impose silence on any or all stations interfering with distress traffic by sending the instruction:

SEELONCE MAYDAY

This instruction must not be used by any station other than the ship in distress, or the station controlling distress traffic.

> Any station which has knowledge of distress traffic and cannot provide assistance should continue to monitor the traffic until such time that it is obvious assistance is being provided.

14.10.5 Resumption of normal working

When distress traffic has ceased on a frequency which has been used for distress traffic, the station which has been controlling that traffic must transmit a message addressed to all stations indicating that normal working may be resumed.

The message takes the following form:

- The distress signal MAYDAY;
- The words ALL STATIONS, spoken three times;
- The words THIS IS;
- The name and call sign of the station sending the message, spoken 3 times;
- The time the message originated;
- The MMSI (if the initial alert has been sent by DSC), the name and call sign of the mobile station which was in distress; and
- The words SEELONCE FEENEE.

14.10.6 Transmission of a distress message by a station not Itself in distress

This is sometimes referred to as DROBOSE (distress relay on behalf of someone else).

A station in the mobile or mobile-satellite service which learns that a mobile unit is in distress (for example, by a radio call or by observation) shall initiate a distress alert relay or a distress call relay on behalf of the mobile unit in distress once it has ascertained that any of the following circumstance apply:

- On receiving a distress alert or call which is not acknowledged by a coast station or another vessel within 5 min; and
- On learning that the mobile unit in distress is otherwise unable or incapable of participating in distress communications, if the master or other person responsible for the mobile unit not in distress considers that further help is necessary.

A station transmitting a distress alert relay in accordance with the above shall indicate that it is not itself in distress.

When an aural watch is being maintained on shore and reliable ship-to-shore communications can be established by radiotelephony, a distress call relay is sent by radiotelephony and addressed to the relevant coast station or rescue coordination centre on the appropriate frequency.

The distress call relay sent by radiotelephony should be given in the following form:

- The distress signal MAYDAY RELAY, spoken three times;
- ALL STATIONS or coast station name, as appropriate, spoken three times;
- The words THIS IS;
- The name of the relaying station, spoken three times;
- The call sign or other identification of the relaying station;
- The MMSI (if the initial alert has been sent by DSC) of the relaying station (the vessel not in distress)

This call shall be followed by a distress message which shall, as far as possible, repeat the information contained in the original distress alert of distress message.

If the station in distress cannot be identified, then it will be necessary to originate the distress message as well, using, for example, terms such as "Unidentified trawler" to refer to the mobile unit in distress.

When no aural watch is being maintained on shore, or there are other difficulties in establishing reliable ship-to-shore communications by radiotelephony, an appropriate coast station or RCC may be contacted by sending an individual distress alert relay, addressed solely to that station and using the appropriate call formats.

Note: In the event of continued failure to contact a coast station or RCC directly, it may be appropriate to send a distress call relay by radiotelephony addressed to all ships, or to all ships in a certain geographical area.

Example of a message transmitted by a ship station on behalf of another vessel (the original distress message from Section 14.7.2 is used in this example):

Distress Signal relay (x3)	MAYDAY RELAY MAYDAY RELAY MAYDAY RELAY
The words 'all stations' (or coast station as appropriate) (x3)	ALL STATIONS ALL STATIONS ALL STATIONS
The words 'this is'	THIS IS
Name of acknowledging station (x3)	LAKE BARRINE LAKE BARRINE LAKE BARRINE
Callsign or other identification	VLLB
MMSI	503543000
Distress Signal	MAYDAY
Name of vessel in distress	WILTSHIRE
Callsign or other identification	VJEK
MMSI (station in distress)	503123000
	POSITION 5 MILES EAST OF GREEN CAPE ON FIRE OUT OF CONTROL VESSEL IS A GAS TANKER CREW TAKING TO LIFEBOATS
To signify end of message	OVER"

A ship should not acknowledge receipt of a Mayday relay message transmitted by a coast station unless definitely in a position to provide assistance.

14.10.7 Urgency and safety procedures

Non-GMDSS vessels sending an Urgency or Safety message will use the voice procedures outlined in Sections 14.7.7 and 14.7.9.

14.11 PROTECTION OF DISTRESS FREQUENCIES

14.11.1 General

Any emission capable of causing harmful interference to distress urgency or safety communications on any of the MF HF and VHF radiotelephone DSC and NBDP distress and safety channels is prohibited by the ITU *Radio Regulations*.

This includes both deliberate interference (jamming) and improper use of the frequencies, such as prolonged routine traffic between ships and coast stations on distress channels.

The transmission of false or deceptive distress, urgency or safety signals is strictly forbidden. Extremely severe penalties, including imprisonment, exist under the Radio communications and Navigation Acts for any person found guilty of making such a transmission.

Unnecessary conversations, non-essential remarks and all profane or obscene words are forbidden. Test transmissions on distress frequencies shall be kept to a minimum, and wherever practicable be carried out using artificial antennas or with reduced power.

14.11.2 Avoiding interference

Operators should take every precaution to ensure that their transmissions will not cause harmful interference to other stations. It is important that all operators:

- When using terrestrial communications, listen on the frequency before transmitting;
- Where possible, use the minimum power necessary for reliable communications;
- Strictly observe the purpose for which a frequency is allocated; and
- Keep test signals to a minimum.

14.11.3 Guard bands

The ITU *Radio Regulations* establish a guard band either side of the 2 MHz radiotelephony distress frequency of 2 182 kHz. This band extends from 2 173.5 – 2 190.5 kHz. Transmission on any frequency except 2 177 kHz, 2 189.5 kHz, 2 182 kHz, 2 187.5 kHz (DSC) and 2 174.5 kHz (NBDP) within this band is prohibited.

14.11.4 Silence periods

In order to increase the safety of life at sea, stations of the maritime mobile service normally keeping watch on the frequencies in the authorized bands between 1 605 kHz and 2 850 kHz, should keep watch on the international distress frequency 2 182 kHz for 3 min twice each hour beginning on the hour and at the half hour.

With the exception of distress traffic all transmissions must cease during silence periods.

The IMO has decided for GMDSS vessels that *listening watches are no longer mandatory* on 2 182 kHz, and silence periods are not part of the GMDSS.

The silence period provision ceased to be mandatory within the ITU *Radio Regulations* from 1 February 1999, however those stations that still maintain voice watchkeeping are urged to observe silence periods.

14.11.5 Safety calling

The distress, urgency and safety frequencies 12 290 kHz and 16 420 kHz should be used for distress, urgency and safety communications, and safety-related calling to and from rescue centres only, which includes radio checks, provided of course, that no distress, urgency or safety traffic is in progress. The alternative frequencies of 12 359 kHz and 16 537 kHz should be used for routine calling. This new rule came into force on 1 January 2004 worldwide.

14.12 MEDICAL TRANSPORTS

The term "medical transports", as defined in the *1949 Geneva Conventions and Additional Protocols*, refers to any means of transportation by land, water or air, whether military or civilian, permanent or temporary, assigned exclusively to medical transportation and under the control of a competent authority of a party to a conflict or of neutral States and of other States not parties to an armed conflict, when these ships, craft and aircraft assist the wounded, the sick and the shipwrecked.

ITU *Radio Regulations* No. 33 states that for the purpose of announcing and identifying medical transports, the following procedure is used:

The urgency signal shall be followed by the addition of the single word MAY-DEE-CAL pronounced as in French "médical", in radiotelephony, or by the addition of the single word MEDICAL in narrow-band direct-printing.

The use of the signal indicates that the message which follows concerns a protected medical transport.

The message shall convey the following data:

- Call sign or other recognized means of identification of the medical transport;
- Position of the medical transport;
- Number and type of vehicles in the medical transport;
- Intended route;
- Estimated time en route and of departure and arrival, as appropriate; and
- Any other information, such as flight altitude, radio frequencies guarded, languages used and secondary surveillance radar modes and codes.

The use of radiocommunications for announcing and identifying medical transports is optional; however, if they are used, the provisions of the ITU *Radio Regulations* shall apply.

When using DSC for Medical Transports on the appropriate DSC Distress and Safety frequency shall always be addressed to all stations on VHF and to a specified geographical area on MF and HF and shall indicate "Medical Transport" in accordance with the most recent versions of Recommendations ITU-R M.493 and M.541.

14.13 RADIOMEDICAL ADVICE

The International Convention on Maritime Search and Rescue 1979 requires parties to the Convention to provide (among other things) on request, medical advice, initial medical assistance and MEDEVACS. Australia, through RCC Australia provides these services in the Australian search and rescue region (SRR).

Terms such as 'seek Radiomedical Advice' appear frequently in shipboard publications such as the *Shipmasters Medical Guide*. Communications concerning medical advice may be preceded by the urgency signal. Mobile stations requiring medical advice may obtain it through any of the land stations shown in the *List of Coast Stations and Special Service Stations*, and suitable stations listed in the *Admiralty List of Radio Signals* (Volume 1).

In Australia, the arrangements for seeking medical advice via Special Access Codes using Inmarsat GMDSS equipment are described in Appendix 3 in this Handbook, and initially may be to a service in the Netherlands, which may then refer back to RCC Australia, if appropriate. These are part of Telemedical Maritime Advice Services (TMAS) provided by AMSA. In the case of urgent radiomedical advice via HF DSC to RCC Australia, calls are connected to Careflight (Queensland).

RCC Australia contact details

Rescue Coordination Centre (RCC) 24 h emergency contact telephone numbers:

Maritime (Australian caller) 1800 641 792

Maritime (International caller) +61 2 6230 6811

MMSI: 005030001

GMDSS operators should be familiar with the medical proforma checklists contained in the International Code of Signals (INTERCO) and the Medical First Aid Guide (MFAG) of the International Maritime Dangerous Goods (IMDG) Code. These may prove invaluable in conducting radiomedical communications, as may the medical section of the International Code of Signals.

Another overseas agency, the International Radio Medical Centre (CIRM), sometimes known as 'Roma Radio' provides free radiomedical advice. This service is headquartered in Rome, Italy. **For details, refer to www.cirm.it/eng/index_eng.html**

In addition, there are private companies providing complete medical services for ships at sea, which include 24/7 radiomedical advice and can arrange other services. An example is Medlink's Medical Advisory Systems (MedAire Ltd). For details, refer to www.medaire.com

14.14 MARITIME ASSISTANCE SERVICES

A number of international conventions require notifications, reports and consultations arising from ship operations. This may include loss of cargo, accidental discharge of oil, rescue of those on board, for example. To assist in handling these situations, the establishment of a Maritime Assistance Service (MAS) is recommended by IMO. In Australia, MAS services are provided by AMSA, who may be contacted via Inmarsat-C SAC 39, or via RCC Australia (Canberra) via telephone 1800 641 792 (Australian caller), or +61 2 6230 6811 (International caller).

The role of the MAS includes:

- receiving the reports, consultations and notifications required by the IMO;
- monitoring the ship's situation if a report, discloses an incident that may cause the ship to be in need of assistance;
- serving as the point of contact between the master and the coastal State concerned, if the ship's situation requires exchanges of information between the ship and the coastal State but is not a distress situation that could lead to a search and rescue operation; and
- serving as the point of contact between those involved in a marine salvage operation undertaken by private facilities at the request of parties having a legitimate interest in the ship and the coastal State, if the coastal State concerned decides that it should monitor all phases of the operation.

15 ROUTINE TESTING

This chapter provides guidance on routine testing procedures to be followed by operators of GMDSS ship stations.

15.1 GENERAL REQUIREMENTS

The routine testing requirements for Australian GMDSS vessels are contained in Section D of the AMSA GMDSS Radio Log (included in Appendix 11).

Section D of the AMSA GMDSS Radio Log specifies minimum testing. Under a ship's International Safety Management (ISM) system, more frequent testing may be carried out - with the exception of MF/HF DSC, which should be restricted to once per week.

15.2 VHF DSC SYSTEMS

It is recommended in the STCW95 Code, Section B–VIII/2 that VHF DSC systems be tested daily using the built–in test facility.

15.2.1 VHF DSC test procedures

VHF DSC can be tested by selectively calling the duplicate set on one's own vessel, preferably using the lower power setting. By ensuring that the automatic acknowledgement facility is enabled, both sets can be tested with a single call.

In some countries (but not in Australia), automatic test facilities are available, in a similar way to HF DSC in Australia, by sending to a specific MMSI to obtain an automated response (e.g. United States Coast Guard MMSI 003669999). A routine selective call to another station can also be used.

15.3 MF/HF DSC SYSTEMS

15.3.1 Introduction

The International Maritime Organization (IMO) recommends that ships regularly test their DSC system with a coast station, for both system verification and operator familiarisation, and this is also required as set out in the GMDSS Radio Log Section D. To achieve this, live testing on DSC distress and safety frequencies with coast stations should be limited to once a week. Refer to COMSAR/Circ. 35. ITU regulations specify that the DSC frequencies are reserved for Distress and Safety traffic only. It is therefore not possible to use a ROUTINE priority call on these channels for system verification.

The IMO, recognising the need for a means of testing the DSC system without either initiating a commercial call (ROUTINE priority) or generating a false alarm, have introduced a special "TEST" call, which enables a safety priority message to be generated by a vessel and automatically acknowledged by a suitably equipped coast station.

The DSC installations at Canberra provide fully automatic testing facilities on all HF channels.

Ship's DSC systems may be tested with Canberra on any of the DSC distress and safety channels between 4 and 16 MHz. The frequency used for testing should be determined by your vessels location and time of day.

15.3.2 Frequency for DSC test calls

The following DSC channels (in kHz) and stations are suggested as a guide for the appropriate frequency to be used for test calls from various locations on the Australian coast.

- **Bass Strait vessels:**

  DAY 12 577 or 16 804.5

  NIGHT 4 207.5 or 6 312

- **Vessels trading on the eastern coast and trans-Tasman:**

  DAY 12 577 or 16 804.5

  NIGHT 4 207.5, 6 312 or 8 414.5

- **Vessels trading to remote parts of Australia (across the Great Australian Bight, the north west coast, northern Qld and NT waters):**

  DAY 12 577 or 16 804.5

  NIGHT 4 207.5, 6 312 or 8 414.5.

If no response is observed within 5 min, try again on another DSC channel, or use another station in the Global Maritime Distress and Safety System.

15.4 INMARSAT-C EQUIPMENT

Each Inmarsat-C system must be tested at least once by a GMDSS operator during the passage of the ship between each port at which the ship calls, by communicating with a coast earth station. This communication may be in the form of transmission of routine commercial traffic or Information Reports to RCC Australia, etc.

15.5 EMERGENCY RADIO BATTERIES

Once a month, a full examination of each battery, cell by cell including measurement of the specific gravity must be made, and a report on the general condition entered, cell by cell, in the appropriate section of the radio logbook. More details on battery testing and maintenance procedures may be found in Chapter 16.

15.6 406 MHZ EPIRBS

406 MHz EPIRBs are to be physically examined and the self-test function checked, at least once per month.

Note: Some manufacturers recommend using the TEST function sparingly to maintain the battery life. Testing therefore should be done in accordance with the manufacturer's user manual.

15.7 SARTS

SARTs are to be physical examined, but are not required to be tested routinely. AMSA recommends not performing any 'self-test' whilst at sea, and if in port, the port authority should be advised prior to activation. Some SART's "self-test" is in fact a live test, and inspection of the SART's manufacturer's manual will clarify this.

Should a SART test be required for some over-riding reason at sea, the ship should check its 3 cm radar to see if any vessels are in the range first. A safety priority VHF DSC announcement should then be made prior to activating any live activation of the SART whilst at sea. The SART need only be active for only 2 or 3 sweeps of the radar.

15.8 AIS-SARTS

AMSA recommends testing of AIS-SARTs be done sparingly, in order to prolong battery life, avoid mis-activation and confusion. If testing is required in port, the port authorities should be informed prior to activation. Successful test activation will be evident on the ship's AIS unit and devices accepting AIS data like radars and ECDIS displays. The AIS-SART target will display the text 'SART TEST'.

In the unlikely event of the AIS display showing 'SART ACTIVE' the AIS-SART must be immediately switched off, and an 'All Stations' safety priority message broadcast via DSC / VHF CH. 16 advising of the inadvertent activation.

Physically examine an AIS-SART at least once a month to check:

- There is no obvious physical damage;
- The battery expiry date;
- The MMSI label is legible; and
- To ensure the support cradle is intact.

15.9 SUMMARY OF ROUTINE TESTING

Equipment	Required routine test requirements
VHF DSC	Daily with built-in test equipment (without radiating signals)
VHF R/T	Tested by operational use
MF/HF DSC	Daily: with built-in test equipment (without radiating signals) Weekly: live test call with a Maritime Communications Station. If not in range, a test call is to be carried out when next in range.
GMDSS Inmarsat terminal/s	Tested by operational use

Table 9 - Summary of Routine Testing – Equipment

Survival Craft Equipment	
Handheld VHF	Once/month on channel other than Ch.16, unless transceiver is of the sealed type, in which case it becomes impractical.
406 MHz EPIRB	Physically examined at least once/month and self-test[1]
AIS-SART	Physically examined at least once/month
X-band SART	Physically examined at least once/month
GMDSS Reserve Source of Energy	
GMDSS Batteries	Monthly: Non-sealed wet cells – a full examination of each battery, cell by cell must be made, and report on the general condition entered, cell by cell in Annex 2 of the GMDSS Radio Log. For other types of cells, a visual inspection is required and report on the general condition entered, and replacement when manufacturer recommends.
Non-battery (e.g. motor generator)	Weekly test
Other batteries	Daily test, or in the case of UPS batteries, in accordance with the UPS manufacturer's recommendations

[1]Testing to be done in accordance with the manufacturer's user manual.

Table 10 - Summary of routine testing – survival craft equipment

Communications Equipment			
VHF DSC	X		
VHF R/T tested by operational use	X		
MF/HF DSC self-test performed	X		
MF/HF DSC test call performed		X	
GMDSS Inmarsat terminal/s tested by operational use	X		
Survival Craft Equipment			
Handheld VHF transceiver tested			X
406 MHz EPIRB examined and self-test[2]			X
AIS-SART examined			X
X-band SART examined			X
GMDSS Reserve Source of Energy			
GMDSS batteries – tested[3]	X		
GMDSS battery - full examination			X
Non-battery (e.g. motor generator) - tested		X	
Other batteries – tested	X		

[2]Testing to be done in accordance with the manufacturer's user manual.
[3]Note: Inspection of the automatic battery charger (see Section 3.6.3) indications satisfies this requirement.

Table 11 - Summary of routine testing - communications equipment

16 BATTERY MAINTENANCE

This chapter provides guidance on the procedures to be followed for basic maintenance of battery systems fitted to GMDSS ship stations.

16.1 BATTERY REQUIREMENTS

16.1.1 Reserve power source

As described in Chapter 3, Section 3.6, a reserve source of energy must be provided on every GMDSS ship to supply GMDSS radio equipment in the event of failure of the ship's main and emergency sources of electrical power.

Depending on the type and specifications of the ship's emergency generator, the reserve source of energy must be of sufficient capacity to power the GMDSS equipment for either 1 h or 6 h. Vessels not carrying an approved emergency generator must provide a reserve source with a capacity of 6 h.

Rechargeable accumulator batteries are the most convenient and efficient means of providing the required reserve source.

16.2 TYPES OF BATTERY

16.2.1 Lead acid and nickel cadmium cells

The two types of battery likely to be used on ships as the reserve source of energy are lead–acid cells and, less frequently, nickel cadmium alkaline cells.

Both have their own characteristics and maintenance needs.

Lead acid and alkaline cells must never be placed together in the same locker or battery box. Serious shortening of the useful life of both will result.

16.3 LEAD-ACID CELLS

16.3.1 Construction

A combination of lead and lead peroxide plates and the sulphuric acid in the electrolyte (the liquid contained in the cell) produces a voltage difference between the plates which causes a current to flow.

When the acid in the electrolyte, or the material in the plates is used up, the voltage no longer exists and current cannot flow. At this point the cell can be considered discharged or "flat".

This situation is reversible by passing a current in the opposite direction. This process reverses the chemical reactions in the cell and is known as charging.

Lead–acid cells have a nominal voltage of 2 volts (V) per cell, regardless of size. Larger cells will supply higher currents than smaller cells, or the same current for longer periods. The ability of a cell to produce current for a period of time is known as its capacity and is usually measured in ampere–hours (Ah).

16.3.2 Connection of lead-acid cells

Cells may be connected in series (that is, the positive terminal of one cell to the negative terminal of the next), to provide higher voltages. Three cells connected in series will give a "battery" of 3 x 2 V = 6 V; six cells connected in series will give a "battery" of 6 x 2 V = 12 V.

Most modern lead–acid batteries are supplied in 6 or 12 volt combinations and may themselves be connected in series to provide the required output voltage.

Lead acid cells used for communications purposes aboard ships are usually connected in a 24 volt combination; that is, four 6 volt or two 12 volt batteries in series.

Connection of lead–acid cells in parallel, (that is, the positive terminal to positive terminal, negative terminal to negative terminal), will produce the same output voltage as a single battery but the capacity will have been increased. For example, two 12 volt batteries each with a capacity of 60 Ah, when connected in parallel will provide an output voltage of 12 volt with a capacity of 120 Ah.

16.4 CARE AND MAINTENANCE OF LEAD-ACID BATTERIES

16.4.1 Essential maintenance

If batteries are to provide adequate performance in the event of an emergency, regular and careful maintenance is required.

A battery's service life also depends on the manner in which it is treated.

To ensure the best performance from a battery it is important that it:

- Is kept clean, dry and free from terminal corrosion;
- Has the electrolyte kept at the correct level; and
- Is kept correctly charged.

16.4.2 Battery cleanliness

A battery must be kept clean. A dirty battery may hold spilt electrolyte on its surface thereby providing a path for electrical current to leak away. It is important to keep the outside surfaces of a battery dry and free of contamination, in particular dust from cargoes of metallic ores.

Corrosion forming on terminal clamps may seriously affect, or even prevent, the ability of the battery to supply current. Corrosion will be evident by the formation of a white–green powder between the battery terminals and the terminal clamps. In this situation, the terminal clamp should be removed, and both it and the terminal post cleaned.

To minimise the likelihood of corrosion forming, terminal posts and clamps should be lightly smeared with petroleum jelly.

16.4.3 Electrolyte level

The level of electrolyte inside a battery is important. As a result of the chemical action inside a battery, water is lost. This must be replaced with distilled or demineralised water.

Seawater must not be used to top up batteries.

The level of the electrolyte should be maintained at approximately 10 mm (3/8 inch) above the plates unless otherwise specified by the manufacturer.

If the electrolyte level is too high, it may overflow during charging providing an unwanted discharge path. If the electrolyte is too low, the plates are exposed to air and permanent damage and loss of capacity may result. It may be noticed that more frequent topping–up is required by a battery that is nearing the end of its useful life.

Low maintenance batteries will require infrequent topping–up. Maintenance–free batteries may require none at all.

16.4.4 Correct charging

To provide the best service, a battery must be correctly charged. Overcharging and undercharging can both seriously affect its performance.

The automatic charging facilities fitted to GMDSS vessels should ensure that the batteries are provided with an optimum amount of charge at all times. However, regular monthly specific gravity readings must be taken and recorded in the radio logbook to ensure correct functioning of the charger and to monitor battery condition.

16.4.5 Measuring the specific gravity of cells

The specific gravity of the electrolyte varies proportionally with the amount of charge in the battery. It is highest when the battery is fully charged, and lowest when the battery is fully discharged or "flat". It follows that the amount of charge in a battery can be determined by measuring the specific gravity of the electrolyte.

A simple instrument called a hydrometer is used to measure specific gravity.

In general, for a fully charged battery, the specific gravity should measure about 1 250. Half charge will be indicated by a reading of 1 200, and fully discharged by 1 140. All cells in a battery bank should indicate a similar specific gravity. A variation of more than 25 points will indicate a faulty cell and the battery should be replaced.

Due to differences in manufacturing techniques, specific gravities may vary slightly from brand to brand. The manufacturer's specifications should be consulted for more precise values.

The temperature of the electrolyte will affect specific gravity readings. Manufacturers normally provide specifications at the industry standard of 25ºC, and a correction should be applied if the temperature is significantly above or below this value.

Two specific gravity points should be added for each three degrees above 25ºC, and two points subtracted for each three degrees below. For example a hydrometer reading of 1 250 at 40ºC, when corrected, gives an actual specific gravity of 1 236, indicating that rather than being fully charged, the battery is approximately 86% charged.

Specific gravity readings should not be taken immediately after topping–up a cell as the added water will float towards the top of the cell and give a false reading. Charging for 30 min or more after topping–up will mix the electrolyte and allow accurate readings.

Batteries which have cells where specific gravity readings fail to rise, or respond poorly to adequate charging should be replaced without delay.

16.4.6 Measuring the on-load terminal voltage

Measurement of the on–load (that is, when the battery is supplying a reasonably heavy current) terminal voltage will also provide an indication of the amount of charge in a battery.

For a 24 V battery bank, the terminal voltage should not fall below approximately 22.8 V during transmissions. If the voltage does fall significantly below this value, the battery requires charging.

If, after charging, the on–load terminal voltage still falls significantly below 22.8 V, it is an indication of a faulty cell.

Measuring the off–load (that is, when the battery is idle or only supplying current to a receiver) terminal voltage of a battery is a poor indication of its condition.

16.4.7 Loss of capacity

A battery will suffer a gradual loss of capacity during its life. This is inevitable and the battery should be replaced when the capacity loss becomes significant.

Many lead–acid batteries have a commercial life of only two to three years.

However, the useful life of a battery can be considerably shortened by:

- Operating the battery in a low state of charge for long periods;
- Allowing a battery to stand in a discharged state for long periods;
- Leaving a charged battery for long periods without periodic discharging; and
- Overcharging.

16.5 ALKALINE BATTERIES

16.5.1 Construction

The vented alkaline batteries used aboard ships for radiocommunications purposes use a combination of nickel hydrate and cadmium oxide plates with an electrolyte of potassium hydroxide. They are often referred to as nickel cadmium or 'nicad' batteries.

Whilst initially considerably more expensive, nickel cadmium batteries have a number of advantages over lead–acid batteries. Their commercial life may be many times that of lead–acid batteries.

Individual nickel cadmium cells have a terminal voltage of 1.2 V and may be connected in a "battery" to provide the required output voltage.

Cells should be regarded as fully discharged when an on–load terminal voltage of 1.1 V is reached.

16.5.2 Specific gravity of alkaline batteries

The specific gravity of the electrolyte in a nickel cadmium battery does not vary during charge/discharge cycles and cannot be used as an indication of its state of charge.

Specific gravity should normally be in the range 1 190 to 1 250. However, it will gradually fall as the cells age.

The electrolyte should be replaced once its specific gravity falls to below about 1 160. Manufacturer's specifications should be consulted for a more precise value.

16.5.3 Electrolyte level of alkaline batteries

As with lead–acid batteries, nickel cadmium batteries use water during the charge/discharge cycle and periodic topping–up with distilled or demineralised water will be necessary.

For batteries on a continuous low rate charge (such as might be the case with reserve source batteries on GMDSS ships), it may not be necessary to top–up more frequently than once every four to six months.

Where batteries are being regularly used and recharged, topping–up will be necessary more frequently.

The rate at which water is lost from a battery is a good guide to whether it is being correctly charged.

A very high consumption of water probably indicates that batteries are being overcharged. A zero water consumption probably indicates that charging is insufficient.

Providing correct electrolyte levels are maintained, vented nickel cadmium batteries will not be damaged by moderate overcharging.

16.5.4 Basic maintenance

Nickel cadmium batteries must be kept clean, dry and correctly topped–up. Terminals and connectors should be kept lightly smeared with petroleum jelly.

Nickel cadmium batteries are more tolerant of less–than–ideal maintenance than lead–acid batteries and may be left in a discharged condition for long periods without damage.

16.6 BATTERY HAZARDS

16.6.1 Hazards associated with lead acid and nickel cadmium batteries

There are two hazards associated with both lead acid and nickel cadmium batteries that users must be aware of:

- The risk of explosion; and
- The risk of chemical burns.

As a result of the chemical process occurring with the cells of both types of batteries during charging, hydrogen gas is produced. When mixed with air, this can form a highly explosive mixture which can be ignited by a naked flame, lighted cigarette, or a spark. The spark caused by breaking or making an electrical connection in the vicinity of a charging, or recently charging, battery is sufficient to ignite the hydrogen–air mixture.

If using metal tools to work on battery connections, extreme care must be taken to ensure that terminals are not short-circuited.

The electrolyte in a lead–acid battery is sulphuric acid and in a nickel cadmium battery, potassium hydroxide.

Both are sufficiently concentrated to cause damage to eyes, skin or clothes if split or splashed. Particular care should be taken with potassium hydroxide solution which is highly caustic and will burn on contact.

Immediate and prolonged application of running fresh water will minimise the effect of contact with both types of battery electrolyte. Medical advice must be sought immediately for burns to the eye.

It is strongly recommended that safety goggles, gloves and a boiler suit are worn during routine battery maintenance.

Batteries must not be topped up whilst oncharge.

16.6.2 Battery Compartments

Battery lockers or compartments should be provided with adequate ventilation to allow the dispersal of hydrogen gas (lighter than air) produced during charging. They must be well ventilated prior to any work being carried out on the batteries.

If in use, deckhead ventilators should be periodically checked to ensure that they have not been closed for any reason.

Battery lockers and compartments must not be used as storage areas for other items of ship's equipment. During heavy weather, these items may fall across batteries causing short–circuiting with consequent risk of explosion and fire.

Under no circumstances should nickel–cadmium and lead–acid batteries be stored in the same locker or compartment, due to the risk of cross–contamination of the respective electrolytes by inadvertent use of common hydrometers.

16.6.3 Uninterruptible Power Supplies (UPS)

Uninterruptible Power Supplies (UPS) can be used to supply mains power to GMDSS installations, or elements of it (such as Inmarsat-B / Fleet77 equipment).

Their purpose is to provide continuous mains power, in the event of a complete loss of primary mains, or when the mains power characteristics do not meet specified conditions, such as undervoltage, or frequency error.

If power is solely to be provided by an UPS, then there must be two UPS units. Changeover can be manual or automatic. Guidance on the capacity of the UPS and configuration is contained in IMO COMSAR Circular 16, which is reproduced in Appendix 7. Vessels can use a single and a separate battery installation, and UPS units must be operational within 5 s after turn-on.

Despite their advantages, GMDSS operators should examine their vessel's UPS installation to determine the following:

- How can I perform a manual test?
- Can I change the batteries myself?
- What types of batteries are used?
- When do I need to change batteries?
- What alarms exist (what do they mean)?
- How long will the batteries last?
- How do I control the UPS, or bypass it?
- How do I change fuses, and where are the local circuit breakers? and
- What happens when I unplug the mains?

Safety precautions include:

- Beware, the output is live even though mains input may be off or unplugged;
- Only change the batteries if user is allowed to do so (fatal voltages inside);
- Connections to be secure;
- Ventilation fans (if fitted) not to be obstructed;
- Adequate ventilation to be provided; and
- Observe all safety instructions provided by maker.

Figure 32 shows some typical arrangements.

16.6.4 Lithium battery hazards

EPIRBs, VHF survival craft radios and other portable electronics may use lithium-based battery packs:

- These should be disposed of correctly.
- Do not short circuit the battery;
- Do not incinerate;
- Do not throw into landfill;
- Do not throw overboard;
- If leaking, do not touch without protective gloves; and
- Recycle only as directed.

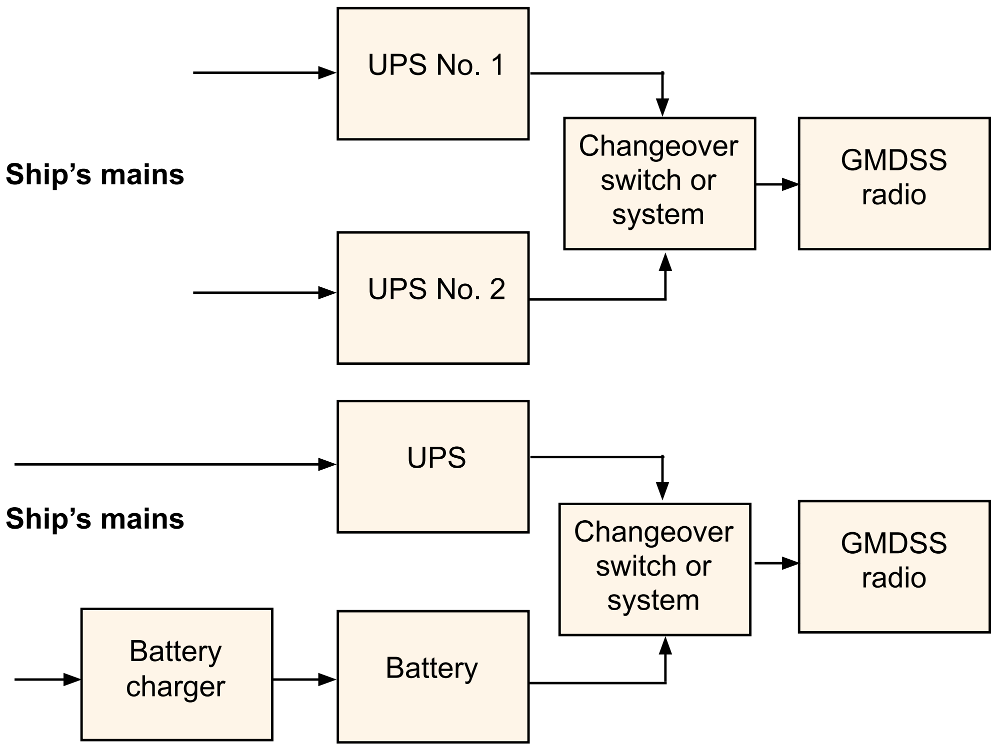


Figure 32 - Typical Uninterruptible Power Supplies

17 EQUIPMENT MAINTENANCE

This chapter provides guidance on the procedures to be followed for basic maintenance of GMDSS ship station equipment.

17.1 ANTENNA SYSTEMS

17.1.1 Introduction

A properly performing antenna system is a fundamental requirement for effective communications. Although antenna systems fitted to GMDSS vessels are specifically designed for the maritime environment, they still require routine maintenance to ensure proper performance.

17.1.2 VHF antennas

Antennas used for operation at VHF are the vertical 'whip' type. They are constructed of either fibreglass or aluminium. Exposure to ultraviolet radiation over long periods of time will cause fibreglass antennas to deteriorate to the point where moisture can enter the antenna. This will affect the radiation efficiency, and usually render the antenna unusable.

VHF antennas should be regularly checked for signs of damage and loose mountings. It should also be noted where new AIS equipment is fitted, strict attention should be paid to the installation guidelines, particularly to the siting of the Antenna. AIS transmits at frequent intervals on VHF and if incorrectly installed can interfere with other onboard equipment including DSC.

17.1.3 MF/HF wire antennas

GMDSS vessels that have been converted from original 'wireless telegraphy' vessels often use the existing wire transmitting antennas as the MF/HF transceiver antenna.

It is particularly important that the insulators used with these antennas are kept clean, as a build-up of salt and funnel soot deposits will seriously degrade their insulating properties, and allow transmitted energy to be lost. The situation may arise where more than 80 percent of the transmitters power is being short circuited to ground, rather than being radiated.

Bulk carriers are particularly prone to this problem, as cargo dust deposited on insulators during loading and unloading operations combines with salt and soot deposits to quickly render insulators ineffective.

All antenna insulators must be regularly washed down with fresh water.

Antenna halyards, wire shackles, wire thimbles and the actual antenna wire should also be regularly inspected for signs of damage and/or corrosion.

Wire transmitting antennas are also fitted with safety loop/weak link assemblies between the halyards and the supporting masts. These assemblies are designed to prevent the antenna breaking by absorbing the shock produced if the vessel is subject to a collision or some other severe impact. They should be inspected regularly for signs of wear or damage.

17.1.4 MF/HF vertical antennas

MF/HF antennas on modern GMDSS vessels are usually large vertical 'whip' types. Some may be in excess of 10 m long. The antenna tuning unit, which matches the antenna to the transceiver, may also be mounted at the base of the antenna.

MF/HF vertical antennas should be regularly checked for signs of damage (including bending) and loose mountings. Any insulators used must be washed regularly with fresh water.

Insulators must not be painted.

17.1.5 Emergency wire antennas

Vessels with two transmitting antennas are often provided with an antenna switch which allows the MF/HF transceiver to be connected to either antenna. This is usually the vessel's original antenna switch box, mounted in the radio room. Simplified operating instructions are provided either on or near the switch box.

Some vessels are fitted with two MF/HF transceivers, each with its own dedicated antenna. These may or may not be switched through the antenna switch box.

GMDSS vessels fitted with only one MF/HF transceiver and one installed antenna for that transceiver are required to carry either a spare antenna of the same type as is installed, or a pre–assembled temporary wire antenna, complete with insulators and mounting hardware. Temporary antennas are used in the situation where the main antenna has either been carried away or damaged to the point where it cannot be used.

The temporary antenna should be slung between a suitable point or points to provide the maximum possible length and elevation. It is preferable that the antenna be arranged vertically, if possible. If the antenna tuning unit for the MF/HF transceiver is mounted externally, the temporary antenna is connected to the 'lead in' insulator, usually mounted on the top of the tuning unit. If the tuning unit is mounted inside the ship's superstructure, the temporary antenna is connected to the 'feed through' insulator at the same position where the original antenna was connected.

The original, damaged antenna must be disconnected from the ATU or feed–through insulator.

17.2 RADIO EQUIPMENT

17.2.1 Power supplies

The most common faults with GMDSS radio equipment are those related to power supply systems. Most GMDSS vessels are fitted with power supplies that provide automatic changeover from AC to DC operation in the event of mains failure. There is usually a set of AC and a set of DC circuit breakers for all equipment fitted. These breakers will trip and shut down the equipment if a fault appears on the power circuit they supply. Additionally, some equipment is fitted with fuses that perform the same function.

> All GMDSS operators must familiarise themselves with the location of all circuit breakers and fuses used by the GMDSS equipment and the respective procedures for reset and replacement.

If a circuit breaker continues to trip, or replacement fuses continue to blow, technical help must be sought.

Please refer to Section 16.6.3 for information relating to Uninterruptible Power Supplies (UPS).

17.2.2 EPIRBs

Expiry dates on hydrostatic releases fitted to float free 406 MHz EPIRBs should be monitored.

The AMSA GMDSS Radio Log requires that each EPIRB shall be examined at least once a month to check:

- built-in self-test performed as per the recommendations in the manufacturer's user manual;
- its capability to operate properly, particularly its ability to float free (where required to do so) in the event of the vessel sinking;
- how secure it is its mounting; and
- for signs of damage.

If there is any doubt, it is strongly recommended that this function is carried out, by a shore-based maintainer at the earliest opportunity, for further advice refer to MSC/Circ.1039.

Refer to Section 15.9 for a summary all routine testing requirements, and to Section D of the AMSA GMDSS Radio Log (included as Appendix 11).

17.2.3 SARTs

A physical examination of the SART(s) should be carried out monthly. Refer to Section 15.9 for a summary all routine testing requirements, and to Section D of the AMSA GMDSS Radio Log (included as Appendix 11).

17.2.4 AIS-SARTs

A physical examination of the AIS-SART(s) should be carried out monthly. Refer to Section 15.9 for a summary all routine testing requirements, and to Section D of the AMSA GMDSS Radio Log (included as Appendix 11).

18 ROUTINE COMMUNICATIONS PROCEDURES

This chapter provides guidance in procedures to be followed during routine and commercial communications.

18.1 RADIO RECORDS

18.1.1 Radio log books

Every ship which is compulsorily fitted with a radio installation must carry a radio log book. This document must be available for inspection by any authorised officer. The Radio Services of a ship station is under the authority of the Master or of the person responsible for the ship, and shall require that each operator complies with the ITU *Radio Regulations*.

Completion of radio log book

Section A – Particulars of Vessel, which must also include method used to ensure availability of service.

Section B – Qualified Personnel, complete with full details of type(s) of certification and date(s) of issue.

Section C – GMDSS Radio Log. This part of the log forms a record of the operation of the ships radio station and must be completed in duplicate. The following entries must be made in chronological order:

1. Summary of Distress, Urgency or Safety traffic received either by radio telephone or Digital Selective Calling. Records for Distress, Urgency or Safety traffic received by Inmarsat satellite systems and NAVTEX may be maintained separately on board in 'print out' or electronic form, but shall be retained on board for six months.
2. Any incident connected with the radio service which appears to be of importance to the safety of life at sea.
3. Tests of the GMDSS equipment (as carried to comply with Marine Order 27) as detailed in the front cover of Section D of the GMDSS Radio Log Book.
4. If the ship's rules permit, the position of the ship at least once a day.

In addition, the Master must inspect and sign the GMDSS Radio Log.

Section D – Details the radio equipment and battery tests to be carried out by operators. Section D also contains Annexes 1 and 2.

Annex 1 – Particulars of Batteries on Board and their purpose.

Annex 2 – Monthly report on Batteries (and records the Specific Gravity Readings of each individual cell before and after full charge along with comments), if applicable.

Both sections C and D are to be completed prepared in duplicate. The duplicates of Sections C and D Annex 1 and Annex 2 must be detached and kept in correct order to form a record of the operation of the radio installation and be retained in board for a minimum of 12 months. These records are to be available for the information of Surveyors and shore maintenance staff and should be filed in the radio room or with the radio equipment.

Retention of Log

Once completed, the original Log(s) must be retained by the ship's operator for a period of not less than two years from the date of the last entry in Section C.

Details of commercial communications passed via maritime mobile-satellite systems may be maintained as described for Section C above, sufficient for the settlement of accounts. If not recorded in Section C, other means shall be provided by the ship's operator to record details of commercial traffic for a period sufficient for the settlement of accounts.

The GMDSS Radio Log book format is shown in Section 18.7 and includes an example of a completed page from the GMDSS Radio Log.

18.2 SERVICE DOCUMENTS

18.2.1 Admiralty List of Radio Signals (ALRS)

At the time of publication of this Handbook, the ALRS is a six-volume series, comprising 12 books, (or Parts), published by the United Kingdom Hydrographic Office, which provides details of services provided by coastal radio stations. It also includes general reference sections describing many maritime radio related services. The ALRS are carried by Australian GMDSS vessels. Regular updates are issued through weekly UKHO Notices to Mariners (Australian Notices to Mariners are issued fortnightly).

Volume 6 (Pilotage Services, VTS services and Port Operations) of the ALRS is the first ALRS volume to be converted into digital format, and is titled as *Admiralty Digital Radio Signals*, Vol 6 (ADRS6) and available as a CD-ROM.

18.2.2 International Telecommunication Union (ITU) publications

The ITU publishes the following service publications;

- *List of Ship Stations and Maritime Mobile Service Identity Assignments* (List V) – a directory of vessels, providing details such as radio equipment fitted, radio callsigns and MMSIs;

  This is also supplied in CD-ROM format and carriage of ITU service publications in electronic form is permitted under AMSA *Marine Order 27 (Radio equipment) 2009* and the ITU *Radio Regulations*.

- *List of Coast Stations and Special Service Stations* (List IV) – an alphabetical list (by country) of coastal radio stations that keep DSC watch, public correspondence, transmit medical advice, maritime safety information, notices to navigators, radio time signals. Also contains stations transmitting radio time signals, AIS and information on port stations, pilot stations, coast earth stations (LESs), VTS stations, SAR agencies and NAVAREA coordinators, that have been notified to the ITU., providing details of services offered and frequencies covered;

- *Manual for use by the Maritime Mobile and Maritime Mobile-Satellite Services* – extracts from the ITU *Radio Regulations* pertaining to maritime radio operation. The ITU also calls this the Maritime Manual. This manual is available in printered or electronic form (CD-ROM).

These publications are required to be carried by all Australian GMDSS vessels, but can be carried in paper or electronic form where available.

List IV is published on CD-ROM annually and there will be no paper supplements printed, but amendments will be available free-of-charge from the ITU MARS webpage at: www.itu.int/ITU-R/go/mars.

List V will be published on CD-ROM every two years and there will be no paper supplements printed, but amendments will be available free-of-charge from the ITU MARS webpage at: www.itu.int/ITU-R/go/mars.

18.2.3 Stratos Global Satcom Services

Customer service for matters associated with Stratos Global Satcom Services can be obtained from their Customer Services Centre direct on:

Toll free +1 709 748 4226 (or dial 33# from handset) or
e-mail: support@stratosglobal.com
www.stratosglobal.com

18.2.4 Marine Order 27

In addition to the publications mentioned above, AMSA Marine Order 27 requires the following publications be carried on GMDSS vessels:

- The Safety Radio, (or Radio) Certificate, the Record of Equipment, any applicable Certificate of Exemption, and other relevant statutory certificates;
- A current edition of the *Marine Radio Operators Handbook*, published by the Australian Maritime College; or a current edition of the *Australian Global Maritime Distress and Safety System (GMDSS) Handbook*, published by AMSA;
- A copy of AMSA Marine Order 27;
- A current edition of the *Admiralty List of Radio Signals*, published by the UK Hydrographic Office*; and
- The ship's GMDSS Radio Log.

**Note: The next revision of Marine Order 27 will reflect the change in titles in the new merged ITU service publications. The Admiralty List of Radio Signals can also be carried in paper or electronic form.*

18.3 GENERAL ROUTINE COMMUNICATIONS PROCEDURES

18.3.1 Use of frequencies

A ship station may only use frequencies which are authorised for its particular activity. Except in the case of distress, use of any other frequency is not permitted. It is most important that frequencies are used only for the purpose for which they are assigned – e.g. a frequency listed for communicating with coast stations is not to be used for communicating with other ships.

18.3.2 Secrecy of communications

Under Article 37 of the Constitution of the International Telecommunication Union, and ITU *Radio Regulations* No. 18.4 the unauthorized interception of radiocommunications not intended for the general use of the public is prohibited, and the divulgence of the contents, simple disclosure of the existence, publication or any use whatever, without authorization of any nature whatever, obtained by the interception of such radiocommunications is prohibited.

Further, under the ITU *Radio Regulation* No. 46, the ship station is placed under the supreme authority of the master or person responsible for the ship or other vessel carrying the station. The person holding this authority shall require that each operator comply with the Regulations and that the ship station at all times is used at all times in accordance with the Regulations. These provisions also apply to operators of ship earth stations.

18.3.3 Control of communications

During routine communications between a ship and a coast station, the coast station controls the working. In order that all communications may be exchanged efficiently, all instructions given by coast stations should be followed immediately.

18.3.4 Calling and working frequencies

Frequencies assigned to ship and coast stations are designated as either:

- Calling channels / frequencies – used to establish communications; or
- Working channels / frequencies – used to exchange routine and public correspondence traffic.

All stations should establish communications with the desired station by using a calling channel. Once these have been established, both stations transfer to an appropriate working channel and exchange information. At the conclusion of this exchange of communications, both stations resume monitoring of the calling channel or channels.

The majority of calling channels are also assigned for distress, urgency and safety purposes. This enables ship stations to use a single channel for both routine calling and for safety of life at sea purposes.

For these reasons, it is essential that calling channels are not used for exchange of routine messages – this must be carried out on a working channel.

18.3.5 Calling channels

The main frequencies used for establishing routine radio telephone communications are:

2 182   4 125   6 215   8 291 kHz   and Channel 16 in the VHF band.

The frequencies of 12 290 and 16 420 kHz are reserved for distress, urgency and safety communications, and safety-related calling to and from rescue centres only, which includes radio checks, provided of course, that no other distress, urgency or safety traffic is in progress.

Some overseas coast radio stations also maintain watch on certain radiotelephone channels in maritime HF bands from 4 to 22 MHz. These are used for radiotelephone calls between ships and telephone subscribers ashore.

18.3.6 Working channel

There is a frequency or pair of frequencies assigned in each of the HF maritime bands used for working with coast stations. These channels can be found in the ITU *List of Coast Stations and Special Service Stations*, along with their hours of operation, and the *Admiralty List of Radio Signals*, Volume 1.

18.3.7 Calling procedures

Before transmitting, an operator must listen for a period long enough to be satisfied that:

- There is no distress, urgency or safety traffic in progress on the channel, and;
- Harmful interference will not be caused to any routine transmissions already in progress.

Silence periods must also be observed (see Section 14.11.4) where national arrangements require silence periods (note: silence periods are not observed as part of the GMDSS).

The initial call should be spoken clearly and slowly, using the following procedures:

- The name and / or callsign of the station being called, spoken not more than three times;
- The words THIS IS;
- The name and / or callsign of the calling station, spoken not more than three times;
- The frequency (or channel number) of the channel being used; and
- The word OVER.

Once the coast station has answered, the ship should reply with a message indicating the purpose of the call and proposed working channel.

18.3.8 VHF procedures

When using frequencies in the VHF maritime band, and communication conditions are good, the initial call may be abbreviated to:

- The name and / or callsign of the station being called spoken once;
- The words THIS IS; and
- The name and / or callsign of the station calling, spoken twice.

On all bands, once communications have been established, names and / or callsigns need only be spoken once.

18.3.9 Repeating calls

When a station being called does not reply to a complete call sent three times at intervals of 2 min, calling must cease for 3 min.

However, before continuing to call, the calling station must ensure that further calling is unlikely to cause interference, and that the station being called is not busy with other communications. In particular, ship stations attempting to call coast stations on any of the distress and safety channels should first check that the coast station is not engaged in broadcasting Maritime Safety Information, by listening on the working channel for the band in use at the time.

If after 3 min there is no reason to believe that further calls will cause interference then calling may resume. When calling is resumed if the station being called does not respond to calls sent three times at intervals of 2 min calling must once again cease for 3 min.

Where communications are between maritime mobile station and an aircraft station the interval between call attempts is 5 min.

18.3.10 Difficulties in establishing communication

If a ship or coast station is unable to communicate with a calling station immediately, it should reply to a call, followed by "wait.....minutes". Coast stations that are busy with other ship stations will respond to a call from a ship with "your turn is number....., please standby".

When a station receives a call without being certain that the call is intended for it, it should not reply until that call has been repeated and understood.

When a station receives a call which is intended for it, but is uncertain of the identification of the calling station, it should reply immediately, asking for a repetition of the call sign or identification of the calling station.

18.3.11 International Phonetic Alphabet

The International Phonetic Alphabet is used to spell out words and figures during poor reception conditions. It is reproduced in Appendix 3. In the ITU *Radio Regulations*, these codes are listed in Appendix 14.

18.3.12 Standard Marine Communications Phrases (SMCP)

The SMCP is an IMO publication, and contained in IMO Resolution A 22/Res.918) and a small portion is included as Appendix 5.

The IMO Standard Marine Communication Phrases (SMCP) has been compiled:

- To assist in the greater safety of navigation and of the conduct of the ship;
- To standardize the language used in communication for navigation at sea, in port approaches, waterways and harbours, and on board vessels with multilingual crews; and
- To assist maritime training institutions in meeting the objectives mentioned above.

These phrases are not intended to supplant or contradict the International Regulations for Preventing Collisions at Sea, 1972 or special local rules or recommendations made by IMO concerning ships' routeing, neither are they intended to supersede the International Code of Signals, and their use in ship's external communications has to be in strict compliance with the relevant radiotelephone procedures as set out in the ITU *Radio Regulations*. Furthermore, the IMO SMCP, as a collection of individual phrases, should not be regarded as any kind of technical manual providing operational instructions.

In the IAMSAR Manual (see also Section 13.2), it is noted "Publications which can be used to overcome language barriers and circumstances among vessels, aircraft, survivors, and SAR personnel include: the International Code of Signals and the Standard Marine Navigational Vocabulary" (the latter now replaced by the SMCP), and also states "While tools like the Code and Vocabulary exist, they are not intended to be necessary for verbal communications among SAR personnel and others who should be able to speak English due to the nature of their duties."

Under the ITU *Radio Regulations*, aircraft are obliged to use maritime procedures when communicating with station in the maritime mobile-service. (ITU *Radio Regulations* No. 41), however, seafarers should be aware of slight differences in radiotelephony usage commonly used by aircraft.

18.3.13 Use of VHF channels other than distress/ safety channels

Safety of Navigation VHF Ch. 13 is also used for ship movements and port operations (subject to national regulations).

When using marine frequencies, ship–helicopter communications are preferred on VHF Ch. 9, 72 and 73. The aircraft should radiate a maximum power of 5 W, and should be below 300 m altitude unless engaged in ice–breaking operations.

VHF Ch. 75 and 76 may be used for navigation–related safety communication, subject to a maximum power of 1 W.

18.4 RADIO TELEX SERVICES

18.4.1 General

Globe Wireless (USA) no longer offers radio telex, but operates an HF Maritime Digital Radio Network is comprised of 24 radio stations strategically located to provide world-wide coverage with messages sent received in near real-time. Using the digital HF network, ships are immediately paged when large files or attachments are waiting ashore reducing the need to connect without knowing if there is traffic waiting.

The service is available 24 h / day and provides ships with automatic access to Australian and international networks. Calls from shore-to-ship are stored at a central bureau and passed to the vessel when it makes contact with a Global Radio Network station. Although not part of the GMDSS distress and safety network, the Globe Wireless network can provide routine communications services.

The service is available 24 h / day. Details are available by contacting Global Wireless direct on:

Telephone: + 1 321 308 0112 or

Fax: + 1 321 309 1366 or

e-mail: customersupport@globalwireless.com

18.5 TRAFFIC CHARGES

18.5.1 Accounting Authority Identification Code (AAIC)

An AAIC is an internationally recognised way of providing a coast station with:

- A reasonable assurance that payment will be made for the service provided; and
- The name and address of the organisation that will make payment.

The way the system works is contained in Recommendation ITU-T D.90.

Each administration is allocated 25 AAIC codes. These are prefixed with two letters representing the country of origin. Australia's 25 codes are prefixed with 'AA' – e.g. AA01, etc.

It will be necessary for ships using commercial services offered by foreign coast stations to quote an AAIC. Failure to be able to quote an AAIC is likely to result in the coast station refusing to accept commercial traffic.

A full list of organisations holding an Australian AAIC may be found in the ITU List of Ship Stations. The licensees of vessels wishing to pass paid traffic through foreign coast stations must make financial arrangements with one of these organisations to ensure that their accounts arriving from overseas are paid promptly.

With the advent of satellite communication systems, and the closure of the 'public correspondence' service by the coast radio network in Australia, the use of AAICs aboard ship is rarely used in Australia, but still used overseas. Typically, an AAIC is allocated to a satellite service provider, who co-ordinates traffic charging.

18.5.2 Currencies used in international charging

Charges for commercial services offered by overseas coast stations are listed in the ITU *List of Coast Stations and Special Service Stations* and by the service providers. These charges are sometimes quoted in special drawing rights (SDR). Conversion tables to enable costs to be determined in Australian dollars should be provided by ships' accounting authorities.

18.5.3 Land line and coast station charges

Charges from foreign coast stations are often quoted in two components:

- Coast Charge (CC) – the charge levied by the coast station for use of its facilities; and
- Land Line (LL) – the charge for connection into the public telephone or telex network from the country in which the coast station is located to the country of destination.

18.6 TIME SIGNALS

18.6.1 Introduction

Various overseas radio stations transmit signals in the MF and HF bands that are used for the calibration of ship's chronometers and equipment clocks. These transmissions are referred to as 'time signals', and usually comprise audible second markers, with a distinct tone to indicate the minute marker. Some transmissions include a synthesised male or female voice which announces the actual time.

Although satellite technology and improvements in chronometer accuracy have lessened their value in recent years, time signal broadcasts continue to be transmitted by shore stations in many parts of the world. Some broadcasts also include useful information on the status of satellite navigation systems and various other alerts.

18.6.2 Frequencies of transmission

Accurate time signals suitable for navigational purposes are regularly available on the frequencies of 5 000, 10 000, 15 000 and 20 000 kHz from various radio stations throughout the world.

Full details of foreign stations broadcasting time signals may be found in Volume 2 of the Admiralty List of Radio Signals or the ITU List of Radiodetermination and Special Service Stations (List VI) - see also Section 18.2.2.

18.7 SAMPLE GMDSS RADIO LOG PAGE

GMDSS RADIO LOG

MV	Callsign	MMSI
Spirit of Tasmania II	*VNSZ*	*503433000*

Date and time UTC	Station from	Station to	Operator's actions or remarks	Frequency, channel or satellite
021000			*Departed Thevenard, bound Sydney all equipment tested satisfactory*	
0550	*VNSZ*	*VIC*	*DSC test call - satisfactory*	*12577*
0602	*786100000*		*DSC distress alert received*	*16804.5*
			position 41-46N 50-14W sinking	
0603/15			*Monitored R/T channel - no traffic*	*16420*
0615	*VNSZ*		*DSC alert information passed via Inmarsat C*	
			Position of vessel in distress well out of this vessel's	
		RCC Australia	*area - no further action*	
0910	*503173456*		*DSC urgency call received*	*8414.5*
0912	*Nonesuch*	*CQ*	*PAN PAN - Man overboard 32-26S 103-10.0E*	*8291*
1000			*Arrived Sydney*	

Appendix 1

FREQUENCIES FOR USE BY GMDSS SHIP STATIONS

All frequencies in this Section are expressed in kHz, unless otherwise noted.

Distress, urgency, safety and calling frequencies

Radiotelephone	DSC	NBDP
2 182	2 187.5	2 174.5
4 125	4 207.5	4 177.5
6 215	6 312.0	6 268.0
8 291	8 414.5	8 376.5
12 290	12 577.0	12 520.0
16 420	16 804.5	16 695.0
VHF Ch. 16	VHF Ch. 70	Not used

Table 12 - Distress, urgency, safety and calling frequencies

Frequences for on-Scene search and rescue for radiotelephony (R/T and NBDP)

2 174.5 (maritime NBDP FEC mode)

2 182.0 (maritime R/T frequency)

3 023.0 (aeronautical R/T frequency)

4 125.0 (maritime and aeronautical R/T frequency)

5 680.0 (aeronautical R/T frequency)

121.5 MHz (aeronautical R/T frequency)

123.1 MHz (aeronautical R/T frequency)

156.8 MHz (VHF Ch. 16 R/T)

156.3 MHz (VHF Ch. 6 R/T)

Frequences for intership navigation safety communications

156.65 MHz (VHF Ch. 13 R/T)

Frequencies for MSI broadcasts in NBDP by coast stations (not used in Australia)

424.0* (National service – Japanese)

490.0* (National service – language decided by Administrations)

518.0* (International service in English)

4 209.5* (National service – language decided by Administrations)

4 210 0

6 314.0

8 416.5

12 579.0

16 806.5

19 680.5

22 376.0

26 100.5

** NAVTEX service (coastal maritime safety information)*

Frequencies for locating/homing signals

121.5 MHz (Cospas-Sarsat aircraft homing)

156 - 174 MHz (VHF maritime band - channel 70 DSC EPIRBs)

161.975 MHz (AIS-SART)

162.025 MHz (AIS-SART)

406.025 MHz (Cospas-Sarsat distress beacon)

406.028 MHz (Cospas-Sarsat distress beacon)

406.037 MHz (Cospas-Sarsat distress beacon)

406.040 MHz (Cospas-Sarsat distress beacon)

9 200 to 9 500 MHz (X-band Search And Rescue Transponder - SARTs)

Frequencies for Inmarsat satellite communications

1 530 to 1 544 MHz (downlink: commercial, distress & safety)

1 626.5 to 1 645.5 MHz (uplink: commercial, distress & safety)

Frequencies for Cospas-Sarsat satellite communications

1 544 to 1 545 MHz (downlink: distress & safety only)

1 645.5 to 1 646.5 MHz (uplink: distress & safety only).

Common identification of frequency bands above 1 GHz

L-band 1-2 GHz (e.g. GPS, Inmarsat-C mobile)

S-band 2-3 GHz (e.g. 10 cm radar)

C-band 4-8 GHz (e.g. Inmarsat-C mobile feeder links)

X-band 8-12 GHz (e.g. SART, 3 cm radar)

Ku band 12-18 GHz (e.g. geostationary satellite links)

Note: The band designations above are used by the IEEE (United Sates). Other variations exist, for other purposes, but these are commonly used in marine and satellite communications.

Primary frequencies for general ship-ship voice communications kHz

2 638

4 146

4 149

6 224

6 230

8 297

12 353

12 356

16 528

16 531

22 159

156. 875 MHz (VHF Ch. 77)

Frequencies for commercial communications

Frequencies available for commercial communications by NBDP and radiotelephony are detailed in the ITU *Manual for use by Maritime Mobile and Maritime Mobile-Satellite Services*.

Appendix

2 PROMULGATION OF MARITIME SAFETY INFORMATION

1 INTRODUCTION

1.1 Maritime Safety Information (MSI) is promulgated under the Global Maritime Distress and Safety System (GMDSS) within the Australian search and rescue region (SRR) and NAVAREA X by RCC Australia.

1.2 The Notice also contains a section, approved by the Bureau of Meteorology, on meteorological information promulgated in a similar manner under GMDSS.

1.3 The RCC and the Bureau of Meteorology provide MSI through Inmarsat's SafetyNET system. The status of world–wide Inmarsat–C MSI broadcasts is provided in ALRS Volume 5 and the IMO Master Plan, Annex 8.

1.4 MSI is provided in accordance with the following international documents:

IMO Resolution A.705(17) – Promulgation of Maritime Safety Information

IMO Resolution A.706(17) – World-Wide Navigational Warning Service

Joint IMO/IHO/WMO Manual on Maritime Safety Information

IMO International SafetyNET Manual

The IMO NAVTEX Manual is not relevant for Australia

1.5 Due to its large length of coastline and the limited communications range of the NAVTEX frequencies, **Australia does not provide a NAVTEX service**. Coastal MSI is disseminated by Inmarsat–C Enhanced Group Call (EGC) service called Safety NET.

1.6 In addition to SafetyNET, the RCC may avail itself of the Inmarsat–B/Fleet77, "ALL SHIPS" broadcast facility for search and rescue (SAR) type broadcasts. These broadcasts will cover an entire ocean region and as such, will seldom be used.

1.7 Every SOLAS-compliant ship must meet the following legal requirements for receiving MSI broadcasts:

- Watch-keeping – every ship, while at sea, shall maintain a radio watch for broadcasts of Marine Safety Information on the appropriate frequencies on which such information is broadcast for the area in which the ship is navigating.
- Logging messages – on a SOLAS-compliant ship, a summary shall be kept in the radio log of all distress, urgency and safety traffic. Records of distress, urgency or safety traffic received by Inmarsat satellite systems, NAVTEX or Narrow-Band Direct-Printing may be maintained separately in 'print out' or disk form. Refer also to 'Notes on the keeping of the Log' in the AMSA GMDSS Radio Log.

In addition to these mandatory requirements, IMO recommends that all current navigational and meteorological messages be retained on the bridge, for as long as they are applicable, for the use of the person in charge of the navigation watch.

2 TYPES OF BROADCASTS

2.1 RCC Australia may initiate six types of broadcasts using Inmarsat–C EGC

(1) Distress messages (MAYDAY)

(2) Urgency messages (PAN PAN)

(3) NAVAREA X warnings (SECURITE)

(4) Coastal (AUSCOAST) warnings (SECURITE)

(5) Local (SSM – Sea Safety Message) warnings

(6) General messages (ALL SHIPS/CQ).

2.2 Distress Message

2.2.1 Distress messages will be directed to a circular area. The radius of the area will be dependent on the nearest known vessel from Modernized Australian Ship Tracking and Reporting System (MASTREP) or from other intelligence.

2.2.2 The text of the message will commence with the distress signal, "MAYDAY".

2.2.3 At the conclusion of the distress incident, the RCC will initiate a message including the words "SILENCE FINI", amongst other information, to indicate distress traffic has ceased.

2.2.4 The Mobile Earth Station (MES) or Ship Earth Station (SES) will provide an aural alarm and visual indication to indicate receipt of a distress call or a call having a distress category.

2.3 Urgency messages

2.3.1 Urgency messages can be directed to a circular, rectangular or coastal area, or an ocean region.

2.3.2 The text of the message will commence with the urgency signal, "PAN PAN".

2.3.3 The SES will provide an aural alarm and visual indication to indicate receipt of an urgency call.

2.4 NAVAREA X Warnings

2.4.1 NAVAREA X warnings will be broadcast through the POR and IOR satellites. The text will commence with the signal "SECURITE".

2.4.2 All navigational aids and hazards outside the area of the coastal area schematic diagram, including information on GPS and space debris will be issued as NAVAREA X warnings.

2.5 Coastal (AUSCOAST) warnings

2.5.1 AUSCOAST warnings will be broadcast through the POR and IOR satellites. The text will commence with the signal "SECURITE".

2.5.2 The Australian coastal area has been divided up as per the attached schematic diagram in Figure 33 to facilitate the broadcast of AUSCOAST warnings. All warnings about aids to navigation within the coastal area, other than those mentioned in Section 2.4.2, will be issued as AUSCOAST warnings.

2.6 Local (SSM) warnings

2.6.1 Local (SSM) Warnings refer to hazards which are considered to be of a temporary nature, e.g. floating logs, temporary buoys, etc.

2.6.2 The text will commence with the signal "SECURITE".

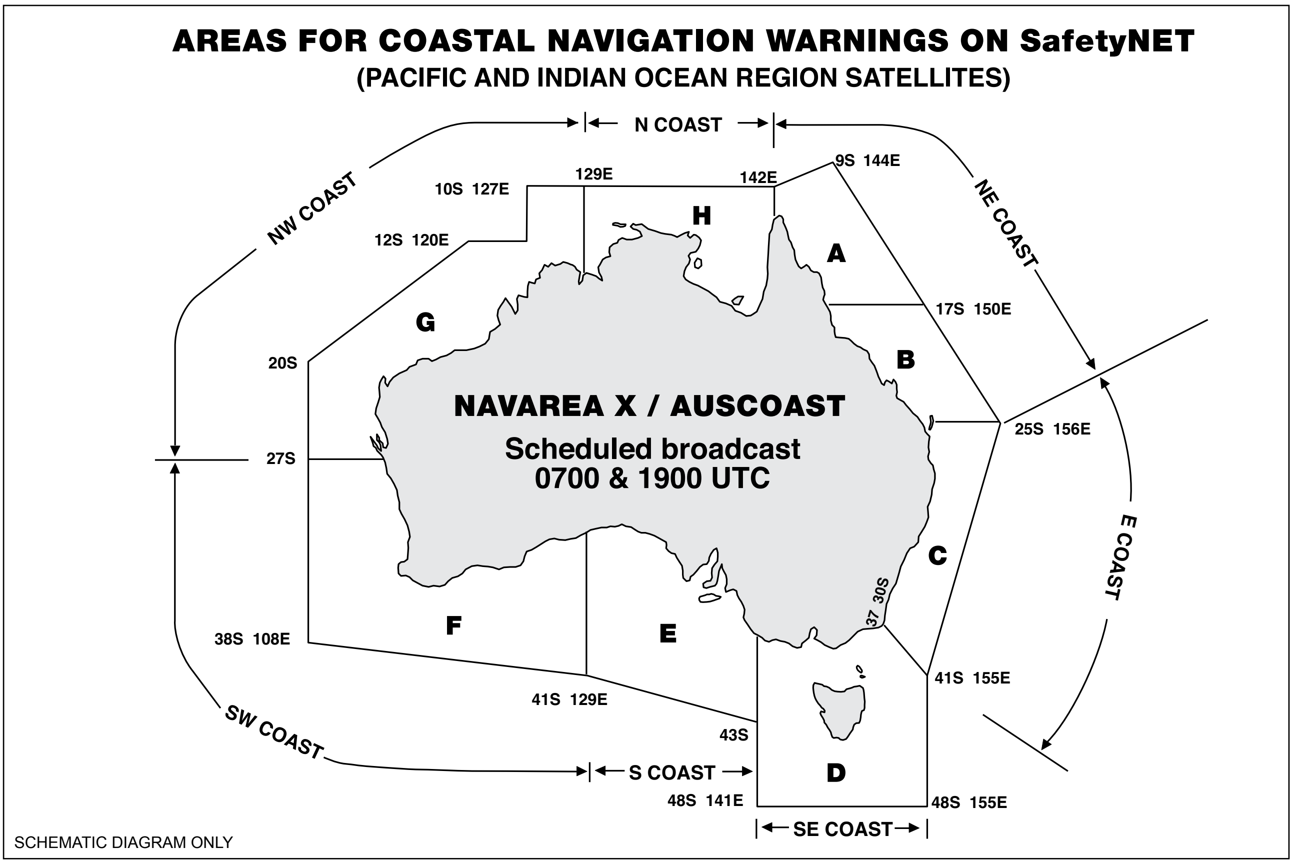


Figure 33 - Areas for Coastal Navigation Warnings on SafetyNET (Pacific and Indian Ocean Region Satellites)

2.6.3 Local warnings for hazards that occur in AUSCOAST areas A – D (Australian coast from Cape York east to Mt Gambier) will be issued through the POR satellite only and those warnings concerning hazards in the AUSCOAST areas E – H (Australian coast from Mt Gambier west to Cape York) will be issued through both the POR and the IOR satellites.

2.7 General messages

2.7.1 General messages (e.g. vessel overdue) can be directed to a circular, rectangular or coastal area or an ocean region.

2.7.2 The text of the message will commence with the signal, "ALL SHIPS".

2.8 EGC message to an individual MES

2.8.1 RCC Australia will use this SafetyNET feature to contact individual vessels as required using the appropriate priority. A message sent to a MES with a distress priority will result in an alarm being raised at the MES to alert the officer of the watch.

3 BROADCAST PROCEDURES

3.1 All messages from the RCC will identify the originator as: "RCC AUSTRALIA DTG ..." (DTG – Date Time Group). Vessels responding to broadcasts should include this DTG. The DTG provides a unique way of identifying messages at the RCC.

3.2 Most broadcasts will be echoed, i.e. repeated 6 min after the initial broadcast. This will give vessels which were transmitting at the time of the initial broadcast another opportunity to receive the message.

3.3 Navigational warnings (NAVAREA X and AUSCOAST) in force, will be promulgated with an echo on receipt of information and then at the scheduled times of 0700 UTC and 1900 UTC without echo and printed on the ship's MES. The scheduled broadcast, if previously received error free, will not be printed again.

3.4 It is possible that, due to operational requirements, some scheduled broadcasts may not occur at the precise time stated above.

3.5 If a message has to be resubmitted to the Land Earth Station (LES) by the information provider, then vessels already in receipt of the message will receive the message again when it is retransmitted.

4 INMARSAT SERVICE CODE MESSAGE ROUTEING VIA SHORT ADDRESS CODES OR SPECIAL ACCESS CODES (SACS)

4.1 Refer to Appendix 14 in respect of the Stratos Network Inmarsat-C SACs and their message distribution.

4.1.1 The following types of messages and corresponding Special Access Codes/Short Address Codes (SACs) provide access to the appropriate services if sent through the Stratos Global LESs of Perth LES (WA) or Burum LES (Netherlands):

SAC 32	MEDICAL ADVICE[1]
SAC 38	MEDICAL ASSISTANCE[1]
SAC 39	MARITIME ASSISTANCE (AND SAR COORDINATION)[2]
SAC 41	METEOROLOGICAL REPORTS[3]
SAC 42	NAVIGATIONAL HAZARDS AND WARNINGS (REPORTS)[2]
SAC 43	SHIP POSITION REPORTS - AMVER[5]

Inmarsat-C only:

SAC 861	REEFVTS REPORTS[7]
SAC 1241	METEOROLOGICAL REPORTS[4]
SAC 1243	INFORMATION REPORTS TO RCC AUSTRALIA (e.g. semi-submerged container sighted)[2]
SAC 1250	ROUTINE TRAFFIC TO RCC AUSTRALIA[6]

[1]SAC 32 and 38 requests are initially routed to Netherlands MRCC when sent via POR LES 212 and IOR LES 312.

[2]SAC 39, 42 and 1243 requests are routed to RCC Australia/ NAVAREA X Coordinator when sent via POR LES 212 and IOR LES 312.

[3]SAC 41 requests are routed to the Royal Netherlands Meteorological Institute when sent via POR LES 212 or IOR LES 312.

[4]SAC 1241 requests are routed to the Australian Bureau of Meteorology when sent via POR LES 212 and IOR LES 312 (available only via POR LES 212 and IOR LES 312).

[5]SAC 43 requests are routed to AMVER when using the Stratos network.

[6]SAC 1250 has been introduced to enable vessels wishing to send an ordinary text message to RCC Australia. This service is paid by the vessel (available only via POR LES 212 and IOR LES 312).

[7]SAC 861 requests are routed to the ReefVTS centre, Townsville (available only via LES 212 and 312).

Note: Due to the merger between Xantic and Stratos Global, a rationalisation of Inmarsat-C infrastructure at Perth LES occurred from 1 March 2007. At the time of publication of this Handbook, the Perth POR and IOR channel units are remotely controlled from Burum (Netherlands).

The host called LES 22 is no longer available or selectable via Inmarsat-C. AMSA Maritime Safety Information is being sent via a host called LES 12 (Burum). This means logging into 212 (POR) or 312 (IOR). There has been no change to the SAC arrangements regarding Inmarsat-B/Fleet77/M/ mini-M, etc.

4.2 Vessels should discriminate between medical advice and medical assistance. Medical advice (Code 32), as implied, is provided by doctors and concern diagnosis, on board treatment, etc. Medical assistance (Code 38), provided by the RCC, involves evacuation of a patient subsequent to medical advice being obtained.

4.3 Vessels unable to use the above Inmarsat Special Access Codes (SACs) should direct traffic to the RCC on telephone +61 2 6230 6811.

5 WEATHER

5.1 The Bureau of Meteorology will initiate two types of broadcasts: forecasts and warnings.

5.2 There are four high seas forecast areas: Western, Northern, North Eastern and South Eastern. See Figure 34.

Forecasts for the area south of latitude 50 degrees South are prepared on request during the summer expedition months and made available to shipping through arrangements with the Bureau's Regional Forecasting Centre in Hobart.

5.2.1 High seas forecasts will be issued in one EGC message addressed to METAREA X, and promulgated at the following scheduled times:

POR – all areas at 1100 UTC and 2300 UTC.

IOR – Western area only at 1030 UTC and 2330 UTC.

5.2.2 Coastal waters forecasts are also issued for the Bass Strait, Western Australia and the Northern Territory.

These messages are addressed to the AUSCOAST areas as shown below (B1 Code) and have message type codes (B2 Codes): meteorological forecasts – Code E; meteorological warnings – Code B.

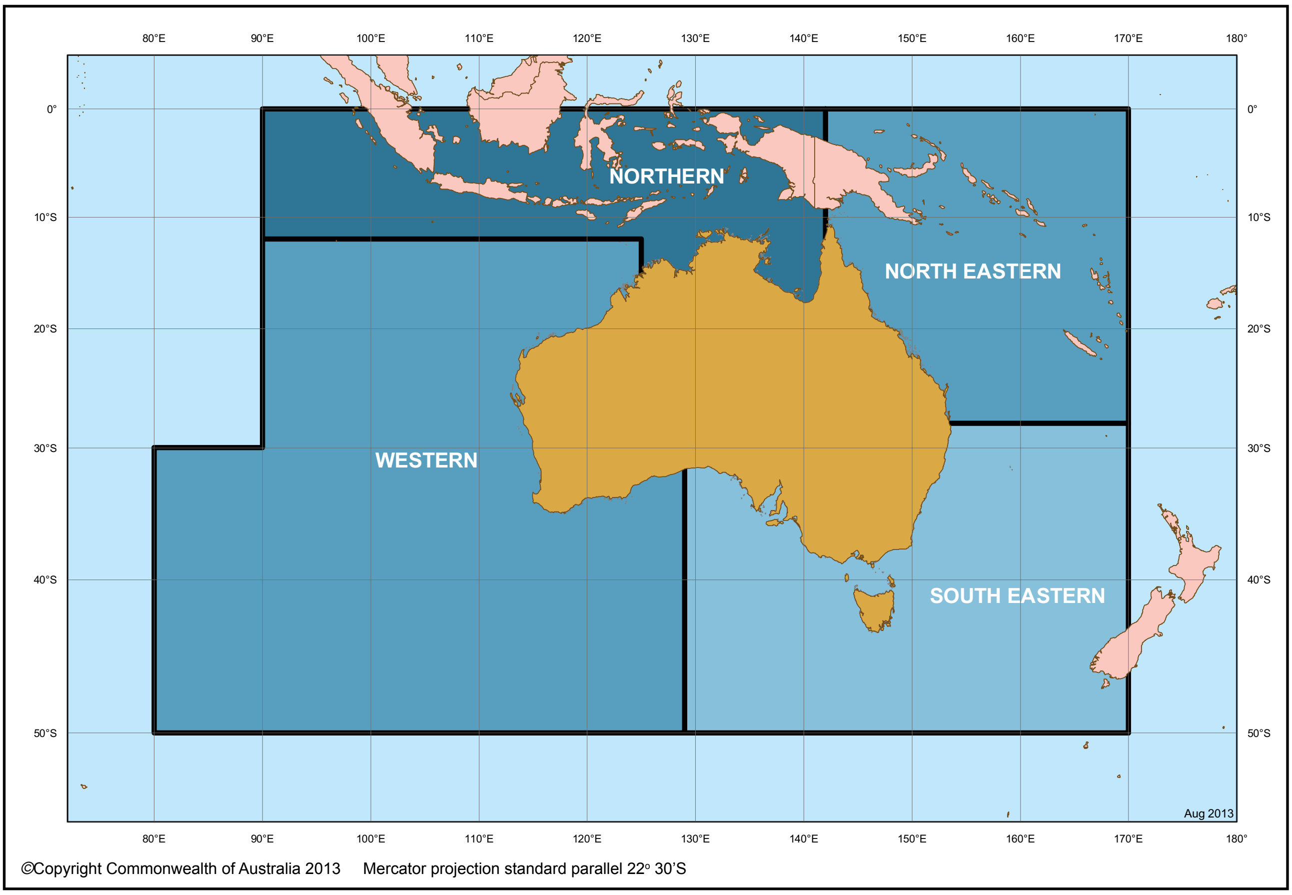


Figure 34 - Forecast Areas for High Seas

Schedule of Australian SafetyNET Weather Bulletins for Coastal Water Areas

Region	AUSCOAST Areas	Coastal Water Areas	Times
POR	D	Bass Strait	1910 UTC*
			0700 UTC
	G,H	Northern Territory	2015UTC
			0815 UTC
IOR	F, G	Western Australia	2030 UTC
			0830 UTC
* One hour earlier during Australian Eastern daylight time			

Table 13 - Schedule of Australian SafetyNET weather bulletins

5.3 Warnings to shipping on the high seas are issued whenever gale, storm force or hurricane-force winds are expected.

5.3.1 There are four Gale/Storm/Hurricane warning areas for the high seas and ocean wind warnings; Western, Northern, Northeastern, Southeastern. See Figure 35.

5.3.2 Warnings will be addressed to rectangular areas as required as follows:

POR – All areas except Western, west of 100 degrees East.

IOR – Western, Northern areas only.

5.4 Strong wind, gale, storm force and hurricane force wind warnings are issued for Australian coastal waters and the areas are the same as those used in the issue of coastal waters forecasts.

5.5 Tropical cyclone information is included in current forecasts and warnings (when applicable).

Visit the Bureau of Meteorology's website, www.bom.gov.au/marine, for current weather information and marine radio broadcast schedules.

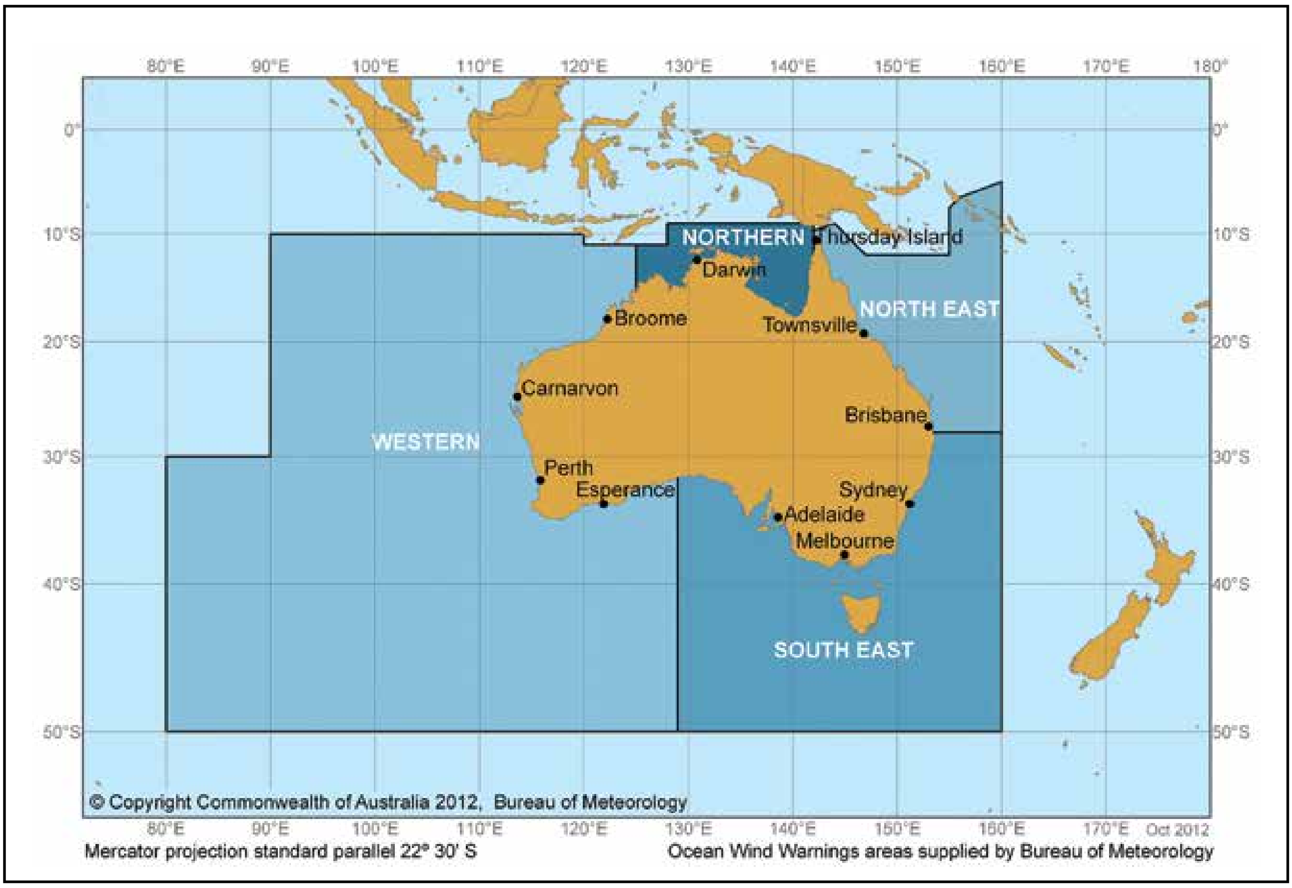


Figure 35 - High Sea Warnings

6 TERRESTRIAL ROUTEING OF WEATHER REPORTS

6.1 The Perth LES will accept weather reports from ships equipped with Inmarsat–B/Fleet77 or C terminals.

6.1.1 All weather reports relayed through the Perth LES will be forwarded to the Bureau of Meteorology free of charge to the reporting vessel, providing service code 41+ is used for their Meteorological Reports.

7 HF MARINE RADIO SERVICES (VOICE AND FAX)

VOICE	VMC*	VMW
	2 201	2 056
	4 426	4 149
	6 507	6 230
	8 176	8 113
	12 365	12 362
	16 546	16 528

Voice broadcasts provide bulletins of warnings repeated every hour and forecasts repeated every four hours.

FAX	VMC*	VMW
	2 628	5 755
	5 100	7 535
	11 030	10 555
	13 920	15 615
	20 469	18 060

Fax broadcasts run on a 24 hour cycle.

Frequencies above in kHz

** VMC is Australia Weather East broadcasting from Charleville, Queensland; VMW is Australia Weather West broadcasting from Wiluna, Western Australia. See Figure 36 for forecast zones.*

8 SHIP TO SHORE TRAFFIC

8.1 Distress Alerts and messages initiated by vessels through Inmarsat on the Pacific or Indian ocean region satellites and routed through the Perth LES will be directed to RCC Australia.

9 SAFETYNET

9.1 SafetyNET is an international service for the broadcast and automatic reception of MSI by means of direct–printing through Inmarsat's EGC system and is an important part of the GMDSS. SafetyNET receiving capability is part of the mandatory equipment which is required to be carried in certain ships under the provisions of Chapter IV of the 1988 Amendments to the *International Convention for the Safety of Life at Sea (SOLAS), 1974*.

9.2 SafetyNET offers the ability to direct a call to a given geographical area. The area may be fixed, as in the case of a NAVAREA, or it may be uniquely defined by the originator as in the case of AUSCOAST Warnings. Area calls will be received automatically by any ship whose MES has been set to one or more fixed areas or recognises a temporary area by the latitude and longitude entered into the MES.

9.3 An operator can elect to suppress certain types of messages. As each message has a unique identity, the printing of a message already received correctly is automatically suppressed. Initial reception of certain types of messages, such as shore–to–ship distress alerts and navigational warnings are mandatory and cannot be suppressed.

9.4 Users of the SafetyNET system should be aware that the latest version of the Inmarsat–C software should be installed on their MES. Equipment suppliers should be consulted for further information.

9.4.1 Users are requested to provide feedback on any aspect of the implementation of the SafetyNET system with the view to improving the MSI service.

9.4.2 In addition to the manuals supplied by the MES manufacturers, it is recommended that vessels also hold a copy of the SafetyNET User Handbook published by Inmarsat. This publication is available for downloading from the Inmarsat website: www.inmarsat.com/cs/groups/inmarsat/documents/assets/018980.pdf

In addition, a useful resource on Inmarsat information is available at: www.inmarsat.com/services/maritime-safety/maritime-safety-services.

10 RECEPTION OF SafetyNET

10.1 In order to receive SafetyNET traffic automatically, the ship's EGC receiver must be configured as follows.

10.1.1 If operating in an area covered by two satellite ocean regions, users should elect to receive SafetyNET traffic from the appropriate satellite.

10.1.2 If the SES is not interfaced to a GPS receiver for automatic position update, the ship's position must be keyed–in manually at periodic intervals.

10.1.3 If the ship's position has not been updated for more than 12 h, all geographically addressed messages with priorities higher than routine within the entire ocean region will be printed out. SOLAS vessels are required to update their SES positions at least once every 4 h when at sea, unless it is updated automatically by GPS. It is also recommended that the receiver remain in operation whilst the ship is in port.

10.1.4 Configure the SES to receive coastal warnings as per the instruction manual noting that the RCC and Bureau of Meteorology will utilise utilise the following codes:

i) Coastal coverage area as per Figure 33.

ii) "Nav. Warnings" for Coastal (AUSCOAST) warnings.

iii) "Additional Nav. Warnings" for Local (SSM) warnings.

iv) "SAR" for search and rescue messages.

v) "Met forecasts" for weather in the Bass Strait, and coastal Western Australia and Northern Territory.

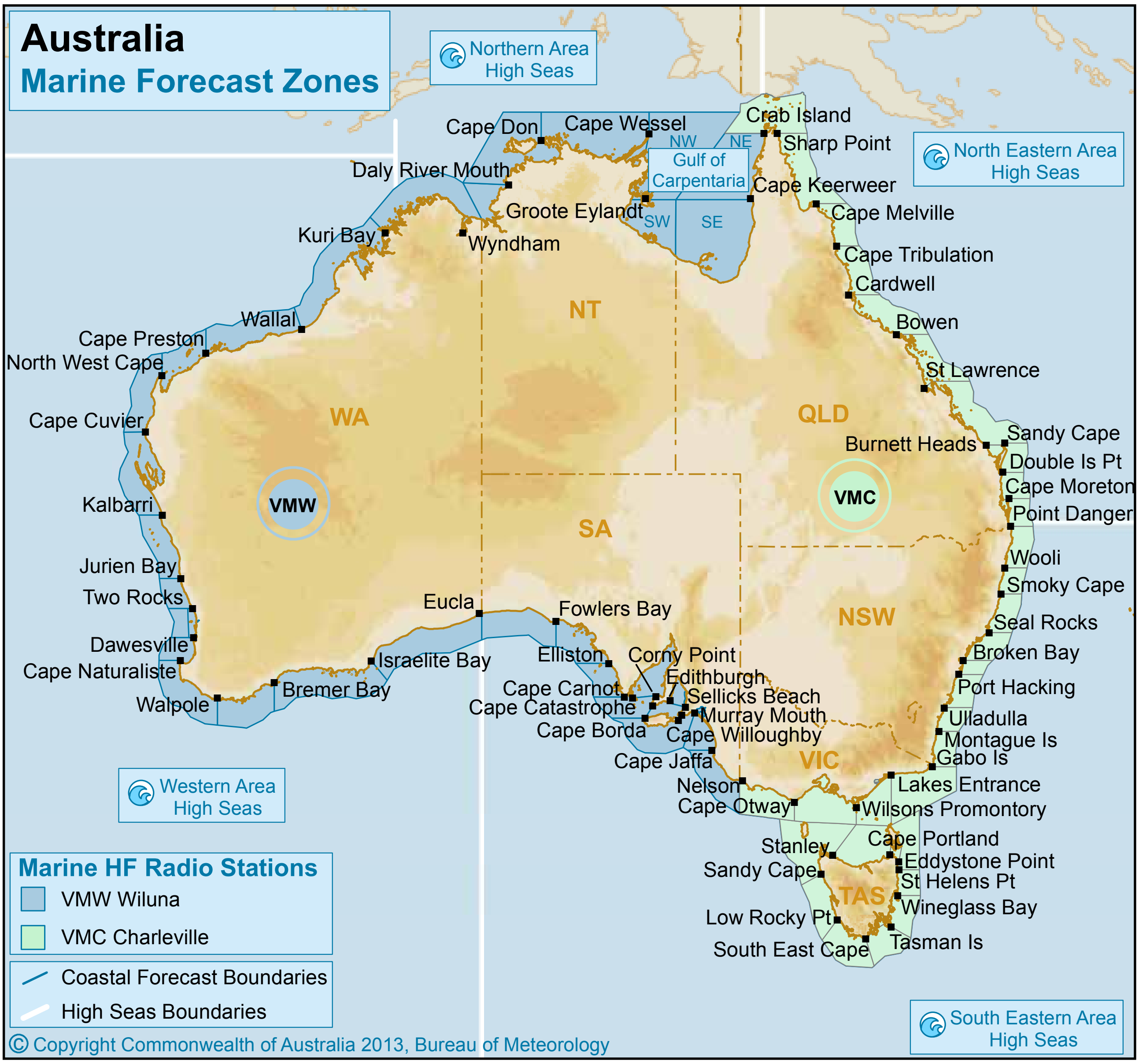


Figure 36 – Australia Marine Forecast Zones

11 PROPOSED NEW NAVAREA X COASTAL WARNING AREA 'P'

"In late 2012, International Hydrographic Organization's World-Wide Navigational Warning Service Sub-Committee (WWNWS) agreed to a request by Papua New Guinea, to establish an Inmarsat SafetyNET service for the broadcast of Maritime Safety Information covering the waters immediately adjacent to PNG within NAVAREA X. The approval provides for, Papua New Guinea to broadcast Maritime Safety Information on a trial basis, for approximately 12 months, under an Initial Operating Capability (IOC) certificate. Subject to a favourable report, the grant of a Full Operating Capability (FOC) certificate would then be considered.

This would be provided via Inmarsat SafetyNET EGC via the Pacific Ocean satellite upon on receipt and repeated at scheduled times at 1000 (or 1100) and 2200 (or 2300) UTC daily.

In addition, Maritime Safety Information is planned to be transmitted from MRCC Port Moresby via HF transmitters in Papua New Guinea on the 4, 6, 8 and 12 MHz frequency bands. Planned service to commence in 2014.

The area proposed to covered by these broadcasts would be known as area Coastal Warning Area 'P' as shown in Figure 37 below.

Figure 37 proposed new NAVAREA X Coastal Warning Area 'P'

Appendix 3

PHONETIC ALPHABET AND FIGURE CODE

PHONETIC ALPHABET

When it is necessary to spell out call signs and words the following letter spelling table should be used.

Letter to be transmitted	Code word to be used	Spoken as (The syllables to be emphasised are underlined)
A	Alfa	AL FAH
B	Bravo	BRAH VOH
C	Charlie	CHAR LEE or SHAR LEE
D	Delta	DELL TAH
E	Echo	ECK OH
F	Foxtrot	FOKS TROT
G	Golf	GOLF
H	Hotel	HOH TELL
I	India	IN DEE AH
J	Juliett	JEW LEE ETT
K	Kilo	KEY LOH
L	Lima	LEE MAH
M	Mike	MIKE
N	November	NO VEM BER
O	Oscar	OSS CAH
P	Papa	PAH PAH
Q	Quebec	KEH BECK
R	Romeo	ROW ME OH
S	Sierra	SEE AIR RAH
T	Tango	TANG GO
U	Uniform	YOU NE FORM or OO NEE FORM
V	Victor	VIK TAH
W	Whiskey	WISS KEY
X	X-ray	ECKS RAY
Y	Yankee	YANG KEY
Z	Zulu	ZOO LOO

Table 14 - Phonetic Alphabet

FIGURE CODE

When it is necessary to spell out figures or marks, the following table should be used.

Figure or Mark to be Transmitted	Code Word to be Used	Spoken as (The syllables to be emphasised are underlined)
0	Nadazero	NAH-DAH-ZY-ROH
1	Unaone	OO-NAH-WUN
2	BISSOTWO	BEES-SOH-TOO
3	Terrathree	TAY-RAH-TREE
4	Kartefour	KAR-TAY-FOWER
5	Pantafive	PAN-TAH-FIVE
6	Soksisix	SOK-SEE-SIX
7	Setteseven	SAY-TAY-SEVEN
8	Oktoeight	OK-TOH-AIT
9	Novenine	NO-VAY-NINER
Decimal Point	Decimal	DAY-SEE-MAL
Full Stop	Stop	STOP

Table 15 - Figure Codes

Appendix

4 STANDARD MARINE COMMUNICATION PHRASES

STANDARD MARINE COMMUNICATION PHRASES

In the interests of accuracy, brevity and clarity it is sound practice for operators to use the Standard Marine Communication Phrases (SMCP) when possible.

A selection of the standard vocabulary and phrases is contained in the following paragraphs.

Message Markers

If necessary, messages passed by radiotelephony may be preceded by the following message markers.

"Question"	Indicates the following message is of interrogative character.
"Answer"	Indicates that the following message is the reply to a previous question.
"Request"	Indicates that the content of the following message is asking for action with respect to the ship.
"Information"	Indicates that the following message is restricted to observed facts.
"Intention"	Indicates that the following message informs others about immediate navigational actions intended to be taken.
"Warning"	Indicates that the following message informs other traffic participants about dangers.
"Advice"	Indicates that the following message implies the intention of the sender to influence the recipient(s) by a recommendation.
"Instruction"	Indicates that the following message implies the intention of the sender to influence the recipient(s) by a regulation.

Responses

Where the answer to a question is in the affirmative, say: "Yes" followed by the appropriate phrase in full.

Where the answer to a question is in the negative, say: "No" followed by the appropriate phrase in full.

Where the information is not immediately available, but soon will be, say: "Stand by".

Where the information cannot be obtained, say: "No information".

Where a message is not properly heard, say: "Say again".

Where a message is not understood, say: "Message not understood".

Miscellaneous phrases

What is your name (and call sign)?

How do you read me? I read you.... bad/1
poor/2
fair/3
good/4
excellent/5

Stand by on channel....

Change to channel....

I cannot read you (pass your message through..../ Advise try channel....) I cannot understand you. Please use the *Standard Marine Communications Phrases/ International Code of Signals*.

I am passing a message for vessel....

Correction

If a mistake is made in a message, say: "mistake" followed by the word: "correction", plus the correct message.

Repetition

If any parts of the message are considered sufficiently important to need particular emphasis, use the word "repeat", e.g. "Do not repeat do not overtake".

Position

When latitude and longitude are used, these should be expressed in degrees and minutes (and decimals of a minute, if necessary), north or south of the Equator and east or west of Greenwich (zero degrees longitude).

When the position is related to a mark, the mark shall be a well-defined charted object. The bearing shall be in the 360-degree notation from true north and shall be that of the position from the mark.

Courses

Courses should always be expressed in the 360-degree notation from true north (unless otherwise stated). Whether this is to, or from, a mark can be stated.

Bearings

The bearing of the mark or vessel concerned is the bearing in the 360-degree notation from true north (unless otherwise stated), except in the case of relative bearings.

Bearings may be either from the mark or from the vessel.

Distances

Distances should be expressed in n miles or cables (tenths of a n mile). The unit should always be stated.

Speed

Speed should be expressed in kn (without further notation meaning speed through the water). "Ground speed" meaning speed over the ground.

Numbers

Numbers should be transmitted by speaking each digit separately, e.g. "one five zero" for 150.

Geographical names

Place names used should be those on the chart or Sailing Directions in use. Should these not be understood, latitude and longitude should be used.

Time

Time should be expressed in the 24-h notation indicating whether UTC, zone-time or local shore time is being used.

Appendix 5

MARITIME IDENTIFICATION DIGITS

Country codes used in DSC and AIS identification numbers

MID	ALLOCATED TO
100 - 200	Not allocated
201	Albania (Republic of)
202	Andorra (Principality of)
203	Austria
204	Azores - Portugal
205	Belgium
206	Belarus (Republic of)
207	Bulgaria (People's Republic of)
208	Vatican City State
209	Cyprus (Republic of)
210	Cyprus (Republic of)
211	Germany (Federal Republic of)
212	Cyprus (Republic of)
213	Georgia
214	Moldova (Republic of)
215	Malta
216	Armenia (Republic of)
217	Not allocated
218	Germany (Federal Republic of)
219	Denmark
220	Denmark
221 - 223	Not allocated
224	Spain
225	Spain
226	France
227	France
228	France
229	Malta
230	Finland
231	Faroe Islands
232	United Kingdom of Great Britain and Northern Ireland

MID	ALLOCATED TO
233	United Kingdom of Great Britain and Northern Ireland
234	United Kingdom of Great Britain and Northern Ireland
235	United Kingdom of Great Britain and Northern Ireland
236	Gibraltar - United Kingdom of Great Britain and Northern Ireland
237	Greece
238	Croatia (Republic of)
239	Greece
240	Greece
241	Greece
242	Morocco (Kingdom of)
243	Hungary
244	Netherlands (Kingdom of the)
245	Netherlands (Kingdom of the)
246	Netherlands (Kingdom of the)
247	Italy
248	Malta
249	Malta
250	Ireland
251	Iceland
252	Liechtenstein (Principality of)
253	Luxembourg
254	Monaco (Principality of)
255	Madeira - Portugal
256	Malta
257	Norway
258	Norway
259	Norway
260	Not allocated
261	Poland (Republic of)

MID	ALLOCATED TO
262	Montenegro
263	Portugal
264	Romania
265	Sweden
266	Sweden
267	Slovak Republic
268	San Marino (Republic of)
269	Switzerland (Confederation of)
270	Czech Republic
271	Turkey
272	Ukraine
273	Russian Federation
274	The former Yugoslav Republic of Macedonia
275	Latvia (Republic of)
276	Estonia (Republic of)
277	Lithuania (Republic of)
278	Slovenia (Republic of)
279	Serbia (Republic of)
280-300	Not allocated
301	Anguilla - United Kingdom of Great Britain and Northern Ireland
302	Not allocated
303	Alaska (State of) United States of America
304	Antigua and Barbuda
305	Antigua and Barbuda
306	Curaçao – Netherlands (Kingdom of the)
306	Sint Maarten (Dutch part) – Netherlands (Kingdom of)
306	Bonaire, Sint Eustatius and Saba – Netherlands (Kingdom of)
307	Aruba – Netherlands (Kingdom of)
308	Bahamas (Commonwealth of the)
309	Bahamas (Commonwealth of the)
310	Bermuda - United Kingdom of Great Britain and Northern Ireland
311	Bahamas (Commonwealth of the)
312	Belize

MID	ALLOCATED TO
313	Not allocated
314	Barbados
315	Not allocated
316	Canada
317-318	Not allocated
319	Cayman Islands - United Kingdom of Great Britain and Northern Ireland
320	Not allocated
321	Costa Rica
322	Not allocated
323	Cuba
324	Not allocated
325	Dominica (Commonwealth of)
326	Not allocated
327	Dominican Republic
328	Not allocated
329	Guadeloupe (French Department of) - France
330	Grenada
331	Greenland - Denmark
332	Guatemala (Republic of)
333	Not allocated
334	Honduras (Republic of)
335	Not allocated
336	Haiti (Republic of)
337	Not allocated
338	United States of America
339	Jamaica
340	Not allocated
341	Saint Kitts and Nevis (Federation of)
342	Not allocated
343	Saint Lucia
344	Not allocated
345	Mexico
346	Not allocated
347	Martinique (French Department of)
348	Montserrat - United Kingdom of Great Britain and Northern Ireland

MID	ALLOCATED TO
349	Not allocated
350	Nicaragua
351	Panama (Republic of)
352	Panama (Republic of)
353	Panama (Republic of)
354	Panama (Republic of)
355	Panama (Republic of)
356	Panama (Republic of)
357	Panama (Republic of)
358	Puerto Rico – United States of America
359	El Salvador (Republic of)
360	Not allocated
361	Saint Pierre and Miquelon (Territorial Collectivity of) - France
362	Trinidad and Tobago
363	Not allocated
364	Turks and Caicos Islands - United Kingdom of Great Britain and Northern Ireland
365	Not allocated
366	United States of America
367	United States of America
368	United States of America
369	United States of America
370	Panama (Republic of)
371	Panama (Republic of)
372	Panama (Republic of)
373	Panama (Republic of)
374	Not allocated
375	Saint Vincent and the Grenadines
376	Saint Vincent and the Grenadines
377	Saint Vincent and the Grenadines
378	British Virgin Islands - United Kingdom of Great Britain and Northern Ireland
379	United States Virgin Islands – United States of America
380-400	Not allocated
401	Afghanistan
402	Not allocated

MID	ALLOCATED TO
403	Saudi Arabia (Kingdom of)
404	Not allocated
405	Bangladesh (People's Republic of)
406-407	Not allocated
408	Bahrain (Kingdom of)
409	Not allocated
410	Bhutan (Kingdom of)
411	Not allocated
412	China (People's Republic of)
413	China (People's Republic of)
414	China (People's Republic of)
415	Not allocated
416	Taiwan (Province of China) - China (People's Republic of)
417	Sri Lanka (Democratic Socialist Republic of)
418	Not allocated
419	India (Republic of)
420-421	Not allocated
422	Iran (Islamic Republic of)
423	Azerbaijani Republic
424	Not allocated
425	Iraq (Republic of)
426-427	Not allocated
428	Israel (State of)
429-430	Not allocated
431	Japan
432	Japan
433	Not allocated
434	Turkmenistan
435	Not allocated
436	Kazakhstan (Republic of)
437	Uzbekistan (Republic of)
438	Jordan (Hashemite Kingdom of)
439	Not allocated
440	Korea (Republic of)
441	Korea (Republic of)
442	Not allocated

MID	ALLOCATED TO
443	State of Palestine (In accordance with Resolution 99 Rev. Guadalajara, 2010)
444	Not allocated
445	Democratic People's Republic of Korea
446	Not allocated
447	Kuwait (State of)
448-449	Not allocated
450	Lebanon
451	Kyrgyz Republic
452	Not allocated
453	Macao (Special Administrative Region of China) - China (People's Republic of)
454	Not allocated
455	Maldives (Republic of)
456	Not allocated
457	Mongolia
458	Not allocated
459	Nepal (Federal Democratic Republic of)
460	Not allocated
461	Oman (Sultanate of)
462	Not allocated
463	Pakistan (Islamic Republic of)
464-465	Not allocated
466	Qatar (State of)
467	Not allocated
468	Syrian Arab Republic
469	Not allocated
470	United Arab Emirates
471	Not allocated
472	Tajikistan (Republic of)
473	Yemen (Republic of)
474	Not allocated
475	Yemen (Republic of)
476	Not allocated
477	Hong Kong (Special Administrative Region of China) - China (People's Republic of)
478	Boznia and Herzegovina

MID	ALLOCATED TO
479-500	Not allocated
501	Adelie Land - France
502	Not allocated
503	Australia
504-505	Not allocated
506	Myanmar (Union of)
507	Not allocated
508	Brunei Darussalam
509	Not allocated
510	Micronesia (Federated States of)
511	Palau (Republic of)
512	New Zealand
513	Not allocated
514	Cambodia (Kingdom of)
515	Cambodia (Kingdom of)
516	Christmas Islands (Indian Ocean) - Australia
517	Not allocated
518	Cook Islands – New Zealand
519	Not allocated
520	Fiji (Republic of)
521-522	Not allocated
523	Cocos (Keeling) Islands - Australia
524	Not allocated
525	Indonesia (Republic of)
526-528	Not allocated
529	Kiribati (Republic of)
530	Not allocated
531	Lao People's Democratic Republic
532	Not allocated
533	Malaysia
534-535	Not allocated
536	Northern Mariana Islands (Commonwealth of the) – United States of America
537	Not allocated
538	Marshall Islands (Republic of the)
539	Not allocated

MID	ALLOCATED TO
540	New Caledonia - France
541	Not allocated
542	Niue – New Zealand
543	Not allocated
544	Nauru (Republic of)
545	Not allocated
546	French Polynesia - France
547	Not allocated
548	Philippines (Republic of the)
549-552	Not allocated
553	Papua New Guinea
554	Not allocated
555	Pitcairn Island - United Kingdom of Great Britain and Northern Ireland
556	Not allocated
557	Solomon Islands
558	Not allocated
559	American Samoa – United States of America
560	Not allocated
561	Samoa (Independent State of)
562	Not allocated
563	Singapore (Republic of)
564	Singapore (Republic of)
565	Singapore (Republic of)
566	Singapore (Republic of)
567	Thailand
568-569	Not allocated
570	Tonga (Kingdom of)
571	Not allocated
572	Tuvalu
573	Not allocated
574	Vietnam (Socialist Republic of)
575	Not allocated
576	Vanuatu (Republic of)
577	Vanuatu (Republic of)
578	Wallis and Futuna Islands
579-600	Not allocated

MID	ALLOCATED TO
601	South Africa (Republic of)
602	Not allocated
603	Angola (Republic of)
604	Not allocated
605	Algeria (People's Democratic Republic of)
606	Not allocated
607	Saint Paul and Amsterdam Islands - France
608	Ascension Island - United Kingdom of Great Britain and Northern Ireland
609	Burundi (Republic of)
610	Benin (Republic of)
611	Botswana (Republic of)
612	Central African Republic
613	Cameroon (Republic of)
614	Not allocated
615	Congo (Republic of the)
616	Comoros (Union of the)
617	Cape Verde (Republic of)
618	Crozet Archipelago - France
619	Côte d'Ivoire (Republic of)
620	Not allocated
621	Djibouti (Republic of)
622	Egypt (Arab Republic of)
623	Not allocated
624	Ethiopia (Federal Democratic Republic of)
625	Eritrea
626	Gabonese Republic
627	Ghana
628	Not allocated
629	Gambia (Republic of the)
630	Guinea-Bissau (Republic of)
631	Equatorial Guinea (Republic of)
632	Guinea (Republic of)
633	Burkina Faso
634	Kenya (Republic of)

MID	ALLOCATED TO
635	Kerguelen Islands - France
636	Liberia (Republic of)
637	Liberia (Republic of)
638-641	Not allocated
642	Libya
643	Not allocated
644	Lesotho (Kingdom of)
645	Mauritius (Republic of)
646	Not allocated
647	Madagascar (Republic of)
648	Not allocated
649	Mali (Republic of)
650	Mozambique (Republic of)
651-653	Not allocated
654	Mauritania (Islamic Republic of)
655	Malawi
656	Niger (Republic of the)
657	Nigeria (Federal Republic of)
658	Not allocated
659	Namibia (Republic of)
660	Reunion (French Department of) - France
661	Rwanda (Republic of)
662	Sudan (Republic of the)
663	Senegal (Republic of)
664	Seychelles (Republic of)
665	Saint Helena - United Kingdom of Great Britain and Northern Ireland
666	Somali Democratic Republic
667	Sierra Leone
668	Sao Tome and Principe (Democratic Republic of)
669	Swaziland (Kingdom of)
670	Chad (Republic of)
671	Togolese Republic
672	Tunisia
673	Not allocated
674	Tanzania (United Republic of)

MID	ALLOCATED TO
675	Uganda (Republic of)
676	Democratic Republic of the Congo
677	Tanzania (United Republic of)
678	Zambia (Republic of)
679	Zimbabwe (Republic of)
680-700	Not allocated
701	Argentine Republic
702-709	Not allocated
710	Brazil (Federative Republic of)
711-719	Not allocated
720	Bolivia (Plurinational State of)
721-724	Not allocated
725	Chile
726-729	Not allocated
730	Colombia (Republic of)
731-734	Not allocated
735	Ecuador
736-739	Not allocated
740	Falkland Islands (Malvinas) - United Kingdom of Great Britain and Northern Ireland
741-744	Not allocated
745	Guiana (French Department of) - France
746-749	Not allocated
750	Guyana
751-754	Not allocated
755	Paraguay (Republic of)
756-759	Not allocated
760	Peru
761-764	Not allocated
765	Suriname (Republic of)
766-769	Not allocated
770	Uruguay (Eastern Republic of)
771-774	Not allocated
775	Venezuela (Bolivarian Republic of)
776-999	Not allocated

Appendix 6

AUSTRALIAN GMDSS COURSES

Learning Objective	Course hours	
	Student without RPL*	Student with RPL*
1. INTRODUCTION		
1.1 The course	**2.5**	**2.5**
1. the background and purpose of the GMDSS – definition of sea areas (A1, A2, A3 and A4) – dates of implementation 2. State the requirements for radio installations in the GMDSS – details of carriage requirements – communications equipment used in each sea area – methods of distress, urgency and safety alerting 3. State the certification requirements in the GMDSS		
2. PRINCIPLES OF MARITIME RADIOCOMMUNICATIONS		
2.1 Principles and basic features of the maritime mobile service	**5.5**	**2.5**
1. State the types of communications in the Maritime Mobile Service – distress, urgency and safety – public correspondence – port operations service – ship movement service – inter-ship communications – on-board communications 2. State types of station in the Maritime Mobile Service – ship stations – coast stations – pilot stations, port stations – aircraft stations – Rescue Coordination Centres (RCCs) 3. Show an elementary knowledge of frequencies and frequency bands – the concept of frequency – equivalence between frequency and wavelength – units of measurement Hz, kHz, MHz, GHz – subdivision of the RF spectrum: MF, HF, VHF, UHF, SHF		

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

Learning Objective	Course hours	
	Student without RPL*	Student with RPL*
4. Characteristics of radio propagation – describe basic propagation mechanisms – describe action of the ionosphere – describe action of ground waves, sky waves and space waves – detail propagation mechanisms according to frequency – state relevant propagation mechanisms at: LF, MF, HF, VHF – describe Maximum Useable Frequency (MUF) – describe Optimum Traffic Frequency (OTF) and calculation – describe how to select the correct frequency bands for short, medium and long range communication by day and night – describe purpose and operation of Automatic Gain Control – detail frequencies used for satellite communications 5. Different types of modulation and emission – list classes of emission – describe carrier and bandwidth of emission – list official designations of emission (e.g. F1B, J3E, F3E, A3E, A1A etc) – unofficial designations of emission (e.g. TLX, SSB, AM, CW etc) – state the uses and restrictions for different emissions according to frequency and purpose in the maritime bands 6. Knowledge of the role of the various modes of communications – DSC – Radiotelephony – NBDP – Data – Test calls 7. Frequency allocations in the maritime mobile bands – describe the usage of bands and frequencies in the MM service – describe the concept of duplex, simplex, paired frequencies and ITU channels – describe the correct usage of frequencies, frequency bands and modes of emission for maritime communications as required by the radio regulations list frequencies for routine call and reply – Frequencies for Distress, Urgency and Safety for GMDSS		
2.2 Principles and basic features of the Maritime Mobile Service 1. Basic operation of satellite communications – describe the Inmarsat system – list the services available on Inmarsat B/Fleet55, M, C and E – describe the function of the EGC system – describe distress, urgency and safety communications by satellite 2. List types of station in the Maritime Mobile Satellite Service – LES and their functions – NCS and their functions – SES and their operation	**1.0**	**1.0**

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

<table>
<tr><th rowspan="2">Learning Objective</th><th colspan="2">Course hours</th></tr>
<tr><th>Student without RPL*</th><th>Student with RPL*</th></tr>
<tr><td>2.3 Global Maritime Distress and Safety System
1. Functional requirements of ship stations
– detail equipment specification
– state definition of coverage and sea areas for DSC
– state details of carriage requirements in relation to maintenance options
– describe MSI services
– state watchkeeping procedures as defined in the Radio Regulations and STCW code
2. Sources of power
– describe reserve power supplies, capacity and duration as defined by SOLAS IV
– describe prohibitions on the connection on non-GMDSS equipment
3. Means of ensuring availability of ship station equipment
– describe equipment duplication
– describe maintenance strategies and requirements for the GMDSS as defined in SOLAS and the Radio Regulations
4. Describe primary/secondary means of alerting
5. Ship licences and safety radio certificates
– list details shown on the ship licence
– describe requirements for safety radio certificates
6. Record keeping and log book daily entries
– list details of log book daily entries
– list details of other periodic entries to include results of equipment tests, etc. as required by the Radio Regulations.</td><td>3.5</td><td>3.5</td></tr>
<tr><td>3. GMDSS COMMUNICATION SYSTEMS
3.1 Purpose and use of DSC
1. Describe and demonstrate basic functions of DSC
– DSC message types
– DSC call format
– frequency select in call format
– call acknowledgment
– call relay process
2. Describe and demonstrate call format specifier and types of call
– distress call
– all ships call
– call to individual station
– DSC test call
– geographic area call
– group call
– call to individual station using automatic service
3. Describe the MMSI and selection of MMSI for calling
– MMSI system and selection of the MMSI
– MIDs
– ship station allocation numbers
– group calling numbers
– coast station numbers</td><td>7.5</td><td>7.5</td></tr>
</table>

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

<table>
<tr><th rowspan="2">Learning Objective</th><th colspan="2">Course hours</th></tr>
<tr><th>Student without RPL*</th><th>Student with RPL*</th></tr>
<tr><td>4. List priority and categories of call
– distress call
– urgency call
– safety call
– ship business call
– routine call

5. Describe and demonstrate call telecommand and traffic information
– distress calls
– undesignated distress messages
– designated distress messages
– distress co-ordinates
– time and validity of distress co-ordinates
– other calls and messages
– working frequency and channel selection

6. Describe DSC facilities and usage
– channel 70 instant alert selector
– the 2 187.5 kHz instant alert selector
– multi-frequency HF DSC alert
– manual selection of modes for further communication
– methods of DSC data entry and retrieval: - updating vessel position, - entering preset message, - entering traffic information, - reviewing received information
– DSC watchkeeping functions and controls</td><td></td><td></td></tr>
<tr><td>3.2 General principles of NBDP
1. Describe and demonstrate NBDP systems
– automatic systems
– semi-automatic systems
– manual systems
– ARQ mode
– FEC mode
– information sending/receiving
– shore and ship station procedures
– selcall numbers for coast and ship stations
– answerback procedures
– controls and indicators</td><td>3.5</td><td>3.5</td></tr>
<tr><td>3.3 Knowledge and use of Inmarsat systems
1. Inmarsat satellite systems and network
– describe the basic features of the Inmarsat network, including; extent of global coverage, ocean regions, NCS.
– provide overview of Inmarsat B/Fleet77, C and M systems
– describe use of different Inmarsat systems within the GMDSS</td><td>6.0</td><td>6.0</td></tr>
</table>

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

Learning Objective	Course hours	
	Student without RPL*	Student with RPL*
2. Describe Inmarsat B/Fleet77 SES – components of an Inmarsat B/Fleet77 SES – methods of acquiring satellite both manually and automatically – usage of Inmarsat B/Fleet77 SES – distress procedures – use of 2 digit code services – basic procedure for sending and receiving telex messages – basic procedures for making a telephone call 3. Describe and demonstrate an Inmarsat-C SES – components of an Inmarsat-C SES – entering and updating ship's position both manually and automatically – usage of Inmarsat-C SES – distress procedures – sending and receiving Inmarsat-C text messages – use of 2 digit code services – overview of SafetyNET and FleetNET services – data reporting and messaging using Inmarsat-C 4. Describe and demonstrate an EGC receiver – components of an EGC receiver – entering and updating position both manually and automatically – usage		
3.4 Knowledge and practical use of ship station equipment 1. Describe and demonstrate the purpose and use of watchkeeping receivers: – the controls and usage of a VHF DSC watch receiver – the controls and usage of an MF/HF DSC watch receiver 2. Describe the usage and function of the VHF installation: – usage of controls – selection of channels – DSC facilities 3. Describe the usage and function of the MF/HF installation: – use and selection of frequencies – use and functions of controls – connection of power – selecting receive frequency – selecting transmit frequency – selecting ITU channel number – tuning the transmitter – selecting class of emission – use of clarifier or receiver fine tuning – controlling RF gain – using AGC – using 2 182 kHz instant selector – using the alarm generator – selection of transmitter power level	9.5	6.0

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

Learning Objective	Course hours	
	Student without RPL*	Student with RPL*
4. Describe and demonstrate survival craft radio equipment: – portable two-way VHF transceivers – transceiver on 121.5 and 123.1 MHz – operation and use of SARTs: - list the main technical details, - explain operating height and range considerations, - describe the effect of a radar reflector, - describe the radar screen indication, - describe SART testing procedures, - describe routine maintenance procedures: checking battery expiry date – operation and use of AIS-SARTs: - list the main technical details, - explain operating height and range considerations, - describe the radar screen indication, - describe AIS-SART testing procedures, - describe routine maintenance procedures: checking battery expiry date 5. Describe the COSPAS-SARSAT system and EPIRBs – the basic operation of the system – the operation of a 406 MHz EPIRB – the information content of a distress alert – the registration and coding of a 406 MHz EPIRB – manual operation – float free function – the correct use of the lanyard – routine maintenance procedures: - testing requirement and test operation, - checking battery expiry dates, - cleaning/checking float free mechanism - elementary fault repair such as replacement of user-accessible fuses and indicator lamps and the like - use of test equipment, meters etc. ~~6. Describe the Inmarsat E EPIRB~~ ~~– the basic operation of the 1.6 GHz EPIRB~~ ~~– the information content of a distress alert~~ ~~– registration and coding of Inmarsat E EPIRBs~~ ~~– float free function: - describe precautions taken to avoid false distress alerts,~~ ~~- safe handling procedures,~~ ~~- transportation precautions~~ 7. Describe additional EPIRB features: – 121.5 MHz homing – strobe light – Australian requirements for carriage in liferafts 8. Describe basic antenna systems: – insulators – VHF whip antennas – MF/HF whip antennas – MF/HF wire antennas – construction of an emergency antenna – satellite antennas		

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

Learning Objective	Course hours Student without RPL*	 Student with RPL*
9. Describe and demonstrate battery storage systems: – different types of batteries – characteristics of different battery types – charging of batteries – battery charging methods – maintenance and monitoring of batteries **3.5 Fault location and rectification on marine electronic equipment** 1. Demonstrate proficiency in basic fault recognition – use of manufacturers documentation to locate faults – use of built in test facilities – replacement of fuses and indicator lamps – basic knowledge of location of major components	 **2.0**	 **2.0**
4. OTHER GMDSS EQUIPMENT **4.1 MSI services** 1. Purpose and use of MSI services – describe message types containing MSI – list availability of MSI services – describe use of published data on MSI services 2. Describe services available and methods of transmission – MSI by satellite – MSI by MF and HF – MSI by HF telex 3. Operation and use of the NAVTEX system – describe operation of the NAVTEX receiver – list frequencies – describe coverage areas of transmissions – state range of transmitters – describe message format and identification: - selection of transmitters, - selection of message types, - message types which can not be rejected – describe use of receiver controls – demonstrate method of changing paper 4. Operation and use of the international SafetyNET system – describe EGC facilities – program EGC receiver/Inmarsat C equipment for reception of EGC/SafetyNET broadcasts – update ships position both manually and automatically – select mode for EGC reception	**2.5**	**2.5**

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

Learning Objective	Course hours		Comments
	Student without RPL*	Student with RPL*	
5. DISTRESS ALERTING	**1.5**	**1.0**	
5.1 SAR operation 1. Describe the role of the RCC – knowledge of SAR systems worldwide – knowledge of SAR system interconnection 2. Describe the role of SAR units – IAMSAR Manual (vol. 3) 3. Describe the use and method of ship reporting systems – AUSREP transition to MASTREP, REEFREP and AMVER, etc			
5.2 GMDSS terrestrial distress, urgency and safety procedures 1. Describe and demonstrate distress communication and DSC alerts – definition of a distress alert/distress message – transmission of a distress alert – transmission of a shore to ship distress alert relay – transmission of a distress alert by a station not itself in distress – receipt and acknowledgment by a shore station – receipt and acknowledgment by a ship station – preparations for handling distress traffic – distress traffic terminology – NBDP communications – on-scene communications 2. Describe urgency and safety communications – the meaning of urgency and safety communications – procedures for DSC and NBDP urgency and safety calls – urgency communications – medical transports – safety communications 3. Describe radiotelephony procedures for distress, urgency and safety communications – the radiotelephone 2 182 kHz 2-tone alarm signal – the distress signal – the distress call – the distress message – acknowledgment of distress messages – distress traffic terminology – transmission of a distress alert by a station not itself in distress – request for medical advice 4. Describe the use of International Phonetic Alphabet	5.0	2.0	Expanded to include NBDP procedures

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<table>
<tr><th rowspan="2">Learning Objective</th><th colspan="2">Course hours</th><th rowspan="2">Comments</th></tr>
<tr><th>Student without RPL*</th><th>Student with RPL*</th></tr>
<tr><td>5.3 GMDSS satellite distress, urgency and safety communication procedures
1. Describe the B/Fleet77 ship earth station alerting functions:
• distress and safety procedures
• methods of initiating alerts
• satellite acquisition
• telex and telephony distress calls
• telex and telephony urgency and safety calls
• procedures for preparation of calls
• details of Rescue Coordination Centres (RCCs) associated with Land Earth Stations (LESs)
2. Describe and demonstrate Inmarsat-C ship earth station alerting functions:
• distress and safety procedures
• methods of initiating alerts
• satellite acquisition
• sending a distress priority message
• Inmarsat-C safety services
• special access codes (SACs) and their purpose</td><td>2.0</td><td>2.0</td><td></td></tr>
<tr><td>5.4 Protection of distress frequencies and avoidance of false distress alerts
1. Describe methods of preventing false distress alerts
2. Describe procedures to minimise the effect of a false distress alert
3. Describe testing procedures for GMDSS equipment and procedures for avoiding false distress alerts during testing
4. State prohibitions on transmissions during distress traffic
5. State procedures to avoid harmful interference
6. State regulations regarding unauthorised transmissions
7. State guard-bands protecting distress frequencies</td><td>1.0</td><td>1.0</td><td></td></tr>
<tr><td>6. MISCELLANEOUS SKILLS AND OPERATIONAL PROCEDURES FOR GENERAL COMMUNICATIONS
6.1 Ability to use the English language, written and spoken, for the exchange of communications relevant to the safety of life at sea and keyboard skills
1 Ability to use a standard computer keyboard for data entry at a speed of 10 words a minute at 98% accuracy
2 Explain the use of the IMO Standard Marine Communication Phrases and the International Code of Signals
3 State recognised standard abbreviations and commonly used service codes
.4 Describe the use of International Phonetic Alphabet and Figure Code</td><td>4.0</td><td>1.5</td><td>Covered in other training</td></tr>
</table>

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian Maritime College within the proceeding 5 years.

Learning Objective	Course hours	
	Student without RPL*	Student with RPL*
6.2 Obligatory procedures and practices 1. Explain the use of obligatory documents and publications – detail methods of updating information 2. Describe procedures for radio record keeping – details log book requirements and mandatory entries 3. Demonstrate a knowledge of the regulations and agreements governing the maritime mobile service and the maritime mobile-satellite service		
6.3 Practical and theoretical knowledge of general communications procedures 1. Describe the use of documentation to receive traffic lists and meteorological information 2. Describe procedures for radiotelephone calls: – method of calling coast station by radiotelephone – ordering a manually switched link call – terminating a call – special facilities available methods of calling a coast station by DSC selecting an automatic radiotelephone call 3. Describe methods of charging: – the international charging and accounting system – the Inmarsat charging systems – the AAIC and use of documentation to determine/verify it – gold francs and special drawing rights etc		
7 ASSESSMENTS Descriptions and demonstrations of all equipment functions must be accompanied by practical sessions for students with guidance from the instructor. The students must be given adequate time to practice the functions and operation of equipment available. The written and practical assessments must be conducted in accordance with the established question banks and practical assessment schedules	**9.0**	**9.0**
TOTAL HOURS	**66**	**53.5**

*RECOGNITION OF PRIOR LEARNING (RPL)
To obtain RPL, the trainee should be a qualified Deck Officer or a person training to be a Deck Officer, and should hold a Marine Radio Operator's Certificate of Proficiency (MROCP) after completing the relevant course at an Australian maritime college within the proceeding 5 years.

Appendix

7 RESERVE SOURCE OF ENERGY

INTERNATIONAL MARITIME ORGANIZATION

4 ALBERT EMBANKMENT LONDON SE1 7SR

Telephone: 0171-735 7611
Fax: 0171-587 3210
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IMO

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Ref. T2/6.0

COMSAR/Circ.16
4 March 1998

GUIDELINES ON THE CONFIGURATION OF THE RESERVE SOURCE OR SOURCES OF ENERGY USED TO SUPPLY RADIO INSTALLATIONS ON GMDSS SHIPS

1 With a view to provide recommendations on the configuration of possible reserve source or sources of energy to be used for supplying radio equipment on GMDSS ships, the Sub-Committee on Radiocommunications and Search and Rescue (COMSAR), at its third session (23 to 27 February 1998), prepared the annexed Guidelines.

2 Member Governments are invited to bring the annexed Guidelines to the attention of classification societies, shipbuilders, shipowners, ship operators, shipping companies, manufacturers and shipmasters.

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COMSAR/Circ.16

ANNEX

GUIDELINES ON THE CONFIGURATION OF THE RESERVE SOURCE OR SOURCES OF ENERGY USED TO SUPPLY RADIO INSTALLATIONS ON GMDSS SHIPS

1. INTRODUCTION

1.1 The radio reserve source or sources of energy should meet the requirements set out in regulation IV/13 of SOLAS 1974, as amended, and in IMO resolutions A.694(17) and A.702(17), as applicable, and should also comply with the following requirements.

1.2 The configuration of such reserve sources of energy could comply with recommendations of annexes 1, 2 and 3 of these guidelines, as applicable.

2. GENERAL

2.1 Where the reserve source or sources of energy consists of rechargeable accumulator batteries, the arrangement may consist either of batteries used solely in the absence of ships supply of electrical energy (see paragraph 3) or of batteries used in an uninterruptable power supply (UPS) configuration (see paragraph 4).

2.2 Only equipment specified in regulation IV/13 of SOLAS 1974, as amended, and paragraphs 2.1.1 and 2.1.2 of the annex to resolution A.702(17) may be connected to the reserve source or sources of energy.

2.3 Any ship's navigational or other equipment providing to the radio installation an input of information, which is needed to ensure its proper performance, should be connected to the ship's main and emergency supply and to the reserve source of energy to ensure an uninterruptable input of information.

2.4 To determine the electrical load to be supplied by the reserve source of energy for each radio installation required for distress conditions, the following formula should be applied:

½ of the current consumption necessary for transmission

+ the current consumption for reception

+ the current consumption of any additional loads.

2.5 If a manual change-over switch is provided in the configuration, this switch should be clearly marked and readily accessible to the operator.

3. BATTERIES USED SOLELY IN THE ABSENCE OF SHIP'S SUPPLY

3.1 A single battery may be provided for the radio installation specified in regulations IV/13.2, 13.4, 13.5, and 13.8 of SOLAS 1974, as amended. The capacity of the battery should be sufficient for the load determined in paragraph 2.4 in compliance with the requirements of regulations IV/13.2 and 13.4 of SOLAS 1974, as amended, taking in consideration duplication equipment when provided.

3.2 The charging current of the automatic battery charger should be sufficient to comply with regulation IV/13.6.1 for the load determined in paragraph 2.4 (see annex 2, paragraph 2.1).

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3.3 The supply lines from the battery distribution panel to each radio installation of both the basic and the duplication equipment should be independent and fused separately.

3.4 In case of interruption of the ship's supply, as well as upon its recovery, the change-over between the radio reserve source of energy and the ship's supply may be manual or automatic.

3.5 The change-over between the ship's supply and the radio reserve source of energy should not require any of the equipment connected to it to be re-initialized manually and should not result in the loss of data stored in memory.

3.6 Any fault in the battery or battery charger should not impair or reduce the functional availability of any GMDSS equipment while energized from the ship's supply.

4. BATTERIES USED IN AN UNINTERRUPTABLE POWER SUPPLY (UPS) CONFIGURATION

4.1 A single UPS may be provided for the radio installation specified in regulations IV/13.2, 13.4, 13.5 and 13.8 of SOLAS 1974, as amended. The UPS should comply with the load determined in paragraph 2.4 and the requirements of regulations IV/13.2, 13.4 and 13.6 of SOLAS 1974, as amended, taking into consideration duplication equipment when provided.

4.2 To provide for a failure of the single UPS, a second UPS or means for direct supplying the radio installation from ship's main or emergency supply should be installed and be available permanently.

4.3 The change-over to the second UPS or to the ship's supplies may be manual or automatic.

4.4 This change-over should not require any of the equipment connected to it to be re-initialized manually and should not result in the loss of data stored in memory.

4.5 The capacity of the battery charger or chargers used in the UPS configuration should be sufficient to comply with regulation IV/13.6.1 for the load determined in paragraph 2.4 and that all equipment connected can be operated.

For guidance, the following may be used for determining the nominal current of the charger:

1/10 of the current consumption necessary for transmission

+ the current consumption for reception

+ the current consumption of any additional loads

+ the nominal charging current of the battery.

4.6 The supply lines from the UPS output to each radio installation of both the basic and the duplication equipment should be independent and fused separately.

5. ALARMS AND INDICATORS

5.1 Provision should be made for an aural alarm and visual indication at the position from which the ship is normally navigated, indicating an interruption of the ship's supply. It should not be possible to disable this alarm and indication. It should only be possible to acknowledge and silence the alarm manually. Both the alarm condition and indication should reset automatically when the ship's supply has been restored.

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ANNEX 1

RECHARGEABLE ACCUMULATOR BATTERIES

1. INTRODUCTION

1.1 Rechargeable accumulator batteries as installed should meet the general requirements set out in regulation IV/13 of SOLAS 1974, as amended, and in resolution A.694(17), as applicable and should also comply with the following requirements.

2. GENERAL

2.1 Any type or construction of batteries (e.g. lead acid, alkaline, maintenance free, traction, semi-traction, etc.) may be used as reserve source or sources of energy, taking into consideration the environmental conditions of the location where they are installed.

2.2 The capacity of the battery should be sufficient for the load determined in accordance with the annex, paragraph 2.4.

For guidance, the nominal battery capacity to comply with the minimum capacity requirements at all times is 1.4 times the load determined in paragraph 2.4 multiplied by the intended period of operation (1 hour or 6 hours in accordance with SOLAS IV/13.2).

2.3 The battery should maintain its rated capacity when inclined at any angle up to 22^{o} in any orientation.

3. INSTRUCTIONS FOR RECHARGEABLE BATTERIES

3.1 An instruction manual which contains all necessary specifications of the batteries should be available on board. The information should include at least:

1. Capacity and temperature range within which the stated capacity is maintained for the specified operation period i.e. 1 hour or 6 hours;
2. Charging voltage and current limits in order to keep batteries fully charged while preventing overcharging;
3. Actual specific gravity of the electrolyte and/or cell voltages or the voltage of the fully charged battery;
4. Guidelines on how to carry out a controlled discharge test;
5. methods of determining the condition of charge of the battery, e.g. check of specific gravity of electrolyte (acid density) or check of battery cell voltages/battery voltages by using an accurate measuring instrument in accordance with the battery manufacturer's specifications;
6. Requirement for ventilation; and
7. Requirements for maintenance

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4. MARKINGS

4.1 The batteries should be properly marked with type or construction, rated capacity (capacity for 1 hour discharge C1 and capacity for 5 hours discharge C5), and installation date. The marking must be visible after the batteries have been installed and during their lifetime.

4.2 A label warning of explosion danger should be displayed near the installed batteries.

5. INSTALLATION

5.1 When defining the minimum required battery capacity, consideration should be given to the expected extreme temperatures for the location of the battery and reduction of its capacity during its lifetime in addition to the loads which are to be connected to it.

5.2 The temperature range of the battery should be wider than the expected temperature range of the location where the battery is to be installed.

5.3 Equipment requiring lower voltage than the total voltage of the battery bank should not be connected to a part of the battery bank.

5.4 The batteries should be installed in an elevated position in the ship and as close to the radio equipment as possible.

5.5 An outdoor located battery case should be avoided due to considerable temperature variations.

5.6 Batteries of different types, different cell constructions, different capacities or different manufacturers should not be mixed in a battery bank.

5.7 Batteries of different types and different cell construction should not be installed in the same location if they can affect each other.

5.8 Sufficient ventilation for the battery should be provided, as required by the battery manufacturer.

5.9 Electrical installations including battery chargers, located in the battery room should be intrinsically safe.

5.10 Sufficient space between batteries and battery banks should be provided for carrying out inspections and maintenance. The batteries should be well braced to remain firmly fixed under all sea conditions.

5.11 The cabling from the batteries should be protected against earth- and short-circuits and be appropriately fused and installed according to recognized international standards*. Battery cables should have sufficient dimensions to prevent voltage reduction at peak current consumption.

*IEC 92-101 and IEC 533.

ANNEX 2

AUTOMATIC BATTERY CHARGERS

1. INTRODUCTION

1.1 Automatic battery chargers should meet the general requirements set out in regulation IV/13 of SOLAS 1974, as amended, and in resolution A.694(17), as applicable and should also comply with the following requirements.

2. GENERAL

2.1 The charger should be capable of recharging the completely discharged accumulator batteries to the minimum required capacity within 10 hours.

2.2 The charger should be capable of keeping the batteries appropriately charged as prescribed by the battery manufacturer for permanent automatic charging.

2.3 The supplied voltage and current should always be within the tolerance limits prescribed by the battery manufacturer, taking into account the environmental temperature of the battery, likely to be experienced in ship. A protection should be provided against overcharging or discharging of batteries from a possible fault in the charger.

3. CONTROL AND INDICATORS

3.1 The automatic charger should be provided with a visual indication that it is switched on.

3.2 Provision should be made for an aural alarm and visual indication at the position from which the ship is normally navigated, indicating when the charging voltage or current is outside the limits given by the battery manufacturer for automatic charging conditions. It should not be possible to disable this alarm and indication and it should only be possible to acknowledge and silence the alarm manually. Both the alarm condition and indication should reset automatically when normal charging condition has been restored. Failure of the alarm system should not interrupt the charging or discharging of batteries.

4. READINESS

4.1 The automatic charger should be operational within five seconds of switching on or after a power supply interruption.

5. SAFETY PRECAUTIONS

5.1 The automatic charger should be so designed and constructed that it is protected against damage resulting from disconnecting the batteries or, with the battery disconnected, short-circuiting the battery connections. If this protection is provided by electronic means it should automatically reset following removal of the open or short-circuit conditions.

ANNEX 3

UNINTERRUPTABLE POWER SUPPLIES (UPS)

1. INTRODUCTION

1.1 The UPS should meet the general requirements set out in regulation IV/13 of SOLAS 1974, as amended, and in resolution A.694(17), as applicable, and should also comply with the following requirements.

2. GENERAL

2.1 An uninterruptable power supply system (UPS) is defined as a device which for a specific period of time supplies continuous power to radio equipment independent of any power failures in the ship's main or emergency source of electric energy.

2.2 The UPS should comprise at least:

1. An automatic charger, complying with the requirements of paragraph 4.5 of these guidelines and of annex 2; and
2. Rechargeable accumulator batteries, complying with the requirements of annex 1.

3. CONTROLS AND INDICATORS

3.1 Provisions should be made for an aural alarm and visual indication at the position from which the ship is normally navigated, indicating any failure in the UPS which is not already monitored by the alarm and indicators required by paragraph 5 of these guidelines and by annex 2.

4. READINESS

4.1 The UPS should be operational within 5 s of switching on.

5. SAFETY PRECAUTIONS

5.1 The UPS should be so designed and constructed that it is protected against damage resulting from disconnecting the batteries or, with the battery disconnected, short-circuiting the UPS battery connections. If this protection is provided by electronic means it should automatically reset following removal of the open or short-circuit conditions.

Appendix

8 GUIDELINES FOR OPERATIONAL USE OF SHIPBORNE AIS

INTERNATIONAL MARITIME ORGANIZATION

IMO

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ASSEMBLY
22nd Session
Agenda Item 9

A22/RES.917
25 January 2002
Original: ENGLISH

Resolution A.917(220)
Incorporating Resolution A.956(23)
Adopted on 29 November 2001
Agenda Item 9

GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (AIS)

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO the provisions of regulation V/19 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, requiring all ships of 300 gross tonnage and upwards engaged on international voyages and cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size to be fitted with an automatic identification system (AIS), as specified in SOLAS regulation V/19, paragraph 2.4, taking into account the recommendations adopted by the Organization,

HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its seventy-third session and by the Sub-Committee on Safety of Navigation at its forty-seventh session,

1. ADOPTS the Guidelines for the onboard operational use of shipborne automatic identification systems (AIS) set out in the Annex to the present resolution;

2. INVITES Governments concerned to take into account these Guidelines when implementing SOLAS regulations V/11, 12 and 19;

3. ALSO INVITES Governments which set regional frequencies requiring manual switching which, from the safety viewpoint, should be limited to temporary situations, to notify the Organization of such areas and designated frequencies, for circulation of that information until 1 April 2002;

4. REQUESTS the Maritime Safety Committee to keep the Guidelines under review and amend them as appropriate.

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- 2 -

ANNEX

GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF SHIPBORNE AUTOMATIC IDENTIFICATION SHSTEMS (AIS)

PURPOSE

1. These Guidelines have been developed to promote the safe and effective use of shipborne Automatic Identification Systems (AIS), in particular to inform the mariner about the operational use, limits and potential uses of AIS. Consequently, AIS should be operated taking into account these Guidelines.

2. Before using shipborne AIS, the user should fully understand the principle of the current Guidelines and become familiar with the operation of the equipment, including the correct interpretation of the displayed data. A description of the AIS system, particularly with respect to shipborne AIS (including its components and connections), is contained in Annex

CAUTION

Not all ships carry AIS.

The officer of the watch (OOW) should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including Vessel Traffic Service (VTS) centres, might not be fitted with AIS.

The OOW should always be aware that AIS fitted on other ships as a mandatory carriage requirement might, under certain circumstances, be switched off on the master's professional judgement.

3. The internationally-adopted shipborne carriage requirements for AIS are contained in SOLAS regulation V/19. The SOLAS Convention requires AIS to be fitted on certain ships through a phased implementation period spanning from 1st July 2002 to 1st July 2008. In addition, specific vessel types (e.g. warships, naval auxiliaries and ships owned/operated by Governments) are not required to be fitted with AIS. Also, small vessels (e.g. leisure craft, fishing boats) and certain other ships are exempt from carrying AIS. Moreover, ships fitted with AIS might have the equipment switched off. Users are therefore cautioned always to bear in mind that information provided by AIS may not be giving a complete or correct 'picture' of shipping traffic in their vicinity. The guidance in this document on the inherent limitations of AIS and their use in collision avoidance situations (see paragraphs 39 to 43) should therefore be heeded.

OBJECTIVES OF AIS

4. AIS is intended to enhance: safety of life at sea; the safety and efficiency of navigation; and the protection of the marine environment. SOLAS regulation V/19 requires that AIS exchange data ship-to-ship and with shore-based facilities. Therefore, the purpose of AIS is to help identify vessels; assist in target tracking; simplify information exchange (e.g. reduce verbal mandatory ship reporting); and provide additional information to assist situation awareness. In general, data received via AIS will improve the quality of the information available to the OOW, whether at a shore surveillance station or on board a ship. AIS should become a useful source of

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Supplementary information to that derived from navigational systems (including radar) and therefore an important 'tool' in enhancing situation awareness of traffic confronting users.

DESCRIPTION OF AIS

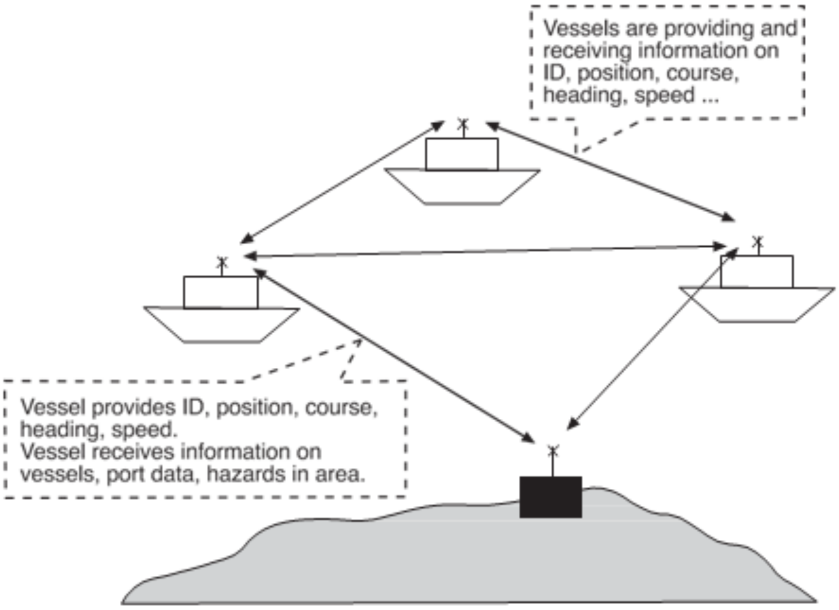

Figure 1 - AIS System Overview

5. Shipborne AIS (See Figure 1)

   - Continuously transmits ship's own data to other vessels and VTS stations;

   - Continuously receives data of other vessels and VTS stations; and

   - Displays this data.

6. When used with the appropriate graphical display, shipborne AIS enables provision of fast, automatic information by calculating Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) from the position information transmitted by the target vessels.

7. AIS Operates primarily on two dedicated VHF channels. Where these channels are not available regionally the AIS is capable of being automatically switched to designated alternate channels by means of a message from a shore facility. Where no shore based AIS or GMDSS sea Area A1 station is in place, the AIS should be switched manually.

8. In practice, the capacity of the system is unlimited, allowing for a great number of ships to be accommodated at the same time.

9. The AIS is able to detect ships within VHF/FM range around bends and behind islands, if the landmasses are not too high. A typical value to be expected at sea is 20 - 30 nautical miles depending on antenna height. With the help of repeater stations, the coverage for both ship and VTS stations can be improved.

10. Information from a shipborne AIS is transmitted continuously and automatically without any intervention or knowledge of the OOW. An AIS shore station might require updated information form a specific ship by "polling" that ship, or alternatively, might wish to "poll" all ships within a defined sea area. However, the shore station can only increase the ships' reporting rate, not decrease it.

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AIS INFORMATION SENT BY SHIPS

Ship's Data Content

11. The AIS information transmitted by a ship is of three different types:

- Fixed or static information, which is entered into the AIS on installation and need only be changed if the ship changes its name or undergoes a major conversion from one ship type to another;

- Dynamic information, which, apart from 'Navigational status' information, is automatically updated from the ship sensors connected to AIS; and

- Voyage-related information, which might need to be manually entered and updated during the voyage.

12. Details of the information referred to above are given in table 1 below:

Information Item	Information generation, type and quality of information
Static	
MMSI (Maritime Mobile Service Identity)	Set on installation Note that this might need amending if the ship changes ownership
Call sign and name	Set on installation Note that this might need amending if the ship changes ownership
IMO Number	Set on installation
Length and beam	Set on installation or if changed
Type of ship	Select from pre-installed list
Location of position-fixing antenna	Set on installation or may be changed for bi-directional vessels or those fitted with multiple antennae
Dynamic	
Ship's position with accuracy indication and integrity status	Automatically updated from the position sensor connected to AIS. The accuracy indication is for better or worse than 10 m.
Position Time stamp in UTC	Automatically updated from ship's main position sensor connected to AIS.
Course over ground (COG)	Automatically updated from ship's main position sensor connected to AIS, if that sensor calculates COG This information might not be available.
Speed over ground (SOG)	Automatically updated from the position sensor connected to AIS. This information might not be available.
Heading	Automatically updated from the ship's heading sensor connected to AIS
Navigational status	Navigational status information has to be manually entered by the OOW and changed as necessary, for example: - underway by engines - at anchor - not under command (NUC) - restricted in ability to manoeuvre (RIATM - moored - constrained by draught - aground

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	- engaged in fishing - underway by sail In practice, since all these relate to the COLREGs, any change that is needed could be undertaken at the same time that the lights or shapes were changed
Rate of turn (ROT)	Automatically updated from the ship's ROT sensor or derived from the gyro This information might not be available
Voyage-Related	
Ship's draught	To be manually entered at the start of the voyage using the maximum draft for the voyage and amended as required (e.g. – result of de-ballasting prior to port entry)
Hazardous cargo (type)	To be manually entered at the start of the voyage confirming whether or not hazardous cargo is being carried, namely: DG (Dangerous goods) HS (Harmful substances) MP (Marine pollutants) Indications of quantities are not required
Destination and ETA	To be manually entered at the start of the voyage and kept up to date as necessary
Route plan (waypoints)	To be manually entered at the start of the voyage, at the discretion of the master, and updated when required
Short Safety-Related Message	
	Free format short text messages would be manually entered, addressed either a specific addressee or broadcast to all ships and shore stations

Table 1 - Data Sent by Ship

13. The data is autonomously sent at different update rates:

- Dynamic information dependent on speed and course alteration (see table 2),

- Static and voyage-related data every 6 minutes or on request (AIS responds automatically without user action).

Type of Ship	General Reporting Interval
Ship at anchor	3 min
Ship 0-14 knots	12 sec
Ship 0-14 knots and changing course	4 sec
Ship 14-23 knots	6 sec
Ship 14-23 knots and changing course	2 sec
Ship >23 knots	3 sec
Ship >23 knots and changing course	2 sec

Table 2 – Report Rate of Dynamic Information

Short Safety-Related Messages

14. Short safety-related messages are fixed or free format text messages addressed either to a specified destination (MMSI) or all ships in the area. Their content should be relevant to the safety of navigation, e.g. an iceberg sighted or a buoy not on station. Messages should be kept as short as possible. The system allows up to 158 characters per message but the shorter the message the more easily it will find free space for transmission. At present these messages are not further regulated, to keep all possibilities open.

15. Operator acknowledgement may be requested by a text message.

16. Short safety-related messages are only an additional means of broadcasting maritime safety information. Whilst their importance should not be underestimated, use of such messages does not remove any of the requirements of the Global Maritime Distress and Safety System (GMDSS).

17. The operator should ensure that he displays and considers incoming safety-related messages and should send safety-related messages as required.

18. According to SOLAS regulation V/31 (Danger messages)

> *"The master of every ship which meets with dangerous ice, a dangerous derelict, or any other direct danger to navigation, or ...is bound to communicate the information by all the means at his disposal to ships at his vicinity, and also to the competent authorities...".*

19. Normally this is done via VHF voice communication, but "by all the means" now implies the additional use of the AIS short messages application, which has the advantage of reducing difficulties in understanding, especially when noting down the correct position.

Confidentiality

20. When entering any data manually, consideration should be given to the confidentiality of this information, especially when international agreements, rules or standards provide for the protection of navigational information.

OPERATION OF AIS ON BOARD

OPERATION OF THE TRANSCEIVER UNIT

Activation

21. AIS should always be in operation when ships are underway or at anchor. If the master believes that the continual operation of AIS might compromise the safety or security of his/her ship, or where security incidents are imminent, the AIS may be switched off. Unless it would further compromise the safety or security, if the ship is operating in a mandatory ship reporting system, the master should report this action and the reason for doing so to the competent authority. Actions of this nature should always be recorded in the ship's logbook together with the reason for doing so. The master should however restart the AIS as soon as the source of danger has disappeared. If the AIS is shut down, static data and voyage related information remains stored. Restart is done by switching on the power to the AIS unit. Ship's own data will be transmitted after a two minute initialization period. In ports AIS operation should be in accordance with port requirements.

Manual Input of Data

22. The OOW should manually input the following data at the start of the voyage and whenever changes occur, using an input device such as a keyboard:

- Ship's draught;
- Hazardous cargo;
- Destination and ETA;
- Route plan (way points);
- The correct navigational status; and
- Short safety-related messages.

Check of Information

23. To ensure that own ship's static information is correct and up-to-date, the OOW should check the data whenever there is a reason for it. As a minimum, this should be done once per voyage or once per month, whichever is shorter. The data may be changed only on the authority of the master.

24. The OOW should also periodically check the following dynamic information:

- Positions given according to WGS 84;
- Speed over ground; and
- Sensor information.

25. After activation, an automatic built-in integrity test (BIIT) is performed. In the case of any AIS malfunction an alarm is provided and the unit should stop transmitting.

26. The quality or accuracy of the ship sensor data input into AIS would not however be checked by the BIIT circuitry before being broadcast to other ships and shore stations. The ship should therefore carry out regular routine checks during a voyage to validate the accuracy of the information being transmitted. The frequency of those checks would need to be increased in coastal waters.

DISPLAY OF AIS DATA

27 The AIS provides data that can be presented on the minimum display or on any suitable display device as described in annex 1.

Minimum Display

28. The minimum mandated display provides not less than three lines of data consisting of bearing, range and name of a selected ship. Other data of the ship can be displayed by horizontal scrolling of data, but scrolling of bearing and range is not possible. Vertical scrolling will show all the other ships known to the AIS.

Graphical Display

29. Where AIS information is used with a graphical display, the following target types are recommended for display:

Sleeping Target A sleeping target indicates only the presence of a vessel equipped with AIS in a certain location. No additional information is presented until activated, thus avoiding information overload.

Activated Target If the user wants to know more about a vessel's motion, he has simply to activate the target (sleeping), so that the display shows immediately:

- a vector (speed and course over ground),
- the heading, and
- ROT indication (if available) to display actually initiated course changes.

Selected Target If the user wants detailed information on a target (activated or sleeping), he may select it. Then the data received, as well as the calculated CPA and TCPA values, will be shown in an alpha-numeric window.

The special navigation status will also be indicated in the alpha numeric data field and not together with the target directly.

Dangerous Target If an AIS target (activated or not) is calculated to pass pre-set CPA and TCPA limits, it will be classified and displayed as a dangerous target and an alarm will be given.

Lost Target If a signal of any AIS target at a distance of less than a pre-set value is not received, a lost target symbol will appear at the latest position and an alarm will be given.

Symbols

30. The user should be familiar with the symbology used in the graphical display provided.

INHERENT LIMITATIONS OF AIS

31. The officer of the watch (OOW) should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including Vessel Traffic Service (VTS) centres, might not be fitted with AIS.

32. The OOW should always be aware that other ships fitted with AIS as a mandatory carriage requirement might switch off AIS under certain circumstances by professional judgement of the master.

33. In other words, the information given by the AIS may not be a complete picture of the situation around the ship.

34. The users must be aware that transmission of erroneous information implies a risk to other ships as well as their own. The users remain responsible for all information entered into the system and the information added by the sensors.

35. The accuracy of AIS information received is only as good as the accuracy of the AIS Information transmitted.

36. The OOW should be aware that poorly configured or calibrated ship sensors (position, speed and heading sensors) might lead to incorrect information being transmitted. Incorrect information about one ship displayed on the bridge of another could be dangerously confusing.

37. If no sensor is installed or if the sensor (e.g. the gyro) fails to provide data, the AIS automatically transmits the "not available" data value. However, the built-in integrity check cannot validate the contents of the data processed by the AIS.

38. It would not be prudent for the OOW to assume that the information received from other ships is of a comparable quality and accuracy to that which might be available on own ship.

USE OF AIS IN COLLISION AVOIDANCE SITUATIONS

39. The potential of AIS as an anti-collision device is recognized and AIS may be recommended as such a device in due time.

40. Nevertheless, AIS information may be used to assist in collision avoidance decision- making. When using the AIS in the ship-to-ship mode for anti-collision purposes, the following cautionary points should be borne in mind:

1. AIS is an additional source of navigational information. It does not replace, but supports, navigational systems such as radar target-tracking and VTS; and
2. The use of AIS does not negate the responsibility of the OOW to comply at all times with the Collision Regulations.

41. The user should not rely on AIS as the sole information system, but should make use of all safety-relevant information available.

42. The use of AIS on board ship is not intended to have any special impact on the composition of the navigational watch, which should continue to be determined in accordance with the STCW Convention.

43. Once a ship has been detected, AIS can assist in tracking it as a target. By monitoring the information broadcast by that target, its actions can also be monitored. Changes in heading and course are, for example, immediately apparent, and many of the problems common to tracking targets by radar, namely clutter, target swap as ships pass close by and target loss following a fast manoeuvre, do not affect AIS. AIS can also assist in the identification of targets, by name or call sign and by ship type and navigational status.

ADDITIONAL AND POSSIB LE FUTURE APPLICATIONS

AIS IN VTS OPERATIONS

Pseudo AIS information

44. VTS centres may send information about vessels which are not carrying AIS and which are tracked only by VTS radar via the AIS to vessels equipped with AIS. Any pseudo AIS target broadcast by VTS should be clearly identified as such. Particular care should always be taken when using information which has been relayed by a third party. Accuracy of these targets may not be as complete as actual directly-received targets, and the information content may not be as extensive.

Text Messages

45. VTS centres may also send short messages either to one ship, all ships, or ships within a certain range or in a special area, e.g.:

- (Local) navigational warnings;
- Traffic management information; and
- Port management information.

46. A VTS operator may request, by a text message, an acknowledgement from the ship's operator.

Note: The VTS should continue to communicate via voice VHF. The importance of verbal communication should not be underestimated. This is important to enable the VTS operator to:
- Assess vessels' communicative ability; and
- Establish a direct communication link which would be needed in critical situations.

(D)GNSS Corrections

47. (D)GNSS corrections may be sent by VTS centres via AIS.

MANDATORY SHIP REPORTING SYSTEMS

48. AIS is expected to play a major role in ship reporting systems. The information required by coastal authorities in such systems is typically included in the static voyage-related and dynamic data automatically provided by the AIS system. The use of the AIS long-range feature, where information is exchanged via communications satellite, may be implemented to satisfy the requirements of some ship reporting systems.

AIS IN SAR OPERATIONS

49. AIS may be used in search and rescue operations, especially in combined helicopter and surface searches. AIS allows the direct presentation of the position of the vessel in distress on other displays such as radar or ECS/ECDIS, which facilitates the task of SAR craft. For ships in distress not equipped with AIS, the On Scene Co-ordinator (OSC) could create a pseudo AIS target.

AIDS TO NAVIGATION

50. AIS, when fitted to selected fixed and floating aids to navigation can provide information to the mariner such as:

- Position;
- Status;
- Tidal and current data; and
- Weather and visibility conditions.

AIS IN AN OVERALL INFORMATION SYSTEM

51. AIS will play a role in an overall international maritime information system, supporting voyage planning and monitoring. This will help Administrations to monitor all the vessels in their areas of concern and to track dangerous cargo.

REFERENCE DOCUMENTS

- IMO Recommendation on Performance Standards for a Universal Shipborne Automatic Identification System (AIS), (MSC. 74(69), Annex 3)
- IMO SOLAS Convention Chapter V
- ITU Radio Regulations, Appendix S18, Table of Transmitting Frequencies in the VHF Maritime Mobile Band
- ITU Recommendation on the Technical Characteristics for a Universal Shipborne Automatic Identification System (AIS) Using Time Division Multiple Access in the Maritime Mobile Band (ITU-R M.1371)
- IEC Standard 61993 Part 2: Universal Shipborne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and required Test Results.

ANNEX 1

DESCRIPTION OF AIS

COMPONENTS

1. In general, an onboard AIS (see figure 1) consists of:

- Antennas;
- One VHF transmitter;
- Two multi-channel VHF receivers;
- One channel 70 VHF receiver for channel management;
- A central processing unit (CPU);
- An electronic position-fixing system, Global Navigation Satellite System (GNSS) receiver for timing purposes and position redundancy;
- Interfaces to heading and speed devices and to other shipborne sensors;
- Interfaces to radar/Automatic Radar Plotting Aids (ARPA), Electronic Chart System/Electronic Chart Display and Information System (ECS/ECDIS) and Integrated Navigation Systems (INS);
- BIIT (built-in integrity test); and
- Minimum display and keyboard to input and retrieve data.

With the integral minimum display and keyboard unit, the AIS would be able to operate as a stand-alone system. A stand-alone graphical display or the integration of the AIS data display into other devices such as INS, ECS/ECDIS or a radar/ARPA display would significantly increase the effectiveness of AIS, when achievable.

2. All onboard sensors must comply with the relevant IMO standards concerning availability, accuracy, discrimination, integrity, update rates, failure alarms, interfacing and type-testing.

3. AIS provides:

- A built in integrity test (BIIT) running continuously or at appropriate intervals;
- Monitoring of the availability of data;
- An error detection mechanism of the transmitted data; and
- An error check on the received data.

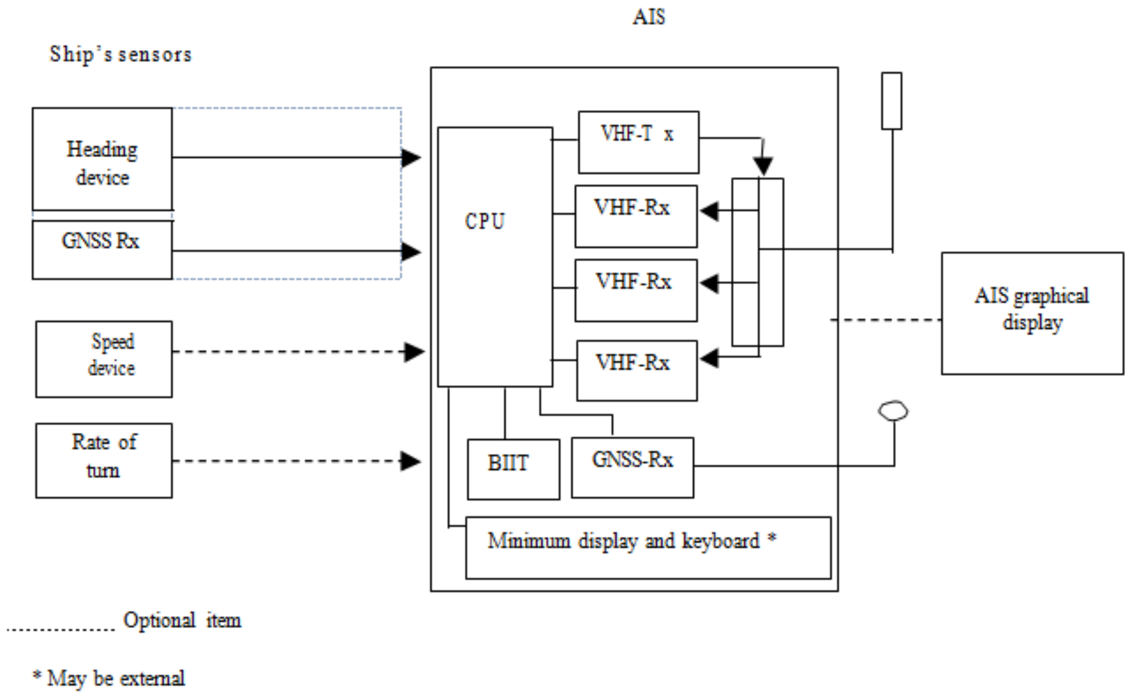

Figure 1 - AIS Components

CONNECTIONS

The connection of AIS to external navigational display systems

4. The AIS can be connected either to an additional dedicated AIS display unit, possibly one with a large graphic display, or to an existing navigational system such as radar or an electronic chart, but in the latter case only as part of an integrated navigation system.

The connection of AIS to external portable navigational equipment

5. It is becoming common practice for pilots to possess their own portable navigational equipment, which they carry on board. Such devices can be connected to shipborne AIS equipment and display the targets they receive.

The connection of AIS to external long-range radiocommunication devices

6. AIS is provided with a two-way interface for connecting to long-range radiocommunication equipment. Initially, it is not envisaged that AIS would be able to be directly connected to such equipment.

7. A shore station would first need to request that the ship makes a long-range AIS information transmission. Any ship-to-shore communication would always be made point-to- point, and not broadcast, and once communication had been established, the ship would have the option of setting its AIS to respond automatically to any subsequent request for a ship report from that shore station.

8. Users are reminded that SOLAS regulation V/11.10 provides that the participation of ships in IMO-adopted ship reporting systems shall be free of charge to the ships concerned.

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ANNEX 2

TECHNICAL DESCRIPTION

1. AIS operates primarily on two dedicated VHF channels (AIS1 - 161,975 MHz and AIS2 - 162,025 MHz). Where these channels are not available regionally, the AIS is capable of automatically switching to alternate designated channels.

2. The required ship reporting capacity according to the IMO performance standard amounts to a minimum of 2000 time slots per minute (see figure 2). The ITU Technical Standard for the Universal AIS provides 4500 time slots per minute. The broadcast mode is based on a principle called (S)TDMA (Self-organized Time Division Multiple Access) that allows the system to be overloaded by 400 to 500% and still provide nearly 100% throughput for ships closer than 8 to 10 NM to each other in a ship-to-ship mode. In the event of system overload, only targets far away will be subject to drop-out in order to give preference to targets close by that are a primary concern for ship-to-ship operation of AIS. In practice, the capacity of the system is unlimited, allowing for a great number of ships to be accommodated at the same time.

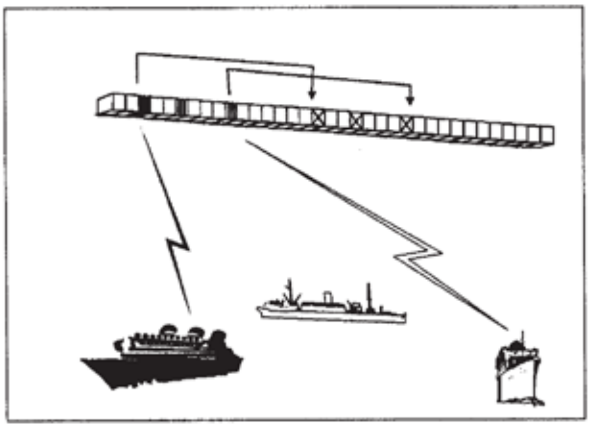

Figure 2 - Principles of TDMA

Appendix 9

FORMS

Australian Government
Australian Maritime Safety Authority

406 MHz Distress Beacon Registration
(Australian coded beacons only)

This form is to be used for registering 406MHz Distress Beacons that are coded with Australian codes. Registration is FREE.

In Australia you do not need to use this form if you register on-line at www.amsa.gov.au/beacons
This is the preferred method of registration

If you have a beacon coded with a foreign country code, or if you do not know what country code has been used, you will need advice, please contact:

Beacon Registration Section,
Australian Maritime Safety Authority
GPO Box 2181 Canberra City ACT 2601
Fax: International +61 2 9332 6323
Local 1800 406 329
Email: ausbeacon@amsa.gov.au
Phone: +61 2 6279 5766 or 1800 406 406

Information contained in this form is critical to your safety and to successful search and rescue (SAR) response:

- You may use this form to register a maritime distress beacon (EPIRB), an aviation distress beacon (ELT) or a personal locator beacon (PLB).
- When entering information, you must include details in the following sections:
  - Distress Beacon details;
  - Reason for registration;
  - Owner/Operator details;
  - Supplier details;
  - 24 Hour Emergency contact details; and
  - Vessel or aircraft details.

On-line registration: www.amsa.gov.au/beacons

Definitions

ELT - Emergency Locator Transmitters are distress beacons that are fixed in aircraft.

EPIRB - Emergency Position-Indicating Radio Beacons are for maritime use and designed to float upright in water.

PLB - Personal Locator Beacons may be used as personal distress beacons in all environments. They are not designed to float upright in water but may be carried to supplement a vessel's EPIRB.

PRIVACY STATEMENT

The Australian Maritime Safety Authority (AMSA) collects the information on this form for the purpose of enabling search and rescue. AMSA is able to collect this information under s 6(1)(b) of the *AMSA Act 1990*.

The information may be passed to other government agencies assisting in search and rescue operations.

AMSA 6 (6/12)

Australian Government
Australian Maritime Safety Authority

406 MHz Distress Beacon Registration
(Australian coded beacons only)

Reason for registration

☐ New registration ☐ Updated information (eg. Change of address)

☐ Replacement of beacon (Beacon to be deregistered)→

Distress beacon details

15 character unique identification (hexadecimal ident.)		Checksum
Manufacturer	Model	Beacon Unit Serial No.

Type of beacon

EPIRB ☐→ Manually activated ☐ Automatically activated ☐ How many other beacons are fitted to the vessel/aircraft?
ELT ☐→ Manually activated ☐ Automatically activated ☐ How many other beacons are fitted to the vessel/aircraft?
PLB ☐

Use of Beacon

Maritime ☐→ please ensure **vessel** details are completed below.
Aviation ☐→ please ensure **aircraft** details are completed below.
Land ☐→ Where use is land, please provide details of expected use eg. bushwalking, four wheel driving (vehicle make. model, registration and colour).etc:

Owner/operator details

Name		Postal address		Postcode
Home phone	Work phone	Mobile/other phone	Email address	

Supplier details

Name	Business address
Phone	Email address

24 Hour Contact
If possible, please supply 3 names (eg family, friend, neighbour); of which, one person must be contactable at all times; these people will be contacted if the beacon is activated.

	Contact 1	Contact 2	Contact 3
Name			
Home phone			
Work phone			
Mobile			

Vessel Details (if applicable)

Name		
Call sign	Registration No.	
MMSI	DWT (tonnes)	Length (metres)
Home port	Type of vessel (owner's description)	
Inmarsat No.	Other satellite mobile No.	
Type of radio fitted/carried (HF/VHF/27MHz/UHF)	Persons on board	No. of liferafts

Aircraft Details (if applicable)

Aircraft registration/tail number
Type of aircraft (owner's description)
Make/type (use ICAO abbreviation if known) –
Satellite and/or mobile phone number used in aircraft

AMSA 6 (6/12)

Appendix

10 TABLE OF TRANSMITTING FREQUENCIES IN THE VHF MARITIME MOBILE BAND

Extracted from the ITU *Radio Regulations 2012*, Appendix 18 (REV.WRC -2) See Article 52

NOTE A – For assistance in understanding the Table, see Notes a) to z) below. (WRC-12)

NOTE B – The Table below defines the channel numbering for maritime VHF communications based on 25 kHz channel spacing and use of several duplex channels. The channel numbering and the conversion of two-frequency channels for single-frequency operation shall be in accordance with Recommendation ITU-R M.1084-4 Annex 4, Tables 1 and 3. The Table below also describes the harmonized channels where the digital technologies defined in the most recent version of Recommendation ITU-R M.1842 could be deployed. (WRC-12)

Channel designator	Notes *	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From Ship stations	From Coast stations		Single frequency	Two frequency	
60	*m)*	156.025	160.625		x	X	X
01	*m)*	156.050	160.650		x	X	X
61	*m)*	156.075	160.675		X	X	X
02	*m)*	156.100	160.700		X	X	X
62	*m)*	156.125	160.725		X	X	X
03	*m)*	156.150	160.750		X	X	X
63	*m)*	156.175	160.775		X	X	X
04	*m)*	156.200	160.800		X	X	X
64	*m)*	156.225	160.825		X	X	X
05	*m)*	156.250	160.850		X	X	X
65	*m)*	156.275	160.875		X	X	X
06	*f)*	156.300		X			
2006	*r)*	160.900	160.900				
66	*m)*	156.325	160.925		X	X	X
07	*m)*	156.350	160.950		X	X	X
67	*h)*	156.375	156.375	X	X		
08		156.400		X			
68		156.425	156.425		X		
09	*i)*	156.450	156.450	X	X		
69		156.475	156.475	X	X		
10	*h), q)*	156.500	156.500	X	X		
70	*f), j)*	156.525	156.525	Digital selective calling for distress, safety and calling			
11	*q)*	156.550	156.550		X		
71		156.575	156.575		X		
12		156.600	156.600		X		
72	*i)*	156.625		X			
13	*k)*	156.650	156.650	X	X		
73	*h), i)*	156.675	156.675	X	X		
14		156.700	156.700		X		
74		156.725	156.725		X		
15	*g)*	156.750	156.750	X	X		
75	*n), s)*	156.775	156.775		X		
16	*f)*	156.800	156.800	DISTRESS, SAFETY AND CALLING			
76	*n), s)*	156.825	156.825		X		
17	*g)*	156.850	156.850	X	X		

Channel designator	Notes *	Transmitting frequencies (MHz)		Inter-ship	Port operations and ship movement		Public correspondence
		From Ship stations	From Coast stations		Single frequency	Two frequency	
77		156.875		X			
18	*m)*	156.900	161.500		X	X	X
78	*t), u), v)*	156.925	161.525		X	X	X
1078		156.925	156.925		X		
2078		161.525	161.525		X		
19	*t), u), v)*	156.950	161.550		X	X	X
1019		156.950	156.950		X		
2019		161.550	161.550		X		
79	*t), u), v)*	156.975	161.575		X	X	X
1079		156.975	156.975		X		
2079		161.575	161.575		X		
20	*t), u), v)*	157.000	161.600		X	X	X
1020		157.000	157.000		X		
2020		161.600	161.600		X		
80	*w), y)*	157.025	161.625		X	X	X
21	*w), y)*	157.050	161.650		X	X	X
81	*w), y)*	157.075	161.675		X	X	X
22	*w), y)*	157.100	161.700		X	X	X
82	*w), x), y)*	157.125	161.725		X	X	X
23	*w), x), y)*	157.150	161.750		X	X	X
83	*w), x), y)*	157.175	161.775		X	X	X
24	*w), ww) x), y)*	157.200	161.800		X	X	X
84	*w), ww) x), y)*	157.225	161.825		X	X	X
25	*w), ww) x), y)*	157.250	161.850		X	X	X
85	*w), ww) x), y)*	157.275	161.875		X	X	X
26	*w), ww) x), y)*	157.300	161.900		X	X	X
86	*w), ww) x), y)*	157.325	161.925		X	X	X
27	*z)*	157.350	161.950			X	X
87	*z)*	157.375	157.375		X		
28	*z)*	157.400	162.000			X	X
88	*z)*	157.425	157.425		X		
AIS 1	*f), l),p)*	161.975	161.975				
AIS 2	*f), l), p)*	162.025	162.025				

NOTES REFERRING TO THE TABLE

General Notes

a) Administrations may designate frequencies in the inter-ship, port operations and ship movement services for use by light aircraft and helicopters to communicate with ships or participating coast stations in predominantly maritime support operations under the conditions specified in Nos. 51.69, 51.73, 51.74, 51.75, 51.76, 51.77 and 51.78. However, the use of the channels which are shared with public correspondence shall be subject to prior agreement between interested and affected administrations.

b) The channels of the present Appendix, with the exception of channels 06, 13, 15, 16, 17, 70, 75 and 76, may also be used for high-speed data and facsimile transmissions, subject to special arrangement between interested and affected administrations.

c) The channels of the present Appendix, with the exception of channels 06, 13, 15, 16, 17, 70, 75 and 76, may be used for direct-printing telegraphy and data transmission, subject to special arrangement between interested and affected administrations. (WRC 12)

d) The frequencies in this table may also be used for radiocommunications on inland waterways in accordance with the conditions specified in No. 5.226.

e) Administrations may apply 12.5 kHz channel interleaving on a non-interference basis to 25 kHz channels, in accordance with the most recent version of Recommendation ITU R M.1084, provided:

- it shall not affect the 25 kHz channels of the present Appendix maritime mobile distress and safety, automatic identification system (AIS), and data exchange frequencies, especially the channels 06, 13, 15, 16, 17, 70, AIS 1 and AIS 2, nor the technical characteristics set forth in Recommendation ITU R M.489 2 for those channels;
- implementation of 12.5 kHz channel interleaving and consequential national requirements shall be subject to coordination with affected administrations. (WRC 12)

Specific notes

f) The frequencies 156.300 MHz (channel 06), 156.525 MHz (channel 70), 156.800 MHz (channel 16), 161.975 MHz (AIS 1) and 162.025 MHz (AIS 2) may also be used by aircraft stations for the purpose of search and rescue operations and other safety-related communication. (WRC 07)

g) Channels 15 and 17 may also be used for on board communications provided the effective radiated power does not exceed 1 W, and subject to the national regulations of the administration concerned when these channels are used in its territorial waters.

h) Within the European Maritime Area and in Canada, these frequencies (channels 10, 67, 73) may also be used, if so required, by the individual administrations concerned, for communication between ship stations, aircraft stations and participating land stations engaged in coordinated search and rescue and anti-pollution operations in local areas, under the conditions specified in Nos. 51.69, 51.73, 51.74, 51.75, 51.76, 51.77 and 51.78.

i) The preferred first three frequencies for the purpose indicated in Note a) are 156.450 MHz (channel 09), 156.625 MHz (channel 72) and 156.675 MHz (channel 73).

j) Channel 70 is to be used exclusively for digital selective calling for distress, safety and calling.

k) Channel 13 is designated for use on a worldwide basis as a navigation safety communication channel, primarily for intership navigation safety communications. It may also be used for the ship movement and port operations service subject to the national regulations of the administrations concerned.

l) These channels (AIS 1 and AIS 2) are used for an automatic identification system (AIS) capable of providing worldwide operation, unless other frequencies are designated on a regional basis for this purpose. Such use should be in accordance with the most recent version of Recommendation ITU R M.1371. (WRC 07)

m) These channels may be operated as single frequency channels, subject to coordination with affected administrations. (WRC 07)

n) With the exception of AIS, the use of these channels (75 and 76) should be restricted to navigation-related communications only and all precautions should be taken to avoid harmful interference to channel 16, by limiting the output power to 1 W (WRC 12)

o) (SUP - WRC-12)

p) Additionally, AIS 1 and AIS 2 may be used by the mobile-satellite service (Earth-to-space) for the reception of AIS transmissions from ships. (WRC 07)

q) When using these channels (10 and 11), all precautions should be taken to avoid harmful interference to channel 70 (WRC 07)

r) In the maritime mobile service, this frequency is reserved for experimental use for future applications or systems (e.g. new AIS applications, man over board systems, etc.). If authorized by administrations for experimental use, the operation shall not cause harmful interference to, or claim protection from, stations operating in the fixed and mobile services. (WRC 12)

s) Channels 75 and 76 are also allocated to the mobile-satellite service (Earth-to-space) for the reception of long-range AIS broadcast messages from ships (Message 27; see the most recent version of Recommendation ITU R M.1371). (WRC 12)

t) Until 1 January 2017, in Regions 1 and 3, the existing duplex channels 78, 19, 79 and 20 can continue to be assigned. These channels may be operated as single-frequency channels, subject to coordination with affected administrations. From that date, these channels shall only be assigned as single-frequency channels. However, existing duplex channel assignments may be preserved for coast stations and retained for vessels, subject to coordination with affected administrations. (WRC 12)

u) In Region 2, these channels may be operated as single-frequency channels, subject to coordination with affected administrations. (WRC 12)

v) After 1 January 2017, in the Netherlands, these channels may continue to be operated as duplex frequency channels, subject to coordination with affected administrations. (WRC 12)

w) In Regions 1 and 3:

Until 1 January 2017, the frequency bands 157.025-157.325 MHz and 161.625-161.925 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23, 83, 24, 84, 25, 85, 26, 86) may be used for new technologies, subject to coordination with affected administrations. Stations using these channels or frequency bands for new technologies shall not cause harmful interference to, or claim protection from, other stations operating in accordance with Article 5.

From 1 January 2017, the frequency bands 157.025 157.325 MHz and 161.625-161.925 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23, 83, 24, 84, 25, 85, 26, 86) are identified for the utilization of the digital systems described in the most recent version of Recommendation ITU R M.1842. These frequency bands could also be used for analogue modulation described in the most recent version of Recommendation ITU R M.1084 by an administration that wishes to do so, subject to not claiming protection from other stations in the maritime mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC 12)

ww) In Region 2, the frequency bands 157.200-157.325 and 161.800-161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) are designated for digitally modulated emissions in accordance with the most recent version of Recommendation ITU R M.1842. (WRC 12)

x) From 1 January 2017, in Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Democratic Republic of the Congo, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe, the frequency bands 157.125-157.325 and 161.725-161.925 MHz (corresponding to channels: 82, 23, 83, 24, 84, 25, 85, 26 and 86) are designated for digitally modulated emissions.

From 1 January 2017, in China, the frequency bands 157.150-157.325 and 161.750-161.925 MHz (corresponding to channels: 23, 83, 24, 84, 25, 85, 26 and 86) are designated for digitally modulated emissions. (WRC 12)

y) These channels may be operated as single or duplex frequency channels, subject to coordination with affected administrations. (WRC 12)

z) These channels may be used for possible testing of future AIS applications without causing harmful interference to, or claiming protection from, existing applications and stations operating in the fixed and mobile services. (WRC 12)

Appendix

11 ROUTINE TESTING (Extract from GMDSS Radio Log)

SECTION D
EQUIPMENT TESTS AND RESERVE ENERGY CHECKS

1. **Daily**

   a. The proper functioning of the DSC facilities shall be tested at least once each day, without radiation of signals, by use of the means provided on the equipment.

2. **Weekly**

   a. The proper operation of the DSC facilities shall be tested at least once a week by means of a test call, when within communication range of a coast station fitted with DSC equipment. Where a vessel has been out of communication range of a coast station fitted with DSC equipment for a period of longer than 1 week, a test call shall be made on the first opportunity that the vessel is within communication range of such a coast station.

   b. Where the reserve source of energy is not a battery (for example, a motor generator), the reserve source of energy shall be tested weekly.

3. **Monthly**

   a. Each EPIRB shall be examined a least once a month to check -

      i) built-in self-test performed as per the recommendations in the manufacturer's user manual;

      ii) its capability to operate properly, particularly its ability to float free (where required to do so) in the event of the vessel sinking;

      iii) how secure it is in its mounting; and

      iv) for signs of damage.

   b. Each search and rescue radar transponder (if fitted) shall be examined at least once a month to check how secure it is in its mounting and for signs of damage.

   c. Each AIS search and rescue transmitter (if fitted) shall be examined at least once a month to check how secure it is in its mounting and for signs of damage.

   d. Each survival craft two-way VHF equipment shall be tested at least once a month on a frequency other than 156.8 MHz (VHF Channel 16), unless the equipment is of a sealed type where such testing is not practical.

4. **Batteries**

   a. Batteries providing a source of energy for any part of the radio installations shall be tested daily and where necessary, brought up to the fully charged condition.

   b. A list of all batteries used as a source of emergency power for the radio equipment must be entered in Annex 1.

   c. Once a month, a full examination of each battery, cell by cell, must be made, and a report on the general condition entered, cell by cell, in Annex 2. If the batteries have sealed cells, then the general condition of the batteries are to be recorded, and the batteries replaced at the intervals recommended by the manufacturer.

      If the batteries are inaccessible, as in an Uninterruptible Power Supply (UPS), the batteries are to be replaced at intervals recommended by the UPS manufacturer.

   d. Yearly, the capacity of the battery/ies shall be checked, using an appropriate method (such as a full discharge and recharge, using normal operating current and period (e.g. 10 h), at intervals not exceeding 12 months, when the ship is not at sea. At sea assessment of battery condition should be done without significant discharge of the battery/ies. In the case of GMDSS UPS units, the in-built battery discharge test facilities shall be exercised, when the ship is not at sea.

   e. Annex 2 should be prepared in duplicate.

The duplicates of Sections C and D Annex 1 and Annex 2 must be detached and kept in correct order to form a record of the operation of the radio installation and be retained in board for a minimum of 12 months. These records are to be available for the information of Surveyors and shore maintenance staff and should be filed in the radio room or with the radio equipment. Once completed, the original Log(s) must be retained by the ship's operator for a period of not less than two years from the date of the last entry in Section C.

Appendix 12 GUIDELINES FOR OPERATIONAL USE OF SHIPBORNE AIS

INTERNATIONAL MARITIME ORGANIZATION

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IMO

SN/Circ.197
1 November 1997
Incorporating
SN/Circ. 197/Corr.1
10 February 1998

Ref. T2/6.03

OPERATION OF MARINE RADAR FOR SART DETECTION

1. At its thirty-ninth session (6 to 10 September 1993), the Sub-Committee on Safety of Navigation (NAV) prepared guidelines on the Operation of marine radar• for SART detection given, at SN/Circ. 161.

2 To avoid misinterpretation of guidance on the use of certain controls, as originally promulgated, the NAV Sub-Committee, at the forty-third session (14 to 18 July 1997) revised and expanded the text of the aforementioned guidelines, as given in the annex.

3 Member Governments are invited to bring this information to the attention of all entities concerned so that they may use it during search and rescue operations.

4. SN/Circ.161is revoked.

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SN/Circ.197
Incorporating
SN/Circ. 197/Corr.1

ANNEX

OPERATION OF MARINE RADAR FOR SART DETECTION

WARNING: A SART will only respond to an X-Band (3 cm) radar. It will not be seen on an S-Band (10 cm), radar.

Introduction

1. Search and Rescue Transponder (SART) may be triggered by any X-Band (3 cm) radar within a range of approximately 8 n miles. Each radar pulse received causes it to transmit a response which is swept repetitively across the complete radar frequency band. When interrogated, it first sweeps rapidly (0.4 µsec) through the band before beginning a relatively slow sweep (7.5 µsec) through the band back to the starting frequency. This process is repeated for a total of twelve complete cycles. At some point in each sweep, the SART frequency will match that of the frequency match during each of the 12 slow sweeps will produce a response on the radar display, thus a line of 12 dots equally spaced by about 0.64 nautical miles will be shown.

2. When the range to the SART is reduced to about 1 n mile, the radar display may show also the 12 responses generated during the fast sweeps. These additional dot responses, which also are equally spaced by 0.64 nautical miles, will be interspersed with the original line of 12 dots. They will appear slightly weaker and smaller than the original dots.

Radar Range Scale

3. When looking for a SART it is preferable to use either the 6 or 12 nautical mile range scale. This is because the total displayed length of the SART response of 12 (or 24) dots may extend approximately 9.5 nautical miles beyond the position of the SART and it is necessary to see a number of response dots to distinguish the SART from other responses.

SART Range Errors

4. When responses from only the 12 slow frequency sweeps are visible (when the SART is at a range greater than about 1 n mile), the position at which the first dot is displayed may be as much as 0.64 nautical mile beyond the true position of the SART. When the range closes so that the fast sweep responses are seen also, the first of these will be no more than 150 metres beyond the true position.

Radar Bandwidth

5. This is normally matched to the radar pulse length and is usually switched with the range scale and the associated pulse length. Narrow bandwidths of 3-5 MHz are used with long pulses on long range scales and wide bandwidths of 10-25 MHz with short pulses on short ranges.

6. A radar bandwidth of less than 5 MHz will attenuate the SART signal slightly, so it is preferable to use a medium bandwidth to ensure optimum detection of the SART. The Radar Operating Manual should be consulted about the particular radar parameters and bandwidth selection.

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Radar Side Lobes

7. As the SART is approached, side lobes from the radar antenna may show the SART responses as a series of arcs or concentric rings. These can be removed by the use of the anti-clutter sea control although it may be operationally useful to observe the side lobes as they may be easier to detect in clutter conditions and also they will confirm that the SART is near to own ship.

Detuning the Radar

8. To increase the visibility of the SART in clutter conditions, the radar may be detuned to reduce the clutter without reducing the SART response. Radars with automatic frequency control may not permit manual detune of the equipment. Care should be taken in operating the radar in the detuned condition as other wanted navigational and anti-collision information may be removed. The tuning should be returned to normal operation as soon as possible.

Gain

9. For maximum range SART detection the normal gain setting for long range detection should be used i.e., with a light background noise speckle visible.

Anti-clutter sea control

10. For optimum range SART detection this control should be set to the minimum. Care should be exercised as wanted targets in sea clutter may be obscured. Note also that in clutter conditions the first few dots of the SART response may not be detectable, irrespective of the setting of the anti-clutter sea control. In this case, the position of the SART may be estimated by measuring 9.5 nautical miles from the furthest dot back towards own ship.

11. Some sets have automatic/manual anti-clutter sea control facilities. Because the way in which the automatic sea control functions may vary from one radar manufacturer to another, the operator is advised to use manual control initially until the SART has been detected. The effect of the auto sea control on the SART response can then be compared with manual control.

Anti-clutter rain control

12. This should be used normally (i.e. to break up areas of rain) when trying to detect a SART response which, being a series of dots, is not affected by the action of the anti-clutter rain circuitry. Note that Racon responses, which are often in the form of a long flash, will be affected by the use of this control.

13 Some sets have automatic/manual anti-clutter rain control facilities. Because the way in which the automatic rain control functions may vary from one radar manufacturer to another, the operator is advised to use manual initially until the SART has been detected. The effect of the auto rain control on the SART response can then be compared with manual control.

Note:

The automatic rain and sea clutter controls may be combined in a single `auto-clutter' control, in which case the operator is advised to use the manual controls initially until the SART has been detected, before assessing the effect of auto.

Appendix

13 INFORMATION ON THE DISPLAY OF AIS-SART, AIS MAN OVERBOARD AND EPIRB-AIS DEVICES

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SN.1/Circ.322
24 June 2013

INFORMATION ON THE DISPLAY OF AIS-SART, AIS MAN OVERBOARD AND EPIRB-AIS DEVICES

1 The Maritime Safety Committee, at its ninety-second session (12 to 21 June 2013), noted the issue of developments in location devices using AIS technology.

2 Although international and national consideration of these devices is ongoing, they are available for use and will be displayed on shipborne AIS equipment. Therefore, it was considered that information for seafarers was needed. Accordingly, the Committee approved the circulation of the attached information to seafarers on the display of AIS-SART, AIS Man overboard (MOB) and EPIRB-AIS devices, prepared by the Sub-Committee on Radiocommunications and Search and Rescue (COMSAR), at its seventeenth session (21 to 25 January 2013), taking into account the recommendation of the Sub-Committee on Safety of Navigation (NAV), at its fifty-eighth session (2 to 6 July 2012).

3 The Committee further noted that the use of these devices might need to be reviewed in the more general context of GMDSS and the role of AIS. This information, therefore, might be reviewed during the process of review and modernization of the GMDSS.

4 Member Governments are invited to bring the information to the attention of all parties concerned.

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SUSTAINABLE DEVELOPMENT: IMO'S CONTRIBUTION BEYOND RIO+20

ANNEX

INFORMATION ON THE DISPLAY OF AIS-SART, AIS MAN OVERBOARD AND EPIRB-AIS DEVICES

1 This circular provides information on the display of AIS-SART, AIS Man Overboard (MOB) and EPIRB-AIS devices today. AIS-SARTs (AIS-search and rescue transmitters) are part of the GMDSS and have been able to be used as an alternative to radar (X-band) search and rescue radar transponders (SARTs) on SOLAS ships since 1 January 2010.

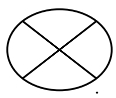
2 EPIRB-AIS devices will be 406 MHz distress alerting devices that contain an additional AIS transmitter developed using the same AIS-SART technology, where the AIS component is used as an aid in locating that EPIRB-AIS.

3 AIS Man Overboard (MOB) devices are now available as locating aids for persons at risk in the water. Once such a situation has been determined as being an emergency, AIS Man Overboard (MOB) devices may be used as an aid in locating that person.

4 In order to protect the integrity of the VHF data link used by AIS, AIS devices, including AIS-MOB devices, are not intended to be used to routinely locate or track people not being in an emergency situation.

AIS-SART

5 AIS-SARTs may be indicated on a newer graphical display of AIS by a circle with an "X" inside it, as shown (extract from SN.1/Circ.243/Add.1):

Topic	Symbol
AIS search and rescue transmitter (AIS-SART)	

6 Alternatively, the AIS-SART may be indicated on an older graphical display of AIS as a normal (sleeping) AIS target (isosceles triangle), as shown (extract from SN.1/Circ.243), taking into account that the triangle may be oriented by Course over Ground (COG):

Topic	Symbol
AIS Target	

7 The symbol remains the same, whether the AIS-SART is in Active or Test Mode; however, there is associated message text displayed, when an AIS-SART target is selected.

8 An AIS-SART uses the following associated message text:

SART ACTIVE means an AIS-SART in Active Mode.
SART TEST means an AIS-SART in Test Mode.
The maritime identity format used is: 970xxyyyy (where "xxyyyy" are numerals from 0 to 9)

AIS Man Overboard (MOB)

9 A Man Overboard (MOB) device using AIS will be displayed in the same way as an AIS-SART (see paragraphs 5 to 7 above).

10 A Man Overboard (MOB) device using AIS may use the same associated message text as in paragraph 8 above, but newer devices might have associated message text displayed as follows:

MOB ACTIVE indicates an AIS-based MOB device in Active Mode.
MOB TEST indicates an AIS-based MOB device in Test Mode.
The maritime identity format used is: 972xxyyyy (where "xxyyyy" are numerals from 0 to 9).

EPIRB-AIS

11 EPIRB-AIS devices will be displayed in the same way as an AIS-SART (see paragraphs 5 to 7 above).

12 EPIRB-AIS devices may use the same associated message text as in paragraph 8 above, but newer devices might have associated message text displayed as follows:

EPIRB ACTIVE indicates a 406 MHz EPIRB that contains an additional AIS transmitter indicating that the EPIRB is in Active Mode.
EPIRB TEST indicates a 406 MHz EPIRB that contains an additional AIS transmitter indicating that the EPIRB is in Test Mode.
The maritime identity used is: 974xxyyyy (where "xxyyyy" are numerals from 0 to 9).

13 The user identity of the EPIRB-AIS indicates the identity of the AIS transmitter of the EPIRB-AIS and not the MMSI of the ship.

8 An AIS-SART uses the following associated message text:

SART ACTIVE means an AIS-SART in Active Mode.
SART TEST means an AIS-SART in Test Mode.
The maritime identity format used is: 970xxyyyy (where "xxyyyy" are numerals from 0 to 9)

AIS Man Overboard (MOB)

9 A Man Overboard (MOB) device using AIS will be displayed in the same way as an AIS-SART (see paragraphs 5 to 7 above).

10 A Man Overboard (MOB) device using AIS may use the same associated message text as in paragraph 8 above, but newer devices might have associated message text displayed as follows:

MOB ACTIVE indicates an AIS-based MOB device in Active Mode.
MOB TEST indicates an AIS-based MOB device in Test Mode.
The maritime identity format used is: 972xxyyyy (where "xxyyyy" are numerals from 0 to 9).

EPIRB-AIS

11 EPIRB-AIS devices will be displayed in the same way as an AIS-SART (see paragraphs 5 to 7 above).

12 EPIRB-AIS devices may use the same associated message text as in paragraph 8 above, but newer devices might have associated message text displayed as follows:

EPIRB ACTIVE indicates a 406 MHz EPIRB that contains an additional AIS transmitter indicating that the EPIRB is in Active Mode.
EPIRB TEST indicates a 406 MHz EPIRB that contains an additional AIS transmitter indicating that the EPIRB is in Test Mode.
The maritime identity used is: 974xxyyyy (where "xxyyyy" are numerals from 0 to 9).

13 The user identity of the EPIRB-AIS indicates the identity of the AIS transmitter of the EPIRB-AIS and not the MMSI of the ship.

Appendix

14 GLOSSARY OF TERMS

AAIC - Accounting Authority Identification Code

AIS - Automatic Identification System

AIS-SART - AIS Search And Rescue Transmitter

ADRS – Admiralty Digital Radio Signals

ALRS – Admiralty List of Radio Signals

AM – amplitude modulation, a form of modulation where the amplitude of a carrier wave is made to vary in sympathy with the amplitude of the input signal. It is also known as A3E, when used for analogue voice double-sideband transmission.

amp – short-form term for ampere, a measurement of electrical current in a circuit, commonly called an "amp." One ampere is a certain number of electrons passing by the point of measurement in one second. Symbol for ampere/s is A.

AMSA – Australian Maritime Safety Authority

ANSWERBACK – A string of telex characters which uniquely identify an individual telex machine or terminal. It can be sent from a telex terminal via the "HERE IS" command, and requested from another telex machine via the 'WRU?' (Who aRe You?) command.

APR – Automated Position Reporting, used in Ship Reporting Systems, such as AUSREP, REEFREP and LRIT.

ARPA – Automatic Radar Plotting Aid, an automatic radar plotting aid that complies with International Maritime Organization (IMO) regulations.

ARQ - Automatic Retransmission reQuest. A NBDP (telex) technique for detecting and correcting transmitted errors, requiring an automatic transmitted response from the receiving station. Communications are limited to a single transmitting and a single receiving station.

ASCII – American Standard Code for Information Interchange. A popular code for the exchange of information between computers, computer terminals and other data applications.

AMVER – Automated Mutual Assistance Vessel Rescue System. Sponsored by the United States Coast Guard, AMVER is a computer-based voluntary global ship reporting system used worldwide by search and rescue authorities to arrange assistance to persons in distress at sea. It is sponsored by the United States Coast Guard.

AtoN – Aid To Navigation.

AUSCOAST - an Australian coastal warning broadcast as long as the information is valid.

AUSREP – Australian Ship Reporting System (replaced by MASTREP).

bit – Binary Digit. One of the digits 0 or 1 used in binary notation. It is the basic unit of information in computers, data processing or digital communications.

BITE – Built-In Test Equipment (used in radio equipment)

BIIT – Built-in Integrity Test (used in AIS equipment)

byte – A group of bits taken together and treated as a unit, in computers, data processing or digital communications. Often, one byte consists of eight or more bits.

CCIR – The International Radio Consultative Committee that formulated new technical standards for radio equipment and the recommendations on the use of radio spectrum (now replaced by the ITU's Radiocommuncations Sector, see ITU-R)

CIRM – International Radio Medical Centre (Rome)

Coast station – A land station in the maritime mobile service providing terrestrial communications to and from ships at sea.

COMSAR - IMO Sub-committee on Radiocommunications and Search and Rescue

COSPAS-SARSAT system – A satellite-aided search and rescue system based on low-altitude, near polar-orbiting satellites. Designed to locate emergency radio beacons transmitting on the frequencies of 406.025, 406.028 and 406.037 MHz, with 121.5 MHz for homing.

CQ - General call to all stations. Frequently used in Morse transmissions, and sometimes in voice communications.

CTR – Conformance Test Report. A report certifying LRIT conformance as per SOLAS regulations.

DE - "from..." (used to precede the name or identification of the calling station). Frequently used in Morse and telex transmissions.

Digital Selective Calling (DSC) - A system in the GMDSS for transmitting distress alerts from ships and for transmitting associated acknowledgements from shore stations. It is also used for relaying distress alerts and for alerts prior to the broadcast of urgency and safety messages.

Distress alert - The transmission of a distress alert indicates that a mobile unit (ship, aircraft or other vehicle) or person is threatened by grave and imminent danger and requests immediate assistance. The distress alert is a digital selective call using a distress call format in the bands used for terrestrial radiocommunications or a distress message format, in which case it is relayed through space stations.

The distress alert shall provide the identification of the station in distress and its position.

DNID - Data Network Identifier, a digital ID downloaded to a ship's Inmarsat-C terminal, to permit Automated Position Reporting (i.e to allow polling of the ship's position).

DRF – Disaster Recovery Facility (i.e. AMSA backup facility)

Duplex – Operating method in which transmission is possible simultaneously in both directions of a telecommunication channel.

ECDIS – Electronic Chart Display and Information System. A computer-based navigation information system that complies with International Maritime Organization (IMO) regulations.

EHF - Extra High Frequency (30 to 300 GHz)

Enhanced Group Calling (EGC) system - A system in the GMDSS to broadcast MSI (SafetyNet) and Routine / Public correspondence (FleetNet) anywhere in the Inmarsat coverage area via the Inmarsat satellite system.

EPIRB - Emergency Position Indicating Radio Beacon.

FEC - Forward Error Correction, an error-tolerant broadcast mode for NBDP, where the sending station transmits to an unlimited number of receiving stations.

FleetBroadband - Inmarsat broadband service providing broadband data and voice, simultaneously using IP (internet protocol), whilst still supporting existing voice and ISDN data capability for legacy applications.

FleetNet - The international commercial service offered under Inmarsat C's EGC capabilty, which allows authorised information providers, such as commercial subscription services, shipping companies or governments to broadcast messages to selected groups of vessels, each of which has registered with the information provider and been added to a FleetNET closed group / network.

Fleet77 - Provides global voice, fax and high-speed data communications at speeds up to 128 kbps via Inmarsat. It is suitable for a wide range of vessels, from deep-sea ships to offshore support craft. Provides full support for GMDSS, including features such as emergency call prioritisation, as stipulated by IMO Resolution A.888(21).

FM - Frequency Modulation (used for VHF marine band transmissions). The frequency of a carrier wave is made to vary in sympathy with the frequency of the input signal.

F1B - A frequency-modulated mode of emission using digital information for automatic reception, without the use of a modulating sub-carrier.

F3E – A frequency-modulated mode of emission using analogue telephony (i.e. voice).

Geostationary satellite - A satellite whose period of revolution is equal to the period of rotation of the earth and whose circular and direct orbit lies in the plane of the Earth's equator; that is, a satellite which remains in the same relative position to any point on Earth. Approximate altitude of satellite is 36 000 km above earth's surface.

GEOLUT - A Local User Terminal in the Cospas-Sarsat system for receiving signals from geostationary satellites fitted with Cospas-Sarsat packages. See also LUT.

GHz - gigahertz (1 000 000 000 hertz). A measurement unit of radio frequency, oscillation and vibration equalling 1 000 000 000 cycles per second.

GMDSS – Global Maritime Distress and Safety System

GMT – Greenwich Mean Time (see also UTC)

GNSS – Global Navigation Satellite System (e.g. GPS, Glonass, Galileo)

GOC - General Operator 's Certificate of Proficiency

GPS - Global Positioning System. A satellite-based system for calculating positions and obtaining time anywhere on the Earth's surface. (also known as 'NAVSTAR').

GRT – Gross Registered Tonnage (also known as GT)

G3E - A phase-modulated mode of emission using analogue telephony (e.g. voice)

HF - High frequency (3 to 30 MHz)

Hz - hertz. The fundamental measurement unit of radio frequency. One hertz equals one cycle per second.

Homing signals - Locating signals transmitted by a ship in distress or survival craft to provide a bearing for searching ships and aircraft.

H3E - Radiotelephony using amplitude modulation, single sideband, full carrier - the 'compatible' mode. See AM.

IAMSAR - International Aeronautical and Maritime Search And Rescue. The IAMSAR Manual is a joint publication of the IMO and ICAO.

ICAO - International Civil Aviation Organization.

IMDG – International Maritime Dangerous Goods Code

IMO - International Maritime Organization

IMSO - International Mobile Satellite Organization

INM – Inmarsat Mobile Number, the Inmarsat terminal identification number.

Inmarsat - Inmarsat Ltd (formerly International Maritime Satellite Organization)

INTERCO – International Code of Signals

IRCS – Integrated RadioCommunication System when used in the GMDSS (see IMO Res. A.811(19)).

ISDN – Integrated Services Digital Network – A digital access network for data and voice, which provides an alternative to the public switched telephone network.

ISM - International Safety Management - refers to the IMO's International Safety Management (ISM) Code 2002, which provides an international standard for the safe management and operation of ships and for pollution prevention.

ISN – Inmarsat Serial Number, a unique number for every Inmarsat terminal's hardware.

ITU - International Telecommunication Union. The lead United Nations agency for information and communication technologies.

ITU-R – The ITU Radiocommunication Sector (ITU-R) is that part of the ITU which performs a major role in the global management of the radio-frequency spectrum and satellite orbits for services such as fixed, mobile, broadcasting, amateur, space research, emergency telecommunications, meteorology, global positioning systems, environmental monitoring and communication services - that ensure safety of life on land, at sea and in the air. Formerly known as the CCIR.

ITU-T – The ITU Telecommunications Standardization Sector is that part of the ITU which defines elements in information and communication technology (ICT) infrastructure. Formerly known as the CCITT.

J2B - A single-sideband, suppressed carrier, amplitude- modulated mode of emission using digital information for automatic reception, without the use of modulating sub-carrier.

J3E - Radiotelephony using amplitude modulation, single sideband, suppressed carrier. Often referred to as "SSB".

kb/s – kilobits per second. One kilobit equals 1 024 bits.

kHz - kilohertz (1 000 hertz). A measurement unit of radio frequency, oscillations and vibrations equalling 1 000 cycles per second

km - kilometre, 1 000 metres

kn - knot, one nautical mile per hour.

knots - nautical miles per hour (1 international nautical mile = 1 852 metres).

kW - kilowatt (1 000 watts). A measurement unit of radio and electrical power (see watt).

Land Earth Station (LES) - An earth station in the maritime mobile-satellite service located at a fixed place and providing communications to and from mobile stations (formerly CES, Coast Earth Station).

LEOLUT – low earth orbit local user terminal (Cospas-Sarsat). See also LUT.

LF – low frequency (3 to 30 kHz)

L-band EPIRB - An EPIRB operating in the 1.6 GHz frequency band through the Inmarsat satellite system (also known as an Inmarsat EPIRB) – discontinued since 1 December 2006.

Local User Terminal (LUT) - A ground receiving station which receives data from COSPAS and SARSAT satellites, calculates the position of the beacon and forwards the resultant information to rescue authorities.

Local (SSM) - local sea safety messages containing warnings which refer to hazards which are considered to be of a temporary nature, e.g. floating logs, temporary buoys, etc, broadcast for a defined period.

Locating signals - Transmissions intended to facilitate the location of ship in distress or survival craft.

LRIT - Long Range Identification and Tracking - a ship reporting system requiring vessels to automatically transmit their identity, position and date / time at 6-hour intervals, as part of Maritime Domain Awareness, by contracting Governments under SOLAS.

LSB - Lower sideband mode of emission. A form of single sideband emission, where only the lower sideband is transmitted.

m - metre, unit of length

Maritime Safety Information (MSI) - Distress alerts, navigational warnings, meteorological warnings and forecasts and other important safety information for ships.

MASTREP - Modernised Australian Ship Tracking and Reporting System (replaces AUSREP).

MCS - Maritime Communications Station. Another term for a coast station.

MFAG – Medical and First Aid Guide (part of the International Maritime Dangerous Goods Code)

MES – A Mobile Earth Station in the Inmarsat system, which includes mobile, land, ship and airborne Inmarsat terminals.

METAREA – METeorological AREA: A meteorological service area with area limits similar to NAVAREAs in the WWNWS.

MF - Medium frequency (300 to 3 000 kHz).

MHz - megahertz (1 000 000 hertz). A measurement unit of radio frequency, oscillation and vibration, equalling 1 000 000 cycles per second.

MID - Maritime Identification Digit, a 2 or 3-digit decimal number used as the first part of ship station identity to indicate nationality.

MKD – Minimum Keyboard and Display. A minimal text-only display provided for AIS Class-A transceivers.

MMSI - Maritime Mobile Service Identity. The number used to identify coast stations' and ships' DSC, NBDP and AIS systems.

MPDS – Mobile Packet Data Service. An Inmarsat service allowing continuous connection of ships to terrestrial networks with payment for volume of data exchanged rather than the duration of 'airtime' used.

MRCC - Maritime Rescue Co-ordination Centre. The Australian MRCC is located in Canberra and operated by the Australian Maritime Safety Authority (see also RCC).

MROCP - Marine Radio Operator 's Certificate of Proficiency.

MROVCP - Marine Radio Operator 's VHF Certificate of Proficiency.

MSC - Maritime Safety Committee of the International Maritime Organization.

MSI - Maritime Safety Information, navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages.

MUF – Maximum Usable Frequency. The highest frequency which is reflected by the ionosphere over any particular path .

n mile – nautical mile (1 international nautical mile = 1 852 m)

NAVAREA - A NAVigation AREA in the world-wide navigational warning service. Australia is located in NAVAREA X (ten). It covers the similar area as a METAREA, and both terms are often used together (NAVAREA / METAREA).

NAVAREA warning - Navigational warning broadcast issued by an area co-ordinator of the world-wide navigational warning service for a particular area. There are currently 16 NAVAREAS in the world plus a newly created one called ARCTIC OCEAN.

NAVTEX - Short range system for transmission of navigational and meteorological warnings to ships by narrow band direct printing. The International NAVTEX service is the system for broadcast and automatic reception of Maritime Safety Information (MSI) by means of narrow-band direct printing on 518 kHz, using the English language, to meet the requirements of the SOLAS convention.

NBDP - Narrow Band Direct Printing (formerly known as "telex over radio")

NCS - Network Coordination Station in the Inmarsat system

On-scene communications - Communications between the distressed ship or survival craft and assisting units.

OTF – Optimum Traffic Frequency. The optimal frequency for sustained reliability, approximately 85% MUF.

PM - Phase Modulation, a form of angle modulation, very similar to FM, used in the VHF maritime mobile service.

PSTN – Public Switched Telephone Network

PTT – Press To Talk, a switch used on microphones and control lines, to activate the voice path and activate transmitter circuitry.

RCC – Rescue Co-ordination Centre. RCC Australia is Australia's RCC, hosted by AMSA, in Canberra, Australia.

ReefRep - A mandatory Ship Reporting System for the Great Barrier Reef and Torres Strait. Otherwise known as the Great Barrier Reef and Torres Strait Ship Reporting System.

ReefVTS - a coastal Vessel Traffic Service declared by the International Maritime Organization (IMO) via resolution MSC.161(78) as a measure to further enhance navigational safety in Torres Strait and the Great Barrier Reef.

Rescue coordination centre (RCC) - A unit responsible for the efficient organisation of search and rescue services and the operation of these resources within a nominated area.

R/T – Radiotelephony (i.e. voice)

RTE - Radar Target Enhancer - a short-range device used on small craft which receives, amplifies and stretches an incoming radar pulse, then re-transmits it, resulting in an increased 'paint' on other vessels' radar display/s.

Rx - Receiver or receive frequency

SafetyNET – Inmarsat satellite system for transmission of navigational and meteorological warnings to ships, complementary to the International NAVTEX service on 518 kHz. The ability to receive SafetyNET service information will generally be necessary for all ships which sail beyond the coverage of NAVTEX.

SAR - Search And Rescue

SAR co-ordinating communications - Communications necessary for the co-ordination of ships and aircraft participating in a search and rescue operation.

SART - Search And Rescue Radar Transponder. Also known as a survival craft radar transponder or radar transponder.

Selcall – An identification number, 5 digits for ship stations, and 4 digits for coast stations, programmed into NBDP (telex) equipment. In the ALRS Volume 1, the coast station selcall is shown in square brackets, e.g. Guam [1096]. It is only required generally for ARQ mode of operation.

SHF - Super High Frequency (3 to 30 GHz)

Ship station - A station in the terrestrial radio-communications service located aboard a ship.

Ship Earth Station (SES) - An earth station in the maritime mobile-satellite service located aboard a ship.

Single frequency - The same frequency used for transmission and reception (simplex).

Simplex – Operating method in which transmission is made possible alternatively in each direction of a telecommunication channel, for example, by means of manual control (see single-frequency).

SMCP - Standard Marine Communication Phrases

SOLAS - Safety Of Life At Sea (International Convention for the Safety Of Life At Sea)

SOLAS Convention - Safety of Life at Sea Convention as adopted by the International Maritime Organization and accepted by contracting governments.

SSAS – Ship Security Alert System. A system fitted under Regulation 6 of SOLAS chapter XI-2, which requires ships to be provided with a ship security alert system. Performance standards for ship security alert systems are given in IMO Resolution MSC.147(77).

SSB - Single side band mode of emission using amplitude modulation where one sideband is reduced, suppressed or fully removed.

SSM - Sea Safety Message, a type of coastal warning referring to hazards which are considered to be of a temporary nature, e.g. floating logs, temporary buoys, etc, usually broadcast for a defined period.

SSRM – Short Safety-Related Messaging, a text-based messaging system available to the users of AIS.

STCW - Seafarers' Training, Certification and Watchkeeping (Code and International Convention on).

TMAS - Telemedical Maritime Advice Services

Tx - Transmitter or Transmit frequency

UHF - Ultra High Frequency (300 to 3 000 MHz)

UPS - Uninterruptible Power Supply

USB - Upper sideband mode of emission. A form of single sideband emission, where only the upper sideband is transmitted.

UTC - Co-ordinated Universal time (replaces Greenwich Mean Time – GMT for practical purposes)

VDL - VHF Data Link (the AIS channels of AIS 1 and AIS 2)

VDU - Visual Display Unit

VHF - Very high frequency (30 to 300 MHz)

VLF - Very low frequency (30 to 300 kHz)

volt - A unit of electric potential and electromotive force, equal to the difference of electric potential between two points on a conducting wire carrying a constant current of one ampere when the power dissipated between the points is one watt. The symbol for the volt/s is V.

VTS – Vessel Traffic Service. The International Maritime Organization (IMO) in IMO Resolution A.857(20), defines a Vessel Traffic Service (VTS) as "a service implemented by a Competent Authority that is designed to improve safety and efficiency of vessel traffic, and to protect the environment. The service shall have the capability to interact with traffic and respond to traffic situations developing situations in the VTS area". It is referenced in SOLAS Chapter V, Regulation 12.

watt – the power required to do work at the rate of 1 joule per second, which is equal to the power dissipated in an electric circuit in which a potential difference of 1 volt causes a current of 1 ampere to flow. The symbol for watt/s is W.

WWNWS - World-wide Navigational Warning Service, a service established by the International Maritime Organization, International Hydrographic Organization and the World Meteorological Organization for the purpose of co-ordinating the transmissions of radionavigational warnings in defined geographical areas.

WRU? – Who Are You? A telex command used to request the Answerback from another telex machine.

W/T - Wireless telegraphy (i.e. Morse code).

Appendix

15 INMARSAT-C SHORT ADDRESS CODES (SACS)

Stratos Network: Inmarsat–C short address codes (special access codes)

SAC	AOR-E		AOR-W		IOR		POR	
	LES 102	LES 112	LES 002	LES 012	LES 302	LES 312	LES 202	LES 212
32	UKCG	Dutch CG	UKCG	Dutch CG	Dutch CG	Dutch CG	RCC NZ	Dutch CG
38	UKCG	Dutch CG	UKCG	Dutch CG	Dutch CG	Dutch CG	RCC NZ	Dutch CG
39	UKCG	UKCG	UKCG	UKCG	Cape Town Radio ZSC	RCC Aus	RCC NZ	RCC Aus
41	UK Met	Dutch Met	UK Met	Dutch Met	UK Met	Dutch Met	UK Met	Dutch Met
42	NAV I Coord.	NAV I Coord.	NAV I Coord.	NAV I Coord.	Cape Town Radio ZSC	RCC Aus/ NAV X Coord.	RCC NZ	RCC Aus/ NAV X Coord.
43	AMVER	AMVER	AMVER	AMVER	AMVER	AMVER	AMVER	AMVER
861	Not Used	Aus REEFVTS	Not Used	Aus REEFVTS	Not Used	Aus REEFVTS	Not Used	Aus REEFVTS
1241	Not Used	RCC Aus	Not Used	Aus BUMET	Not Used	Aus BUMET	Not Used	Aus BUMET
1243	Not Used	RCC Aus	Not Used	RCC Aus	Not Used	RCC Aus	Not Used	RCC Aus
1250	Not Used	RCC Aus	Not Used	RCC Aus	Not Used	RCC Aus	Not Used	RCC Aus

UKCG = Maritime and Coastguard Agency, UK
Dutch CG = Netherlands Coast Guard
RCC Aus = RCC Australia
REEFVTS = Great Barrier Reef & Torres Strait Vessel Traffic Service

Notes:

1. Meaning of SAC Codes:
   SAC 32 – Medical Advice
   SAC 38 – Medical Assistance
   SAC 39 – Maritime Assistance
   SAC 41 – Meteorological Reports
   SAC 42 – Navigational Hazards and Warnings
   SAC 43 – Ship Position Reports (NOT for AUSREP)
   SAC 861 – Reports to REEFVTS (Australia)
   SAC 1241 – Australian Bureau of Meteorology (BUMET)
   SAC 1243 – Information Reports to RCC Australia (e.g. semi-submerged container sighted)
   SAC 1250 – Ordinary text messaging to RCC Australia (paid by vessel)
2. RCC NZ can be contacted on +64 4 5778033 if SAC Code messages cannot be delivered.

Appendix 16 REFERENCES

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