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
- 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 tenth edition of the GMDSS Handbook published in September 2013, and has been amended to reflect:

- changes to regulations adopted by the International Telecommunication Union (ITU) World Radiocommunications Conference (2015)
- changes to Inmarsat services
- an updated AMSA distress beacon registration form
- changes to various ITU Recommendations
- changes to the publications published by the ITU
- developments in Man Overboard (MOB) devices
- clarification of GMDSS radio log procedures
- 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 where safety of life at sea is concerned. Special attention should be given to those sections dealing with distress, urgency, and safety.

Operators of radiocommunications 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 and 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 GMDSS 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 then, numerous technological advances have been made. However, until the introduction of the 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 within range would hear the call and respond.

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

1.2 FUNCTION REQUIREMENTS

The GMDSS provides every ship, while at sea, the following basic communication functions:

- transmitting ship-to-shore distress alerts (by at least two separate and independent methods)
- 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 signals for locating
- transmitting and receiving maritime safety information
- transmitting and receiving general communications
- transmitting and receiving bridge-to-bridge communications.

1.3 BASIC CONCEPT OF THE GMDSS

Figure 1 gives a simplified overview of the GMDSS system.

1.3.1 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.

1.3.2 Search and rescue

The GMDSS uses modern technology including satellite communications and digital selective calling techniques in 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 coordinated search and rescue operation with the minimum of delay.

1.3.3 Maritime Safety Information

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 MSI.

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:

- NAVTEX — which uses MF radio to provide coastal warnings
- SafetyNET — which uses Inmarsat satellites to provide coverage from about 76 degrees north to 76 degrees south latitude.

In addition, some national meteorological services may issue warnings and forecasts for transmission by using HF narrow band direct printing (NBDP).

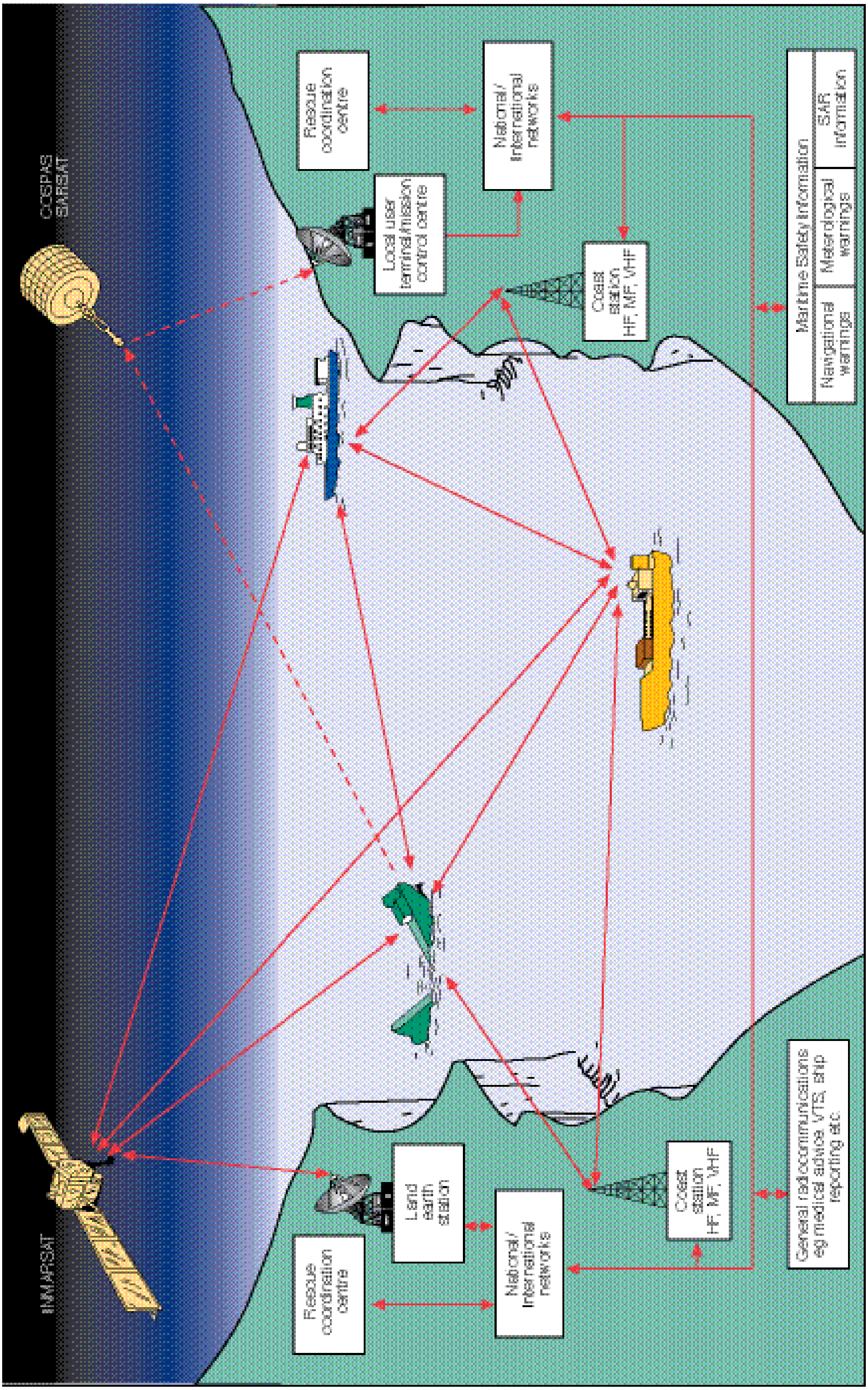


Figure 1 — The Global Maritime Distress and Safety System (GMDSS) - simplified overview

1.4 AREAS OF OPERATION UNDER THE GMDSS

Due to the different radio systems incorporated into the GMDSS having 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, rather than by its size. The GMDSS has divided the world's oceans into four distinct areas. All ships are required to carry equipment appropriate to the sea area or areas in which they operate.

1.4.1 GMDSS operational areas

Sea Area A1	within the radiotelephone coverage of at least one VHF coast station in which continuous VHF DSC alerting is available (approx. 20-30 nm)
Sea Area A2	within the radiotelephone coverage of at least one MF coast station in which continuous MF DSC alerting is available (within approx. 100 nm) (excluding Sea Area A1)
Sea Area A3	within the coverage area of an Inmarsat geostationary satellite in which continuous alerting is available (approx. between 76^{o} N and S) (excluding Sea Areas A1 and A2)
Sea 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 (see www.amsa.gov.au for more details). The only exception to this designation is the Antarctic waters south of approximately 76^{o} S (dependent on longitude) which are Sea Area A4.

There are discussions at IMO that may result in redefining Sea Areas A3 and A4 based on satellite coverage of systems other than Inmarsat, if such systems are approved for use within the GMDSS. This is not expected to come into force for several years.

1.5 THE GMDSS MASTER PLAN

The IMO, a specialised agency of the United Nations, regularly publishes a list of planned and operational GMDSS shore based communications facilities available worldwide. This document is referred to as the GMDSS Master Plan.

1.6 INTRODUCTION OF GMDSS

The International Convention for the Safety of Life At Sea (SOLAS) contains a set of international regulations and standards governing all aspects of merchant ship operations. The convention has been ratified by all major maritime nations which operate through the IMO.

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 (GT) 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.

1.6.1 Relevant conventions and legislation

The carriage requirements for ships subject to the SOLAS Convention are contained in Chapter IV of SOLAS with Australian requirements provided in *Marine Order 27 (Safety of navigation and radio equipment) 2016*. Some requirements (eg for SAR locating devices) are also contained in:

- Chapter III of SOLAS
- the International Life-Saving Appliance (LSA) Code
- the High Speed Craft (HSC) Code.

The carriage requirements for both SOLAS (GMDSS compliant) ships and non-SOLAS (GMDSS compatible) vessels are designed to ensure the vessel can meet the functional requirements of the GMDSS relevant to that vessel and its operating area/s.

1.7 FUNCTIONAL REQUIREMENTS

There are two types of ships/vessels that carry GMDSS equipment:

- SOLAS (GMDSS compliant) ships which are required to carry the equipment under the SOLAS Convention
- non-SOLAS (GMDSS compatible) vessels, which are not subject the SOLAS Convention, but are required to carry GMDSS equipment under commonwealth legislation.

1.7.1 Functional requirements for GMDSS compliant ships

The functional requirements for GMDSS compliant ships (ships to which the SOLAS Convention applies) are contained in Chapter IV, Regulation 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 radiocommunication 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 MSI
- transmitting and receiving general radio-communications relating to the management and operation of the ship
- transmitting and receiving bridge-to-bridge communications.

1.7.2 Functional requirements for GMDSS compatible vessels

The functional requirements for GMDSS compatible vessels (vessels to which the SOLAS Convention does not apply) are contained in Schedule 3 of *Marine Order 27 (Safety of navigation and radio equipment) 2016*. This regulation requires that every vessel, to which the regulation applies, and while at sea, shall be capable of providing for the safety of the vessel 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 coordinating communications
- transmit locating signals
- receive MSI.

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

- receive shore-to-ship distress alerting
- receive ship-to-ship distress alerting.

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 (terrestrial radio) and the maritime mobile satellite service shall be capable of offering four levels of priority in the following order:

2.1.1 Distress communications

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 spoken word MAYDAY sent three times. Subsequent messages are preceded by the word MAYDAY once only (refer to section 16.7.2).

A distress message is often preceded by a distress alert using DSC.

2.1.2 Urgency communications

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.

An urgency message is often preceded by an urgency Alert using DSC.

2.1.3 Safety communications

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.

A safety message can be preceded by a safety alert using DSC.

2.1.4 Other (routine/public) correspondence

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 ships and those ashore through the public telecommunications network. Examples of public correspondence communications are: telephone, fax, email and data messages.

2.2 TYPES OF STATIONS IN THE MARITIME MOBILE SERVICE

2.2.1 Ship stations

A ship station is a radio station established on board a ship 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 provision of SAR communications on behalf of AMSA, the transmission of weather reports and navigation warnings and watchkeeping on GMDSS distress channels. There are two major coast stations in Australia, located at Wiluna (Western Australia) and Charleville (Queensland). Both are remote controlled from JRCC Australia in Canberra
- Limited coast station — a station operated by volunteer marine rescue organisations and state/territory governments.

2.2.3 Port operations stations

Port operations stations are established for the operational control of ships in and around ports and harbours. A vessel traffic service (VTS) can operate within port areas, and can be guided in their operation by with IMO Resolution A.857 (20) (Guidelines on Vessel Traffic Services).

2.2.4 Aircraft stations

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

2.2.5 Joint Rescue Coordination Centre (JRCC)

The Australian JRCC (referred to as JRCC Australia) is located in Canberra and operated by AMSA. The JRCC coordinates search and rescue operations for ships and aircraft and the promulgation of navigation warning information (referred to as MSI). It is also the mission control centre for the Cospas-Sarsat system (discussed later). The JRCC is connected by various communications links to coast radio stations, land earth stations (LESs) 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 (symbol = Hz).

The wavelength of a radio wave is the distance between two successive positive peaks of two cycles. Wavelength is inversely proportional to frequency, ie 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 (λ) = velocity in metres (m) 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.

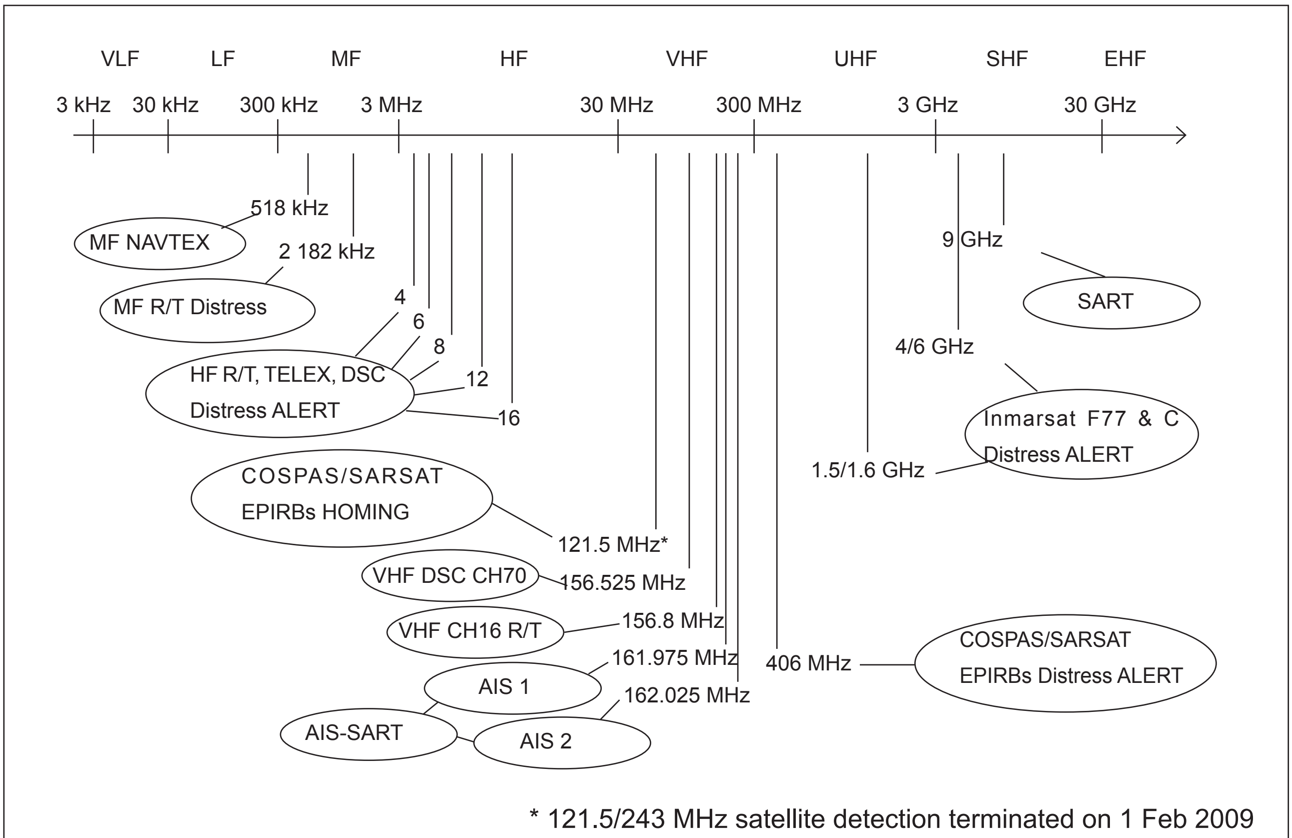


Figure 2 — ITU radio frequency bands and GMDSS usage

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

2.4 FREQUENCIES ALLOCATED TO THE MARITIME SERVICES

2.4.1 Allocations

The 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 switching

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

2.4.3 Simplex operation

A simplex system (figure 3) 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.

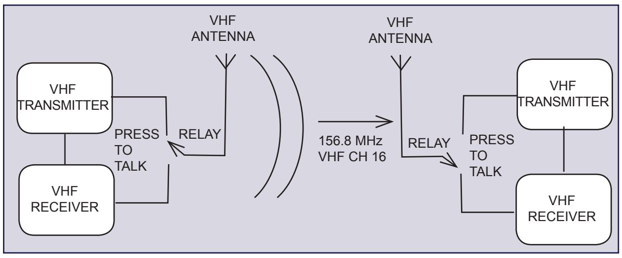


Figure 3 — Simplex operation

2.4.4 Duplex operation

Communications equipment designed for duplex operation (figure 4) 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 (ie 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 ships and coast radio stations to be conducted in the same way as telephone calls made over the conventional land telephone system — ie both parties can speak and be heard at the same time.

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

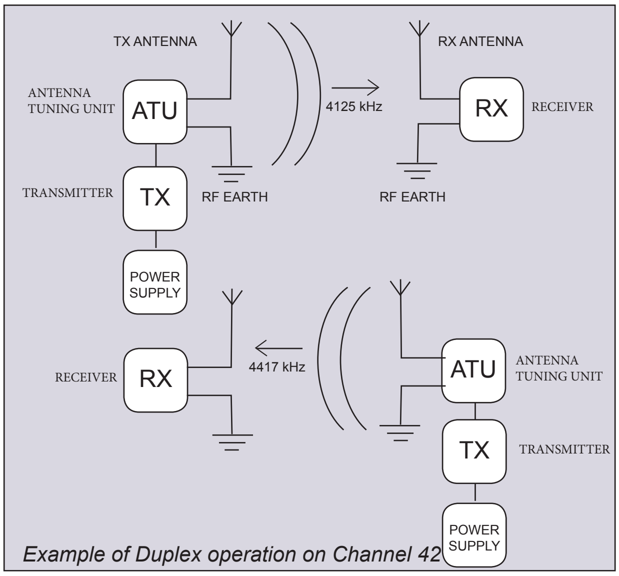


Figure 4 — Duplex operation

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 — ie 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 three or four 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, ie 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 of the Radio Regulations lists both simplex and duplex channels available in the 4 to 26 MHz range. As a result of the introduction of the GMDSS and the move to satellite based communications methods, these sub-bands have become under utilised. 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 is 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 in Appendix 10 of this handbook. The Radio Regulations, Appendix 18 was updated at ITU WRC-15. While the GMDSS channels are unchanged, new single-frequency channels have been created and more flexibility exists for new digital channels. Additionally, new channels for the testing of new technologies have been provided. Some of these changes came into force from 1 January 2017 and others from 1 January 2019. Administrations are evaluating how the new channels are to be used locally. 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 manufacturers programming, as various notes in Appendix 18 of the Radio Regulations allow for a number of channels to be operated in either simplex or duplex mode.

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 coordinated SAR operations. Ship stations should avoid interference on this channel.

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

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 DSC 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 (Appendix 10 of this handbook). Measures should be taken to minimise 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. AIS Class A and Class B 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 three 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 161.975 MHz and 162.025 MHz are known as AIS 1 and AIS 2 respectively and are used exclusively for AIS.

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

2.4.8 Four digit channel numbering

The channel plan now includes four digit channel numbering for certain channels. It is based on Recommendation ITU-R M.1084-4 Annex 4. This 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 (lower) 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 (higher) frequency.

Channel 2006, introduced at WRC-15, has been designated for experimental use for future applications or systems (eg 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 is yet to be determined.

2.4.9 HF NBDP (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.

WRC-12 has reduced the number of commercial NBDP and morse code channels as these modes are now rarely used. The channels are now used for digital data modes.

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 email over the terrestrial (HF) bands has been developed as a global network, but does not form part of the GMDSS.

2.4.10 GMDSS distress and safety frequencies

The ITU has allocated simplex (ie 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 radiocommunication 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 communication can be established. This in turn greatly influences the use to which the particular radiocommunication 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 antenna may be designed to radiate EM waves omni-directionally (in all directions). Alternatively the radiated EM wave may be formed into a narrow beam by the antenna, which must then be directed in a particular direction in order to establish communication, (eg some Inmarsat equipment employs this type of antenna).

2.5.3 Ground wave and sky wave propagation

Radio waves will radiate from the antenna as:

Surface waves or ground waves — which 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 frequencies, apart from their gain, it is mainly the height of the transmitting and receiving antenna that determine the range over which communication can be conducted.

Sky waves — 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 using HF is conducted in this way. At VHF, UHF and SHF, sky waves are not refracted 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 ionization level of the D region reduces and does not absorb the radio energy at 2 MHz. Therefore radio signals around 2 MHz travel longer distances at night, reflected by the ionosphere.

HF 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 the 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 eg 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 for the distance over which communications are required, the time of day and the season.

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

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 nautical miles, day or night (Note: much greater range is possible at night on 2 MHz)

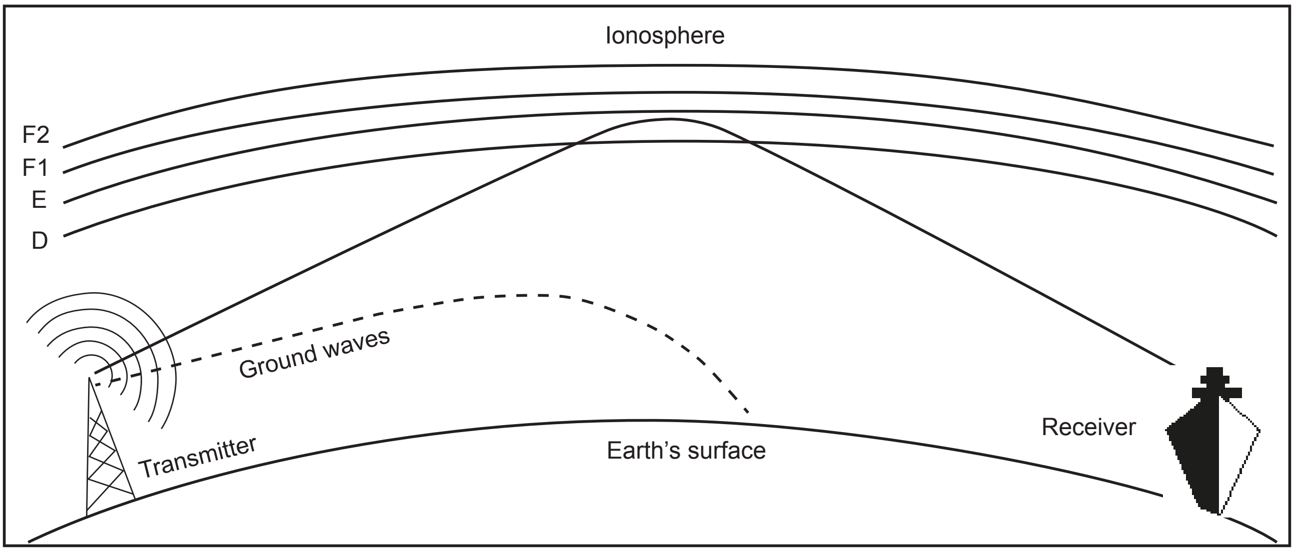


Figure 5 — Propagation of ground waves and sky waves

- use 4 MHz band frequencies for daytime communications with stations at distances greater than 60 nautical miles; or if no response to calls on 2 MHz, and for night-time communications when 2 MHz is unsatisfactory
- use 6 MHz band frequencies for daytime communications when 4 MHz is unsatisfactory, and at night when 2 MHz and 4 MHz are unsatisfactory
- 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 is provided by the Australian Government's (Bureau of Meteorology) IPS Client Support System which is available on line at: www.sws.bom.gov.au (then select 'Products & Services' then select 'AMSA' under 'Client Support').

This system provides hourly frequency coverage charts, referred to as hourly area prediction (HAPs) 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 (ie 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 percent 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 kilometres. 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 main sections:

- the antenna or aerial
- the transmitter and the receiver
- 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
- 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 ship. 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/or 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 or breakers are located 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).

NBDP — telex signals are transmitted over radio. This is not used in Australia.

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 of this handbook.

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, AM and FM which are described below.

2.7.2.1 Amplitude modulation (AM)

This 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 audio signal. 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 (SSB), 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 greater 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.

Due to 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 *Radio Regulations (2016)* Appendix 15.).

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

2.7.2.2 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 (eg 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.

AM and FM are not compatible, even if operating on the same frequency.

Aircraft VHF radios use AM which is why, unless a vessel is fitted with an air-band VHF radio or an aircraft with a marine band VHF radio, they will be unable to communicate using VHF radio.

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 then 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 MSI and distress and safety communications. It is not used on the VHF marine band.

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 two 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.

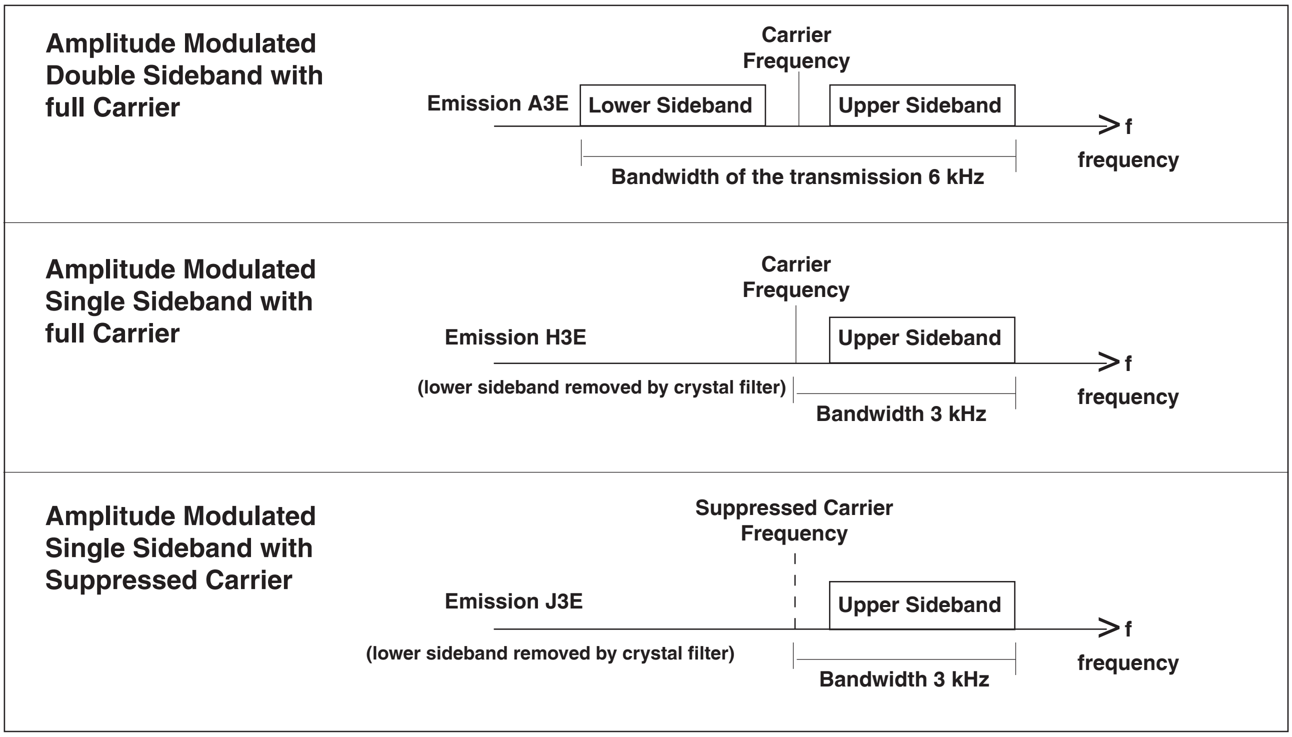


Figure 6 — Various forms of amplitude modulation

Although they work in a similar manner, there are technical differences between VHF and MF/HF DSC systems.

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 use are:

AM – 3 kHz

SSB – up to 3 kHz

NBDP – 304 Hz

MF/HF DSC – 300 Hz

VHF R/T & DSC – 16 kHz

	VHF	MF/HF
Emission Classes	F1B/G2B	J2B/F1B
Bandwidth	16 kHz	300 Hz
Tone separation	800 Hz	170 Hz
Modulation Rate	1200 baud	100 baud

* baud = bits per second

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
- 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
3. The type of information to be transmitted.

For this 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 = Narrow band direct printing (NBDP)

J2B = Digital selective calling (DSC)

F3C = Facsimile (Fax)

A3E = Double sideband (DSB)

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

2.7.7 Australian GMDSS terrestrial network

The Australian GMDSS HF DSC network has remote-controlled stations located at Charleville, Queensland and Wiluna, Western Australia. The stations are controlled from a single manned Network Control Centre (NCC) located in Canberra as shown in Figure 7.

The services provided by the commonwealth are those necessary to meet Australia's GMDSS obligations required under the ITU and SOLAS Conventions.

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 JRCC with all HF sites being unmanned. The sites are linked to the network control centre (NCC) and the JRCC 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 AMSAs GMDSS 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 ships and GMDSS compatible vessels all the high seas weather information, and some of the coastal weather forecasts, provided by the Bureau of Meteorology MF/HF service is also provided via Inmarsat-C EGC. See Appendix 2 of this handbook for details.

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

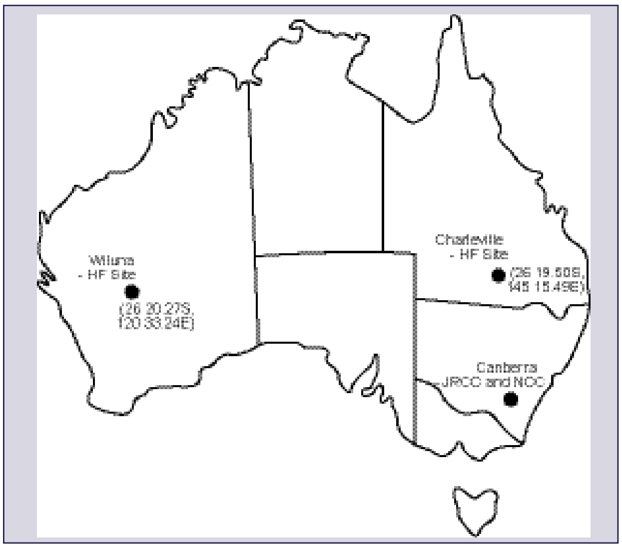


Figure 7 — Australian GMDSS Terrestrial Network

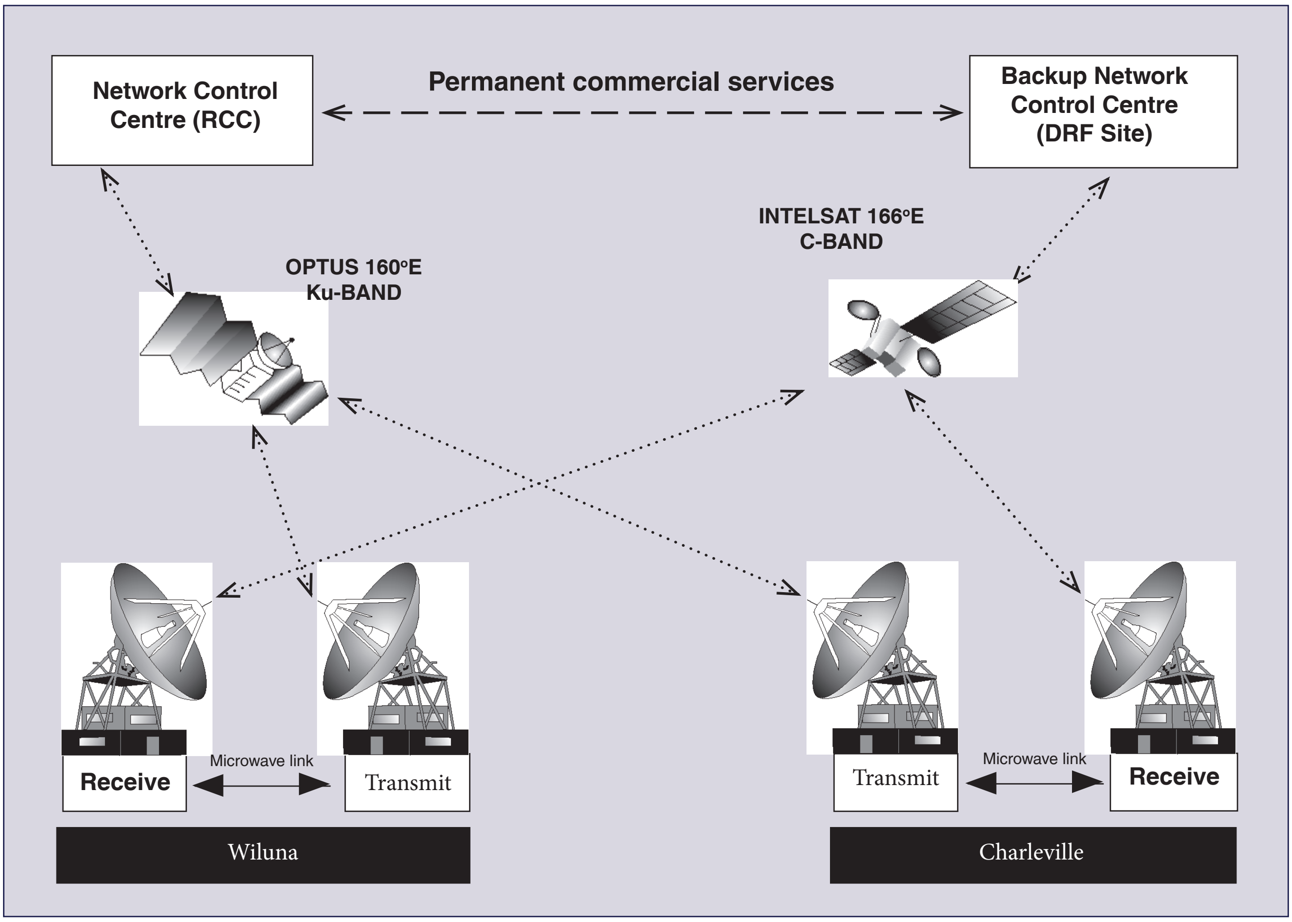


Figure 8 — AMSA HF DSC Network

3 REQUIREMENTS OF MARITIME MOBILE AND SATELLITE SERVICES

3.1 FUNCTIONAL REQUIREMENTS OF SHIPS STATIONS

3.1.1 Regulatory requirements

The GMDSS regulations, as detailed in the SOLAS Convention (see section 1.7 for more details) require that every GMDSS ship shall be capable of 9 core functions, detailed in section 1.7.1.

Equipment performing these functions 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 (ie 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 1 of this handbook, 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 DSC techniques, and the subsequent communications by either radiotelephony or NBDP. Frequencies are also available for commercial traffic and the dissemination of MSI.

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. This is followed by communications via radiotelephony or NBDP on the designated channel as indicated in the DSC message.

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.

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). Although VHF DSC is used primarily for ship-to-ship alerting in Australian waters, some limited coast stations monitor VHF DSC (refer to Admiralty List of Radio Signals, Volume 1). 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. The distress, urgency or safety message will be picked up by ships in the area and by shore stations in range if sent on MF, HF or VHF DSC. It will be picked up by RCCs if transmitted by Inmarsat or satellite distress beacons, and relayed to coast and ship stations as required in these cases.

3.2 EQUIPMENT CARRIAGE REQUIREMENTS FOR SOLAS SHIPS

3.2.1 Introduction

Equipment requirements for GMDSS ships vary according to the area (or areas) in which a ship operates. Coastal ships 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 Chapter IV, regulation 7 of SOLAS):

- a VHF radio installation capable of transmitting DSC on channel 70, and radiotelephony on channels 16, 13 and 6
- a SART (two on ships 500 GT and over, one on ships of 300 GT and upwards but less than 500 GT)
- 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
- a 406 MHz EPIRB (ships 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 radiocommunications 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 Chapter IV of SOLAS. Detailed guidelines when implementing new GMDSS installations on board SOLAS ships should be referred to IMO Circular COMSAR.1/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 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
  - 2 182 kHz using radiotelephony
- **a DSC watchkeeping receiver operating on 2 187.5 kHz.**

AND

a 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***

AND

- 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, 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
  - 2 182 kHz using radiotelephony
- **a DSC watchkeeping receiver** operating on 2187.5 kHz

AND

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

AND

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 4 000 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 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

AND

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.

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 (without an onboard maintainer)

3.3 EQUIPMENT CARRIAGE REQUIREMENTS FOR NON-SOLAS VESSELS

3.3.1 Introduction

As noted in Section 3.2 equipment requirements for GMDSS vessels vary according to the area (or areas) in which a vessel operates. For vessels not subject to the SOLAS Convention, but subject to the *Navigation Act 2012* and required to be GMDSS compatible, equipment 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 Schedule 3 of *AMSA Marine Order 27 (Safety of navigation and radio equipment) 2016*.

3.3.2 On Australian coastal voyages (Sea Area A3)

Option 1

- a VHF radio installation with DSC capability
- a MF radio installation capable of transmitting and receiving for distress and safety purposes on the frequencies:
  - 2 187.5 kHz using DSC
  - 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 SES capable of:
  - transmitting and receiving distress and safety communications using data communications
  - initiating and receiving distress priority calls
  - transmitting and receiving general radiocommunications using either telephony or data communications
  - receiving MSI using EGC
- an approved 406 MHz EPIRB
- a hand held VHF radiotelephone apparatus fitted with VHF channels 6, 13, 16 and 67.

Option 2

- a VHF radio installation with DSC capability
- a 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
- a 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 SES capable of receiving MSI using EGC
- an approved 406 MHz EPIRB
- a hand held VHF radiotelephone apparatus fitted with VHF channels 6, 13, 16 and 67.

3.3.3 On international voyages (Sea Area A3)

Non-SOLAS vessels shall be required to be fitted with, in addition to equipment listed at 3.3.2 above, a NAVTEX receiver when operating in NAVTEX areas.

3.3.4 On voyages in Sea Area A4

- a VHF radio installation with DSC capability
- a 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
- a 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 SES capable of receiving MSI using EGC
- an approved 406 MHz EPIRB
- 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 SHIPS

3.4.1 Types of alerts

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

- **Ship-to-shore alerts** — are directed via Coast Stations and LESs to the nearest Rescue Coordination Centre (RCC). The RCC for the Australian area is located in Canberra, operated by AMSA, and is known as the Joint Rescue Coordination Centre (JRCC). It is connected by landline to the Australian LES 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)
  - 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 DSC. All ships in range will receive the call, range being determined by the frequency band used. In addition, the nearest coast radio station may receive the call depending upon the distance and frequency used.

3.4.2 Methods of sending alerts

Specific methods for sending distress alerts will vary depending upon the ship's area of operation, and are summarised as follows:

Sea Area A1 — ships will transmit a ship-to-ship and ship-to-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.

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

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

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

3.5 WATCHKEEPING ON DISTRESS FREQUENCIES

3.5.1 Requirements

Whilst at sea every GMDSS ship 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 9.3.2)
- for Inmarsat shore-to-ship distress alerts, if the ship is required to be fitted with an Inmarsat SES
- for MSI broadcasts, using the appropriate system(s) with which the ship is equipped (eg NAVTEX, EGC or NBDP).

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

3.5.2 Suggested frequencies for DSC watchkeeping

Table 1 is a guide to channel selection for Australian coastal trading GMDSS ships required to scan HF DSC channels. For those with online 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 ships. For ships equipped with HF, 8 414.5 kHz watchkeeping is also 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)
- 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 18.1).

3.6.2 Battery supply capacity

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

- One hour for ships fitted with an approved emergency generator
- Six hours 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 ten hours and maintaining the charge state must be fitted. Australian GMDSS ships 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 Circular COMSAR/ Circ.16. This is reproduced at Appendix 7 of this handbook.

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

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
- duplication of certain equipment
- 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 administrations. 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 ship 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)
- two complete Inmarsat-C systems
- 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

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
- GMDSS General Operator's Certificate (GOC).

3.8.2 Technical qualifications

The First and Second Class Radio-Electronic Certificates are technical qualifications. They are relevant to personnel aboard GMDSS ships 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
Locked Bag 1399, Launceston, Tasmania, 7250.
Tel: 1300 365 262
Email: amcomm@amc.edu.au.

3.8.3 Non-technical qualification

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

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

3.8.4 Australian *Navigation Act, 2012* operator requirements

An Australian GMDSS ship 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. 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 ship 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 in AMSA *Marine Order 71 (Masters and deck officers) 2014*.

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 (Safety of navigation and radio equipment).

GMDSS requirements are also mentioned in some way in:

- Marine Order 21 (Safety and emergency arrangements)
- Marine Order 25 (Equipment – lifesaving)
- Marine Order 28 (Operations standards and procedures)
- Marine Order 62 (Government vessels).

3.9.2 Annual radio surveys

The SOLAS Convention sets 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 ships 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 ships must be of a type approved by AMSA and/or the eight major class societies; American Bureau of Shipping (ABS), Bureau Veritas (BV), China Classification Society (CCS), Det Norske Veritas Germanischer Lloyd (DNV GL), Korean Register of Shipping (KR), Lloyds Register (LR), Nippon Kaiji Kyokai (NK) and RINA Services SPA, 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 (eg 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 ship. 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 email.

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 20.3.2).

A ship station licence cannot be transferred to another person, business or company. It is the responsibility of the purchaser of a ship 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 ship are not covered by a ship station licence and must be licensed separately. The use of cellular telephones on board ships is authorised by transmitting licences held by the service provider.

Emergency Position Indicating Radio Beacons (EPIRBs) do not require separate licensing 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 ship is loading fuel or when loading or discharging any flammable cargo.

Ships should consult local port or shore terminal guides to verify which equipment cannot be used, or switched to low power, when in port or 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 ship 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 numbers. Call signs for Australian ships participating in the GMDSS are usually assigned 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 GMDSS ships 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 ships 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 ships 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 three digit country identifier.

A Maritime Mobile Service Identity (MMSI) is necessary for DSC operations and will be assigned on application to the JRCC, located in the AMSA 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 safety 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 (see Figure 10). The Inmarsat system provides voice, email, telex, data and facsimile services to shipping. The system also incorporates distress, urgency, safety and routine 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 LES 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.

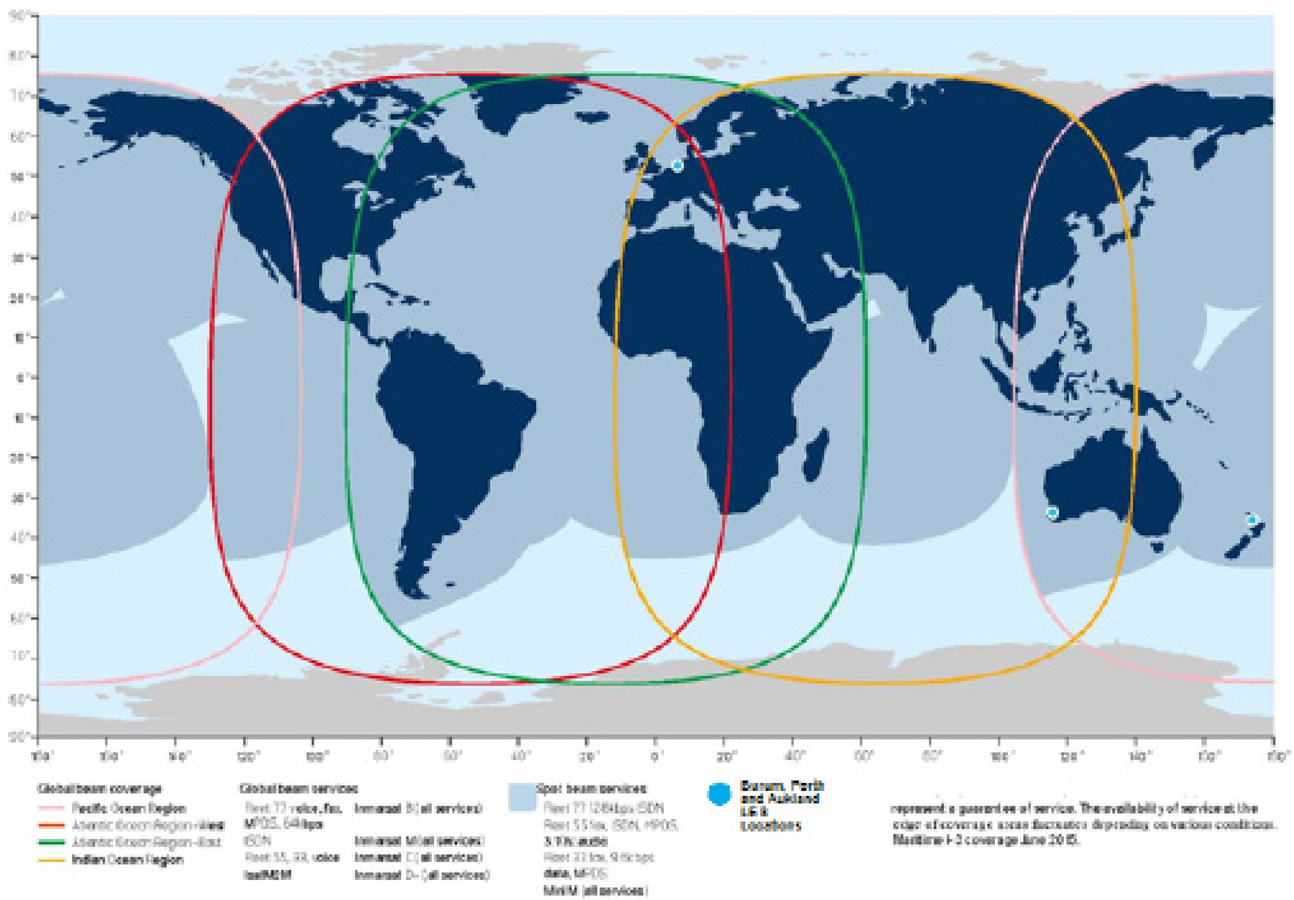


Figure 10 — Inmarsat global coverage applicable to GMDSS
(Image courtesy of www.inmarsat.com)

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

- Pacific Ocean (POR)
- Indian Ocean (IOR)
- Atlantic Ocean East (AOR East)
- 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 coordination 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 signaling channel is also used to broadcast MSI to ships in addressed geographical areas.

The Inmarsat Network Operations Centre (NOC) in London, UK functions around the clock, coordinating the activities of the 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
- data, both real time and store and forward.

4.1.5 Distress facilities

Priority distress facilities exist for both voice and data/messaging. Once the ship 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 coordination centre (MRCC).

4.1.5.1 Dedicated Distress button

Inmarsat GMDSS satellite terminals include a dedicated distress button (DDB), also known as remote distress initiation devices (DIDs), 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 remote distress button (RDB), which can be located remote from the main below deck terminal installation.

4.1.6 Inmarsat services

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

Inmarsat-B — This service was discontinued on 31 December 2016.

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. It 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 and in some countries 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 (see Section 16.4).

Inmarsat FleetBroadband simultaneously provides broadband voice and data using IP (internet protocol), whilst still supporting existing voice and ISDN data and facsimile 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.

FleetBroadband 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 with full priority and pre-emption, as well as short access code dialing, such as 38 — medical assistance and 39 — maritime assistance. A distress test function is also available.

At the time of publication of this handbook, Inmarsat is undergoing IMO evaluation against IMO Resolution A.1002(25) to enable FB safety enabled terminals to become part of the GMDSS.

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

FleetBroadband terminals pending GMDSS approval (at the time of publication of this handbook) are:

> **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.
>
> **FB250** — 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.
>
> **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.

Inmarsat-C — This system is currently the only satellite system required by the SOLAS Convention as a carriage requirement to receive MSI. Inmarsat-C and mini-C terminals support 5 out of 9 communications functions defined by Chapter IV of SOLAS. In addition they also support Ship Security Alert System (SSAS) and LRIT (see Chapter 8 for more detail on LRIT).

Communications via the Inmarsat-C system are data or message-based. Anything that can be coded into data bits, excluding voice, 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 SES 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 alerting and reception of MSI. Mini-C terminals are lower-power terminals than Inmarsat-C with a smaller antenna, smaller in size and with lower power consumption.

Inmarsat-M — this service was discontinued on 31 December 2016.

Inmarsat mini-M — this service was discontinued on 31 December 2016.

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 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	4	C and mini-C
nine	76	Fleet33, 55 and 77 (Voice/9.6 kb/s data)
nine	77	FleetBroadband and FB150, FB250 and FB500

Table 2 — Inmarsat Terminal Numbering

Inmarsat ID numbering must be prefixed with a three digit international country code — 870. Refer to Section 7.1.14 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 LES.

4.1.7 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 MSI for the GMDSS. Australian GMDSS 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 STATIONS IN THE MARITIME MOBILE-SATELLITE SERVICE

4.2.1 Land Earth Stations (LES)

Each Inmarsat ocean region has a number of LESs, 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 Inmarsat 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 Coordination Stations (NCS)

Each Inmarsat ocean region has a network coordination station (NCS) which is responsible for the overall frequency, signaling and traffic management of its respective region. This NCS function is incorporated in one of the LESs. 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 ship.

5.1 INTRODUCTION

A 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 ship's 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 9.3.2). 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
2 187.5 kHz
4 207.5 kHz
6 312.0 kHz
8 414.5 kHz
12 577.0 kHz
16 804.5 kHz
VHF DSC
VHF Marine Channel 70

Table 3 — DSC distress and safety frequencies

5.4 CALL FORMATS

The DSC call sequence is undertaken in nine steps (refer to ITU-R M-493-14):

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.493–14 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
- 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
- all calling sequences to coast stations with format specifier 120 and 123.

5.4.2 Format specifier

The format specifier (summarised in table 4) indicates the type of message (the message format) that is being transmitted. These (numbers in brackets are the applicable ITU symbols) are:

- Distress Alert (112)
- all ships call (116)
- selective call to a group of ships having a common interest eg national or commercial (114)
- selective call to an individual station (120)
- selective call to a group of ships in a geographical area (102)
- 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 format 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.

5.4.4 Category

The category (summarised in Table 4) defines the degree of priority of the call sequence. For a Distress Alert the priority is defined by the format specifier 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):

- Urgency (110)
- Safety (108)
- Routine (100) (see note).

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

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:
110	- urgency
108	- safety
100	- routine

Table 4 — ITU Symbols for DSC Messages

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 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 5.6 in relation to test messages). For Distress Alerts there are four messages, while other calls normally have two (refer to Rec. ITU–R M. 493–14 Section 8).

The distress call message sequence is:

- nature of distress (refer to Table 4)
- 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:

- acknowledge RQ — Call requires acknowledgment. Used for individual and automatic/semi-automatic calls only
- acknowledge BQ — Answer to a Call requiring acknowledgment
- EOS - All other calls.

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.493–14.

5.5 MARITIME MOBILE SERVICE IDENTITY (MMSI)

Each ship and coast station fitted with DSC is allocated a unique nine digit identification number known as an 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 administrations responsible for the station. 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 JRCC 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, though 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 ship 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.

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 ship's MMSI, position, 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.

5.5.1 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, the sequential numbers can be re-used once 9999 is reached.

1 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 (eg. 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 ship.

6 AIS-SARTs are survival craft SAR locating devices which can be carried in lieu of radar SARTs on SOLAS ships from 1 January 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, 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 5 — Australian MMSI formats currently in use

Some DSC controllers offer the user a menu of possible nature of distress situations from which to choose, ie 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 of this handbook).

- **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 16.
- **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 16.

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, 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 Section 17.3.
- **VHF Test** — more modern VHF DSC radios include a TEST call which allow TEST calls to other VHF DSC radios on board ship, other ships and suitably equipped coast stations, who can respond with a TEST acknowledgement. See also Section 17.2.
- **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, Urgency/Safety Announcement or other calls, is a function of VHF DSC equipment.

Unless the function is disabled, a ship's radio channel may automatically switch away from the working channel at an inopportune moment in response to an incoming Distress Alert, 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 manoeuvreing in 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 the latest version of the DSC specification (at the time of publication — Recommendation ITU-R M.493-14 (2016)). 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 DSC Distress 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 2017/10 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 ship, spoken three times
- the call sign or other identification
- the MMSI (if the initial alert has been sent by DSC)
- 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 ship.

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 and 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 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 15s 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 ship'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 6 — 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. 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(s). This system is used to send messages to particular ships that cannot use their transmitters (ship 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 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 of this handbook. 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 ship'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 ship.

7.1 INMARSAT-B/FLEET77 SESs

7.1.1 Inmarsat-B

Inmarsat-B was the digital replacement of Inmarsat-A (which was discontinued 31 December 2007). Inmarsat–B services were discontinued on 31 December 2016.

7.1.2 Inmarsat Fleet77 introduction

Fleet77 (see Figure 11 for a typical installation) 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.

7.1.3 Directional antenna

Due to the range of communications provided by Inmarsat 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 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, roll, yawing and course changes. The latter are assisted by an input from the ship's gyro compass to the stabilisation mechanism.

7.1.5 Above deck equipment

The antenna, stabilization mechanism, antenna control electronics and the UHF transmit/receive equipment are usually referred to as the above deck equipment (ADE). They are usually located in the radome, with a typical all-up mass of about 27 to 150 kg.

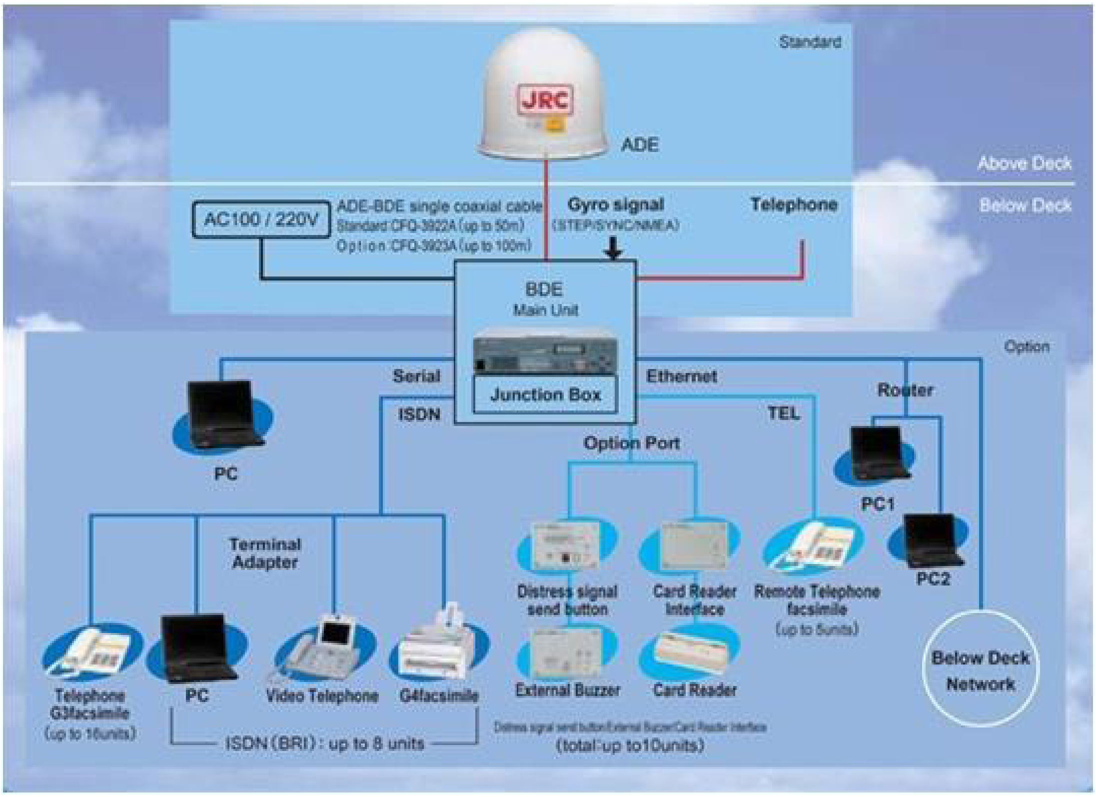


Figure 11 — Typical Inmarsat Fleet 77 installation

7.1.6 Below deck equipment

The below deck equipment (BDE) 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.

7.1.7 Terminal operation

At start up, the operator enters the ship's position and course in 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 be derived from diagrams contained in the ALRS volumes one and five and equipment handbooks. The ship terminal then locks on to the TDM (time division multiplex) carrier, relayed by the satellite from the NCS.

Once the ship antenna has locked on to the satellite, most subsequent operations are performed automatically by the LES and the ship terminal. The equipment automatically tracks the satellite allowing for ship pitch, roll and course changes.

In the event of a shipboard power failure, it is possible that the dish antenna will require repositioning when power is restored. Australian ships should have an uninterruptible power supply (UPS) in order to maintain power to the antenna, so that no re-initialization is required on loss of mains power. IMO Circular MSC Circ.130 (75) requires that no re-initialisation be necessary for an Inmarsat SES after a 60 second loss of power, when changing to the alternative source of supply.

Operators of Inmarsat 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 then rely on auto-acquisition modes, particularly if reflections from the ship's structure are encountered during the search.

7.1.8 Time Division multiplex (TDM) channels

TDM channels are used for sending working channel assignment messages to mobiles from the NCS. These messages advise mobiles to change to other channels for the exchange of communications to and from a LES 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.

7.1.9 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 a 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.

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

7.1.10 Use of Fleet77 equipment in the GMDSS

A Fleet77 SES 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
    - from a source which is independent of the ship's electrical system (see notes 1 and 2 below)
- 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: As the correct stabilization of the dish antenna is dependent on input from the ship's gyro compass, this must also 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 ships.

7.1.11 Radiation hazard

The concentrated beam of radio frequency radiation produced by a Fleet77 antenna can be potentially 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.

If work is to be performed within approximately 7 metres, and at just below or above the level of a 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.

7.1.12 Reception of MSI by Inmarsat

The Inmarsat system provides for MSI to be broadcast to ships using a method known as EGC. Inmarsat–C, mini-C and safety enabled FB terminals can receive EGC, whilst Fleet77 cannot.

7.1.13 LESs offering Fleet77 services

Details of LESs providing 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.

In accordance with IMO Resolution A.707(17) Inmarsat does not charge for distress or urgency communications.

7.1.14 International ocean region codes

Withdrawal of ocean region codes: From 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, eg the Pacific Ocean Region (+872) or Indian Ocean Region (+873). From 1 January 2009, dialing +870 and the Inmarsat Mobile Number (IMN) 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 7 — Ocean Region Codes

7.1.15 International telex service codes

Ship station operators using Fleet77 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-C SESs

7.2.1 Communication capability

Inmarsat–C is a two way data messaging system based on digital technology that enables users to transmit and receive messages ship-to-shore, shore-to-ship and ship-to-ship, 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 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 the message in packets (or bursts) of data. The routine delivery time is dependent on message length but normally is between two minutes and seven minutes. Distress, urgency and safety communications are given priority and broadcast immediately. Once the message is successfully delivered, a delivery notification message will be sent to the mobile.

7.2.2 The Inmarsat–C system

The Inmarsat–C system (see Figure 12 for a typical installation) uses four NCSs, one in each of the ocean regions, to monitor and control communications within that region. The NCSs are linked to LESs by special satellite signaling 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 EGC information to SESs.

However, before Inmarsat–C service is available to a 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 it is 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 LES, perform the necessary change of communication channel and transmit a message through that LES
- 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 MSI (known as SafetyNET) and commercial information (known as FleetNET) using the EGC system are made on the NCS common channel.

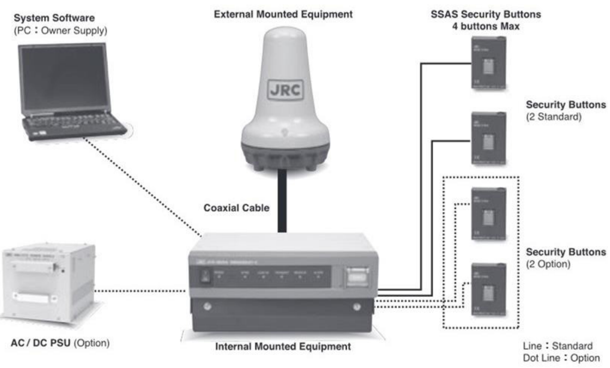


Figure 12 — Typical Inmarsat–C system

7.2.3 Inmarsat-C SES equipment

An Inmarsat–C SES system consists of an antenna, electronics unit, message processor, visual display unit, keyboard and printer. The message processor usually provides a method of storing transmitted and received messages, such as an SD memory card.

Integrated radiocommunications system GMDSS workstations can be connected to computers, provided they are protected against the effects of computer viruses (see IMO Resolution A.811(19)).

Transmitted messages may be prepared by keyboard entry into the text editor or transferred from any other computer in use on board the ship.

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

The Inmarsat–C terminal will provide an audible alert to the watchkeeper when a Distress or Urgent Message is broadcast by EGC.

Facilities are also provided for initiating a Distress Alert from a remote location such as the Master's office or radio room. These facilities are known as remote distress initiation devices (RDIDs) or dedicated distress buttons (DDB). An RDID is required to be fitted to each Inmarsat–C system on board an Australian GMDSS ship.

7.2.4 Omni-directional antenna

Inmarsat–C has an advantage over 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 ship 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 one metre of the antenna which causes a shadow sector of greater than two degrees, will seriously degrade the performance of the equipment.

Obstacles which appear in the fore and aft directions down to five degrees below horizontal, or the port and starboard directions down to 15 degrees below horizontal, may also degrade the performance of the equipment.

7.2.5 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 metre of an Inmarsat–C antenna.

7.2.6 Logging-in procedure

When switched on, it is necessary for the operator of a SES to perform a login 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 EGC 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 SESs will automatically login 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.

7.2.7 Automatic scan and log-in

SES equipment has a facility known as automatic scan and login, 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 logout from the current ocean region, and performs a login 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.

7.2.8 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 logout.

The logout advises the NCS that the SES is no longer operational. This information is passed by the NCS to all LESs. 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.

7.2.9 Interface with ship's navigational equipment

Normally a shipboard Inmarsat–C terminal will be interfaced with the ship'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, ship's position, course and speed must be 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 EGC facility responds to MSI which is relevant to the ship's position.

7.2.10 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 PVT if there is concern about the condition of the equipment.

The PVT 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.

7.3 INMARSAT EGC RECEIVERS

7.3.1 Introduction

The Inmarsat system provides a service known as EGC (Figure 13), which provides the broadcast of information to selected ships in an ocean region. All Australian GMDSS ships carry an EGC facility for the reception of MSI 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 ship. For these reasons, this section will concentrate on the EGC capability of Inmarsat–equipment.

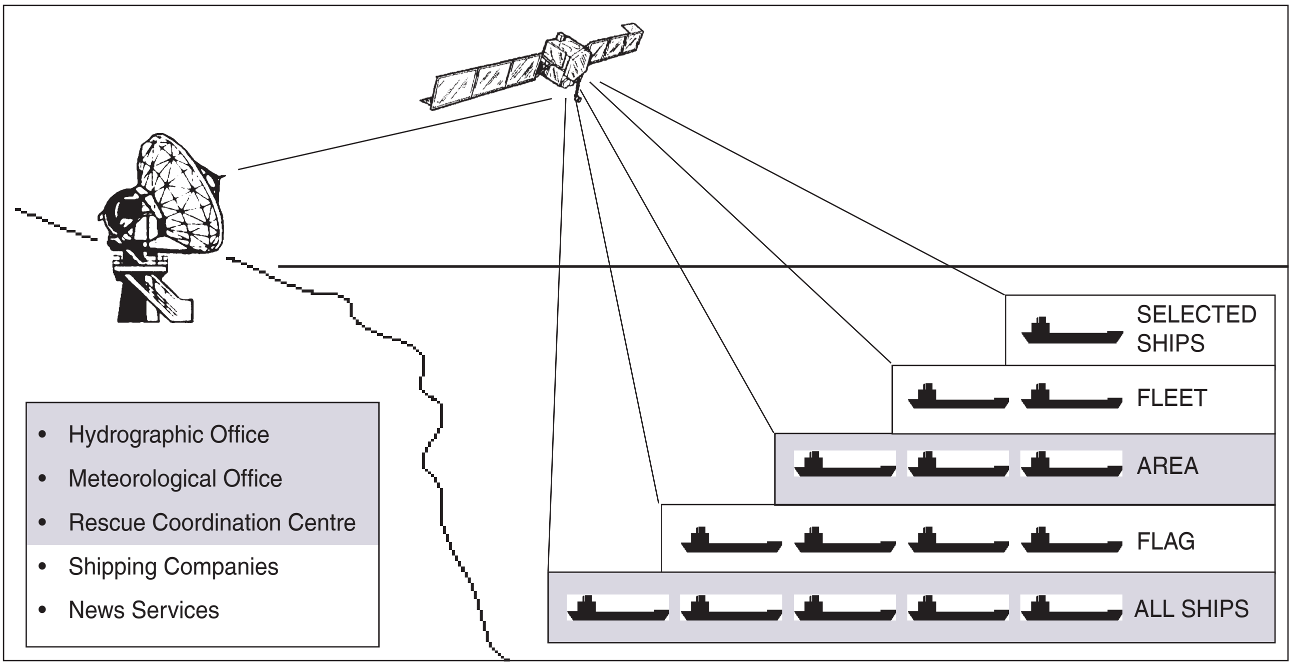


Figure 13 — Basic concept of the Inmarsat Enhanced Group Call system
(the shaded area indicates functions of the SafetyNET service)

7.3.2 Types of EGC service available

Two types of EGC messages are available:

- SafetyNET[1]
- FleetNET[2] .

SafetyNET (Figure 15) — allows information providers authorised by the IMO to broadcast shore-to-ship MSI.

Authorised information providers include:

- Hydrographic offices for navigational warnings (NAVAREA)
- Meteorological offices for weather warnings and forecasts (METAREA)
- RCCs 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 MSI for the GMDSS. Australian GMDSS ships are required to carry an EGC receiving facility.

FleetNET — allows registered information providers to broadcast messages to selected groups of SESs. 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:

- ship-owners for the broadcast of fleet or company information
- news subscriptions services for the broadcast of news bulletins
- Governments for the broadcast of messages to a particular country's ships.

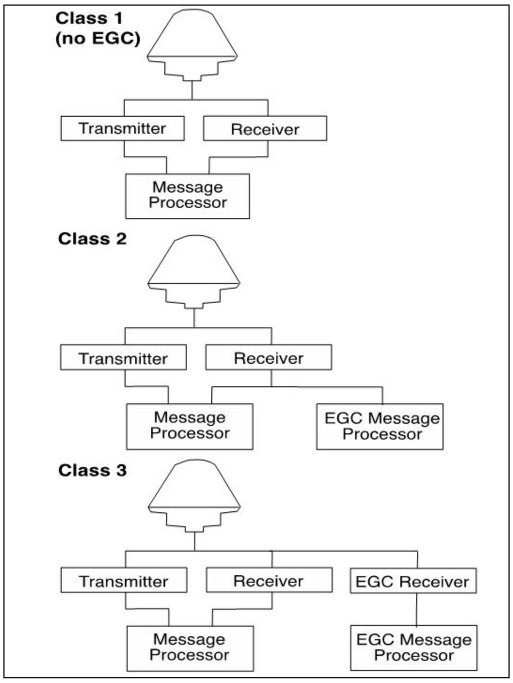


Figure 14 — Classes of mobile earth stations

[1] SafetyNET is a registered trademark of Inmarsat.
[2] FleetNET is a registered trademark of Inmarsat.

7.3.3 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 (Figure 14). Most Australian ships carry Class 2 SES (Figure 14) 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 LES channel and not to the 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 complete, 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 minute 'echo' (ie a repeat) of EGC traffic to allow ships 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. If selected 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 the above 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.

7.3.4 Broadcasts of EGC messages

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

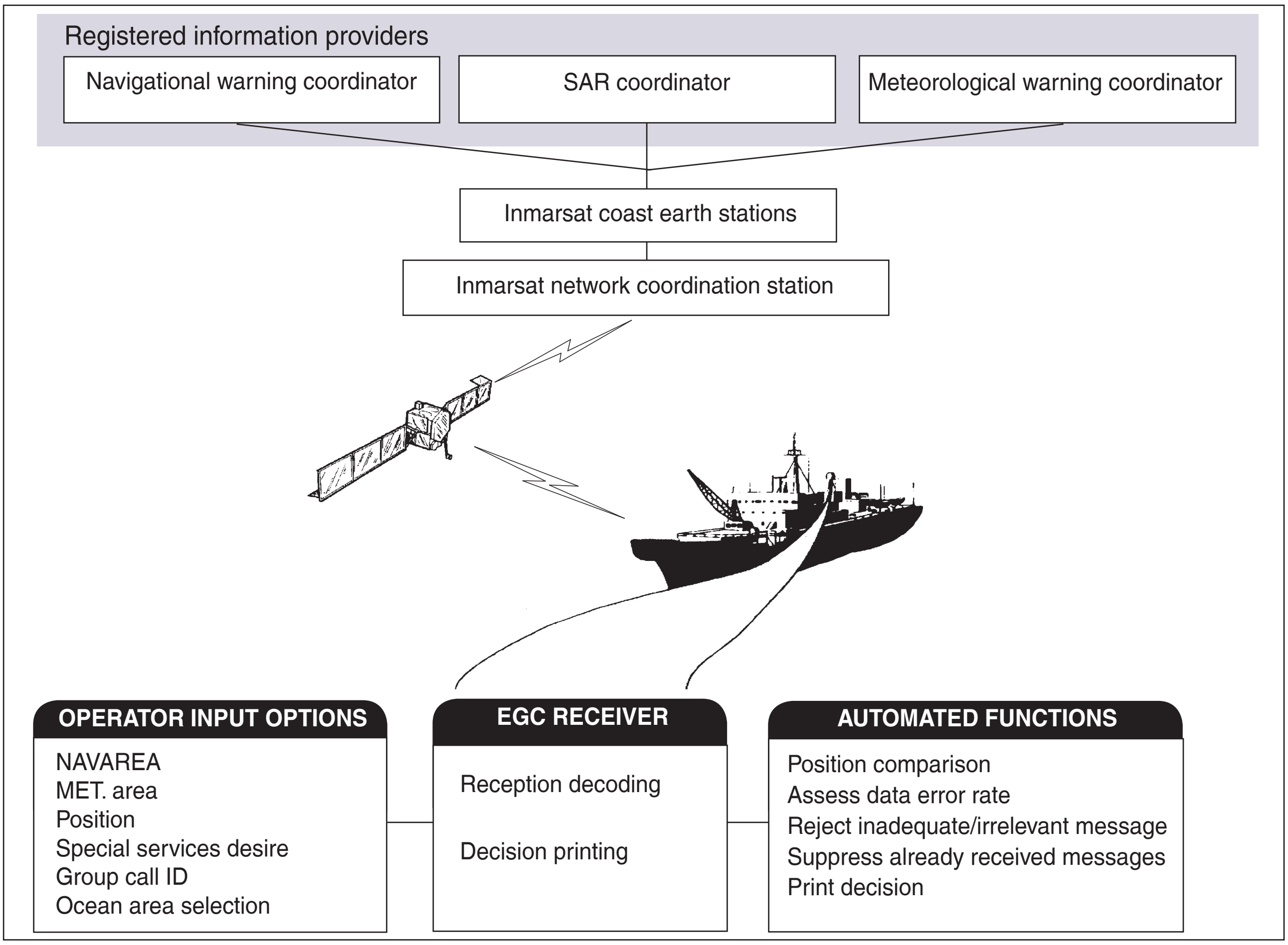


Figure 15 - International SafetyNET Service System Concept

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
- 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.

7.3.5 Broadcasts of SafetyNET information

Information providers of MSI 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 ships 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 hours will result in the EGC receiver accepting all MSI for the entire ocean region, regardless of the ship's position.

7.3.6 Coastal warning service using EGC

In the GMDSS, weather and navigational warnings for coastal areas may be broadcast by two different methods:

- by the Inmarsat SafetyNET EGC service
- by a short range system known as NAVTEX.

The systems are different and should not be confused.

Administrations will decide which of the two systems provide the most efficient method of promulgating this information for their area of responsibility.

As Australia does not provide NAVTEX services, any references to NAVTEX in Australia should 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.

7.3.7 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 RCC. 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 and must be reset manually.

7.3.8 Further information

Further information explaining how mariners can use the Inmarsat–C SafetyNET system and obtain MSI are available at: http://www.inmarsat.com/wp-content/uploads/2013/10/Inmarsat_SNET_Handbook_5th_Edition.pdf

In addition, a useful resource for Inmarsat information can be found at: http://www.inmarsat.com/service/maritime-safety/.

8 LONG RANGE IDENTIFICATION AND TRACKING (LRIT)

The LRIT system provides for 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 SOLAS Convention, Regulation 19-1.

LRIT came into force on 1 January 2008, with compliance being required by 30 June 2009. AMSA *Marine Order 21 (Safety and emergency arrangements) 2016* gives effect to LRIT.

LRIT is a maritime domain awareness (MDA) initiative to allow member states to receive position reports from ships operating under their flag, ships seeking entry to a port within their territory, or ships operating in proximity to the state's coastline.

MDA offers a range of benefits including security, environment, safety and SAR benefits.

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

- all passenger ships, including high speed craft
- cargo ships, including high speed craft, of 300 gross tonnage and above
- mobile offshore drilling units.

Ships operating exclusively in Sea Area A1 and fitted with AIS are exempt. 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
- 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 six hours) to a national data centre or to a cooperative or regional data centre nominated by the Maritime Administrations Flag Register (the 'Flag').

Australia has contracted the services of a commercial data centre provider — PoleStar Global (www.polestarglobal.co). Australian registered ships to which the LRIT regulation applies work with Polestar directly to ensure their six hourly reports are received and forwarded to the International Data Exchange.

Platforms that have been identified as suitable for LRIT include Inmarsat–C, Inmarsat mini–C, Inmarsat–M2M and Iridium. The majority of ships required to participate in LRIT are already fitted with compatible Inmarsat–C systems.

8.1 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, and in other cases 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 hours 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 four 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 or 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 are annual conformance testing requirements.

AMSA has approved four ASPs:

- Pole Star Space Applications Ltd
  www.polestarglobal.com
- Fulcrum Maritime Services Ltd
  www.fulcrum-maritime.com
- Securewest International Incorporated
  www.securewest.com
- Collecte Localization Satellites
  www.cls.fr

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)
- LRIT exemption certificate, issued by AMSA.

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

9 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 ship.

9.1 MF/HF TRANSCEIVERS

9.1.1 System overview

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

- **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
- **Transceiver Unit** — contains the transmitter and receiver electronics and control circuitry
- **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 metres apart.

9.1.2 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
- 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.

9.1.3 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.

9.1.4 Emission class

The equipment provides controls for selection of the mode of transmission (see Section 2.7). SSB operation is usually referred to as USB (upper sideband) or J3E, NBDP and DSC by either F1B, J2B or Telex.

9.1.5 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.

9.1.6 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.

9.1.7 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.

9.1.8 RF gain control/AGC

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

9.1.9 Output power control

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

9.2 VHF TRANSCEIVERS

9.2.1 System overview

VHF transceivers are commonly integrated into one unit which contains all controls and electronics. The transmitters and receivers fitted within 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.

9.2.2 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 Sections 2.7.4 and 3.5.2).

9.2.3 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 volume level of the loudspeaker. For equipment fitted with telephone-style handsets, the earpiece volume is often fixed and cannot be altered.

9.2.4 Squelch control

The squelch 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 that in which the hiss or roar cannot be heard — but only just. Further operation of the control beyond this point will progressively de–sensitise the receiver.

9.2.5 Output power control

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.

9.2.6 Dual watch control

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

9.2.7 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.

9.3 WATCHKEEPING RECEIVERS

9.3.1 Introduction

The GMDSS regulations require that ships at sea continuously monitor certain distress frequencies whilst at sea. 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.

Watchkeeping receivers are fitted with their own dedicated antennas.

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

9.3.2 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 two 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.

9.3.3 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.

10 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 operating instructions, please refer to the equipment operator's manuals carried on board your ship.

10.1 EPIRBS

10.1.1 The EPIRB system

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, many 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 nautical miles.

EPIRBs can also transmit a GNSS position, provided it is fed from an internal or external GNSS device. These are not mandatory on GMDSS ships.

10.2 THE COSPAS–SARSAT SYSTEM

10.2.1 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

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 Organisation (ICAO) and the 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 (LUTs), and data distribution centres, known as mission control centres (MCCs)
- 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 ALRS Vol. 5 and at: http://www.cospas-sarsat.int.

10.2.2 Description of the system

Search and rescue instruments provided by Canada and France are payload 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 operate on the 406 MHz frequencies and may transmit on 121.5 MHz for homing purposes. 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 registration data and additional information to be linked to each beacon. After receipt of ELT, EPIRB or PLB signals the satellite relays the signals to a 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.

10.2.2.1 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

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

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 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 14.2 of this handbook for more information on the IAMSAR Manual).

10.2.3 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 satellites track. This ambiguity is resolved with a subsequent satellite pass.

The frequency time plot (Doppler curve) in Figure 16 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 the two possible locations for the transmitter, one being the actual location and the other being its mirror image. See figure 17.

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's rotation when computing the Doppler solutions. However, this ambiguity resolution technique is dependent upon the stability of the transmitted frequency.

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 probability 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.

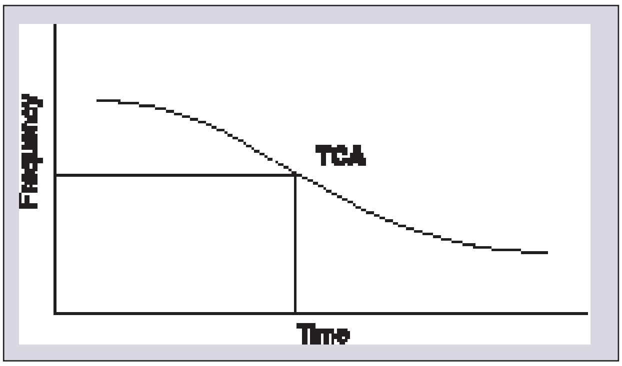


Figure 16 — Doppler Curve

10.2.4 System overview

A system overview is presented in figure 18.

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 (Figure 20), while satellites in GEO and their corresponding ground receiving stations constitute the GEOSAR system (figure 21). Figure 19 shows the relationship between the LEOSAR and GEOSAR orbits.

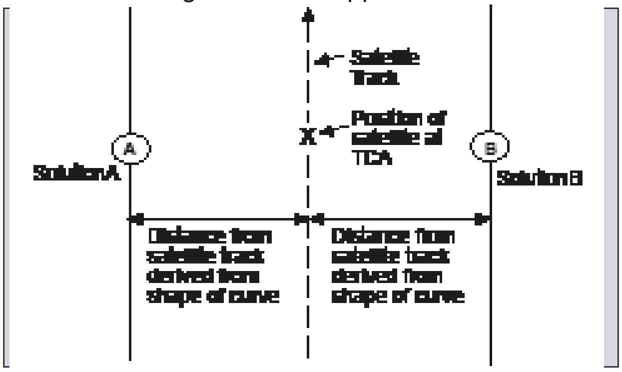


Figure 17 — Doppler Mirror Positions

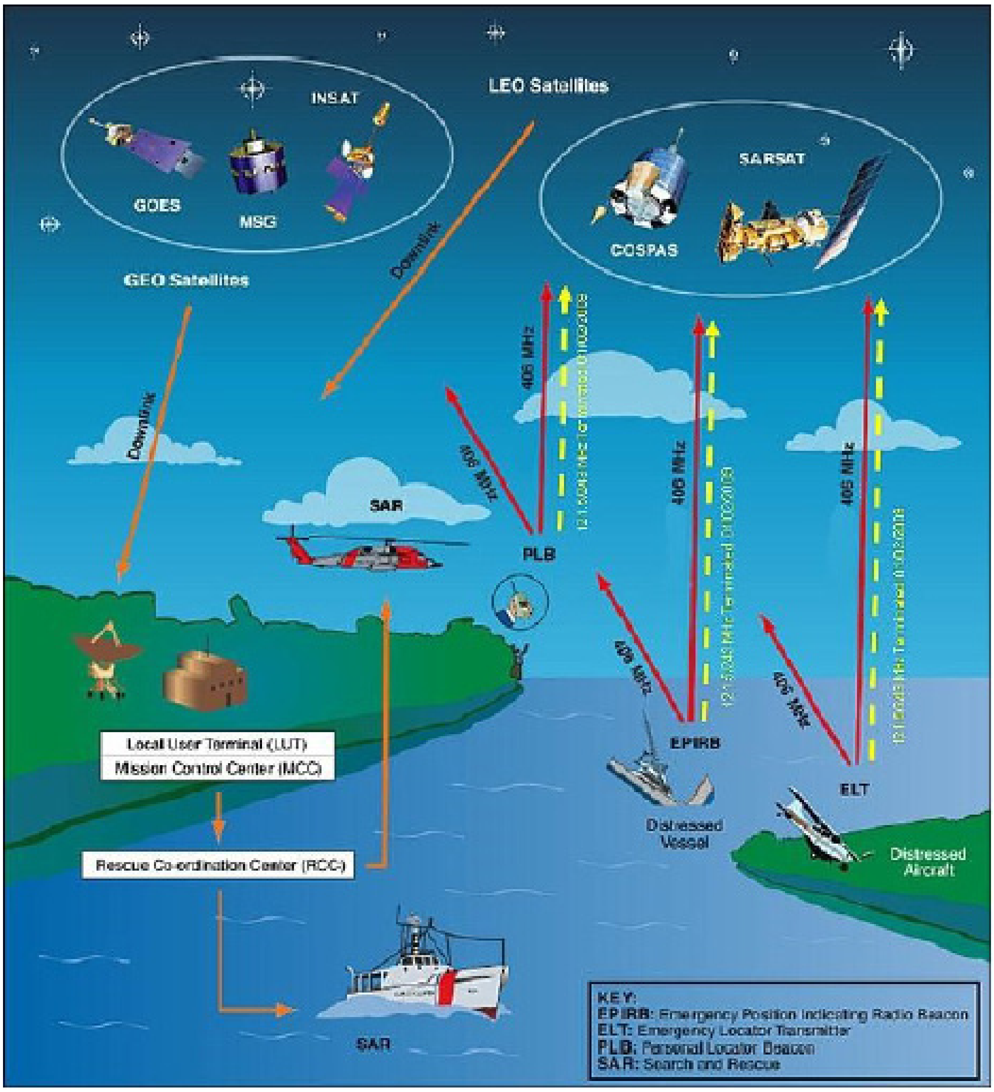


Figure 18 — Basic concept of the Cospas–Sarsat system

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
- high system capacity.

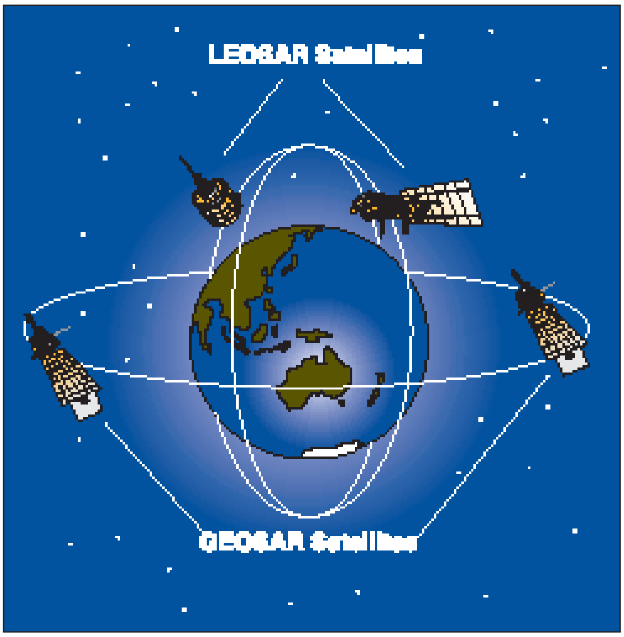


Figure 19 — LEOSAR and GEOSAR satellites

The satellites in the two types of orbit are considered complementary. While the GEO 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.

Cospas–Sarsat estimates that approximately two million (December 2016) 406 MHz distress beacons are currently in use worldwide. While many of those beacons are carried by aircraft and 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 the Convention applies to. A Cospas–Sarsat EPIRB operating at 406 MHz can be used to comply with IMO requirement that ships covered by the SOLAS Convention carry an EPIRB.

10.2.5 New developments

10.2.5.1 Space segment

The International Cospas–Sarsat Programme initiated the development of the Medium–altitude Earth Orbiting Satellite System for Search and Rescue (MEOSAR system) in 2004, with SAR repeaters placed on the satellites of the Global Navigation Satellite Systems (GNSS) of Europe (Galileo), Russia (Glonass) and the USA (GPS).

Once fully operational, the MEOSAR system will offer the advantages of both LEOSAR and GEOSAR systems without their current limitations by providing transmission of the distress message, and independent location of the beacon, with a near real time worldwide coverage.

The MEOSAR system will also facilitate other planned enhancements for Cospas–Sarsat beacons, such as a return link transmission that will allow the beacon to provide to the user a confirmation that the distress message has been received.

The large number of MEOSAR satellites that will be in orbit when the system is fully operational will allow each distress message to be relayed at the same time by several satellites to several ground antennas, improving the likelihood of detection and the accuracy of the location determination.

Full operational capability of the system is anticipated in 2018. MEOSAR will initially complement the existing LEOSAR and GEOSAR systems, and will eventually replace the LEOSAR system.

10.2.5.2 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 GEO 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 equipped, but it may take up to 5 hours, depending on the conditions. Considering that EPIRBs can be deployed from small survival craft in poor sea conditions, from a search and rescue perspective GPS–equipped EPIRBs are recommended.

10.2.5.3 121.5 MHz satellite alerting phased out

121.5 MHz distress beacons had serious limitations and utilised outdated technology. They were the source of a large number of false alerts, and the absence of identification information significantly increased 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.

10.2.5.4 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.

An anticipated 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, has led Cospas–Sarsat to prepare a comprehensive frequency management plan.

10.2.6 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.

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).

Australian users are required to register their beacons at www.amsa.gov.au.

10.3 AUSTRALIAN AND NEW ZEALAND COSPAS-SARSAT GROUND SEGMENT

AMSA has established LEOLUTs at Albany, Western Australia and Bundaberg, Queensland. These LEOLUTs are connected to the MCC at the JRCC in Canberra. New Zealand has established a LEOLUT and two GEOLUTs in Wellington, which are also linked to the MCC in Canberra.

The LEOLUTs/GEOLUTs 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 20 and Figure 21).

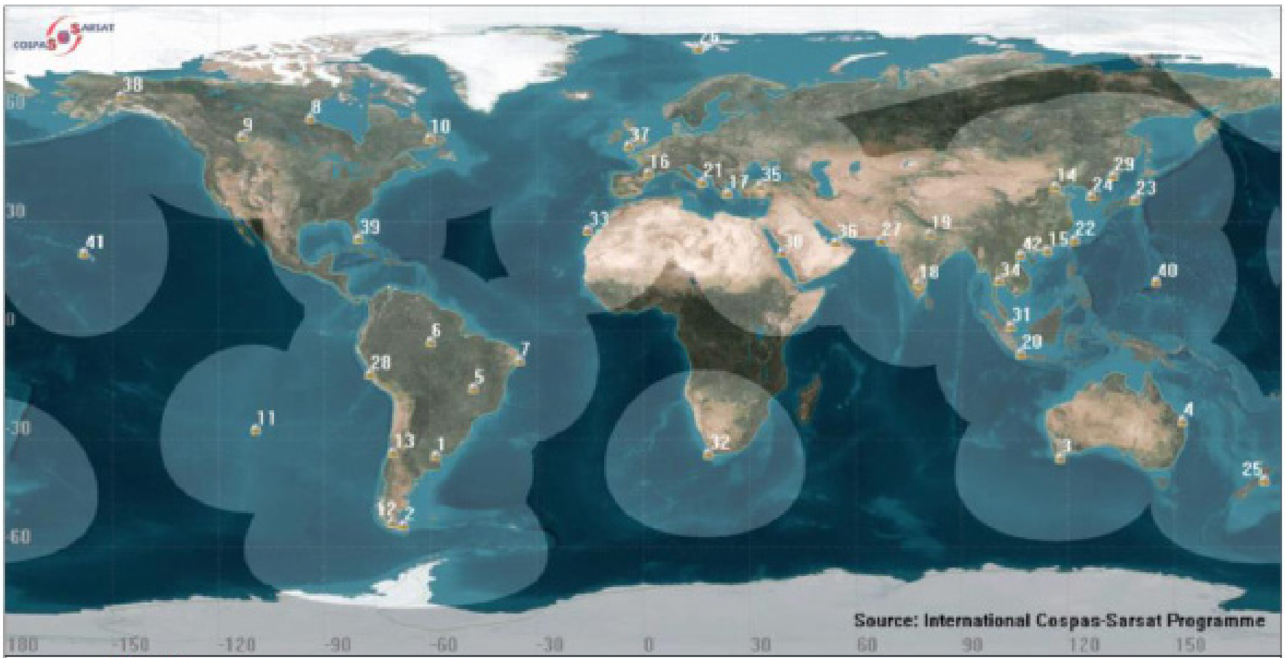
The Australian MCC is located within the JRCC in Canberra, however some MRCCs are located remotely from their associated RCC.

10.4 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, LUT's 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 website: www.amsa.gov.au and a copy is provided in section A9.1 of this handbook. 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*

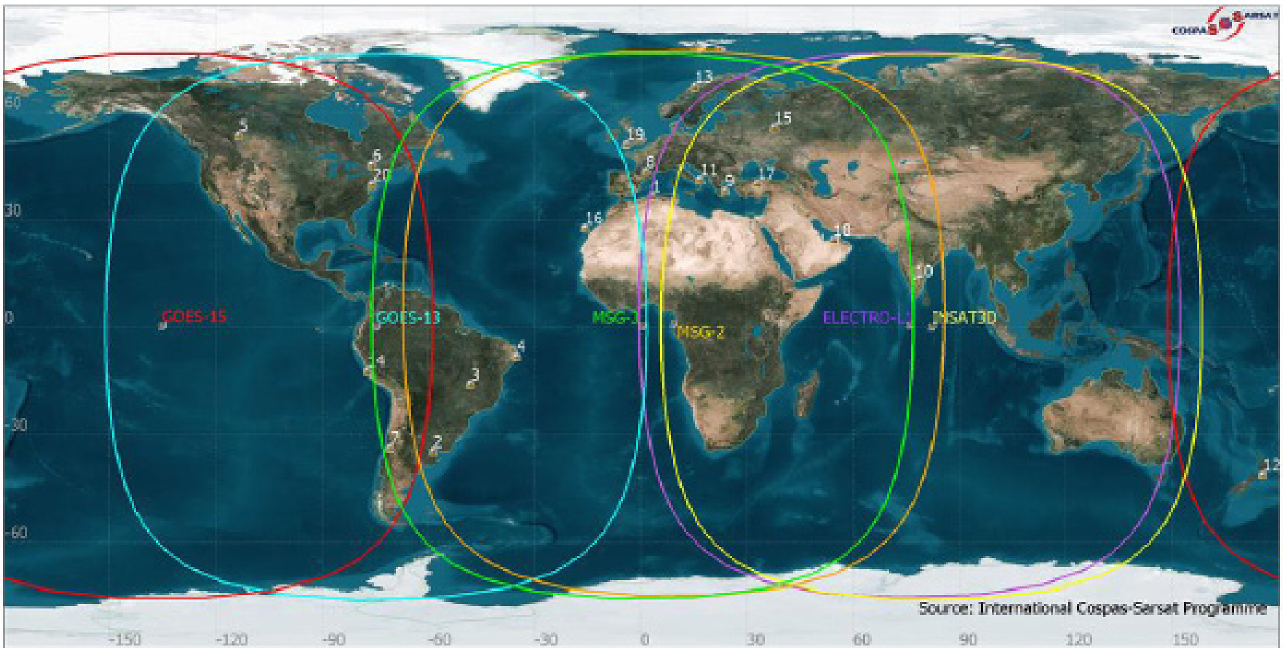


LEOLUTs

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

Notes: * These LEOLUTs are dual systems
This map was created assuming a satellite altitude of 850 km with a 5° elevation angle at each LEOLUT.
This map, courtesy of www.cospas-sarsat.int, is valid as of April 2017

Figure 20 — 406 MHz LEOSAR Satellite Coverage and LEOLUTs



1 - Algiers, Algeria (MSG-3)[1]
2 - El Palomar, Argentina (GOES-East)
3 - Brasilia, Brazil (GOES-East)
4 - Recife, Brazil (GOES-East)
5 - Edmonton, Canada (GOES-West)
6 - Ottawa, Canada (GOES-East)
7 - Santiago, Chile (GOES-East)
8 - Toulouse, France (MSG-3)
9 - Penteli, Greece (MSG-2)
10 - Bangalore, India INSAT-3D)
11 - Bari, Italy(MSG-3)
12 - Wellington (1), New Zealand (GOES-West)
12 - Wellington (2), New Zealand (Louch-5A)[2]
13 - Fauske, Norway (MSG-3)
14 - Callao, Peru(GOES-West)
15 - Moscow, Russia (Electro-L No.1)
16 - Maspalomas (1), Spain (GOES-East)
16 - Maspalomas (2), Spain (MSG-3)
17 - Ankara, Turkey (MSG-2)
18 - Abu Dhabi, UAE (MSG-3)
19 - Combe Martin, UK (MSG-3)[3]
20 – Maryland (1), USA (GOES-East)
20 – Maryland (2), USA (GOES-West)

[1] Not in commission
[2] Undertest with Louch-5A; GOES-West used as a standby satellite when needed
[3] GOES-East used as a standby satellite when needed
This map, courtesy of www.cospas-sarsat.int, is valid as of April 2017

Figure 21 — 406 MHz GEOSAR Satellite Coverage and GEOLUTs

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.

A fine may result if a beacon owner cannot prove current beacon registration. 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 in Australia on 1800 406 406 (business hours), internationally on +612 6279 5766 or via email at ausbeacon@amsa.gov.au.

10.5 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 and/or civilian aircraft with specialised direction finding equipment will be used to locate the EPIRB. All Cospas–Sarsat beacons fitted to Australian ships also radiate on the 121.5 MHz to allow this final homing by search aircraft.

10.6 EPIRB REQUIREMENTS FOR GMDSS SHIPS

Marine Orders 25 and 27, made under the *Navigation Act 2012*, require that every Australian GMDSS ship 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 (Resolution A.810(19)) states the following:

- The satellite EPIRB should:
  - be fitted with adequate means to prevent inadvertent activation
  - be so designed that the electrical portions are watertight at a depth of 10 metres for at least 5 minutes. 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 metres
  - 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), active during darkness, to indicate its position to nearby survivors and to rescue units
  - not be unduly affected by seawater, 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 hours.

- 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
  - after stowage, at temperatures between
  - -30ºC and +70ºC.
- The installed satellite EPIRB should:
  - 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 metres at a list or trim of any angle
- When the satellite EPIRB is manually operated a distress alert should be initiated only by means of a dedicated distress alert activator.
- The dedicated activator should:
  - be clearly identified
  - be protected against inadvertent operation.
- Manual distress alert initiation should require at least two independent actions.
- The satellite EPIRB should not be automatically activated after being manually removed from the release mechanism.
- EPIRBs, when taken to survival craft, are designed to:
  - be tethered to the survival craft by the tether provided
  - float upright in the water
  - use the sea as a 'ground plane' for its antenna.

10.6.1 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. Class 3 is an Australian/New Zealand standard (AS/NZS 4280.1) category for manually activated, non-float free EPIRBs. Although not required to be individually registered to a ship like the distress beacons carried on SOLAS ships, each beacon has a unique manufacturers' serialised number. Life raft servicing agents advise AMSA of the Class 3 beacons in the life rafts of each particular ship, to aid in the event of search and rescue activities.

10.7 406 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
- 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.

10.8 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 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 ships 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
- 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 ship must immediately advise the MRCC for their area of operation.

If this is unknown, then report the occurrence to JRCC 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 ship when the beacon was known to be activated
- the make and model of the beacon
- 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.

10.9 SERVICING AND TESTING OF 406 MHZ EPIRBS

Marine Order 27 (Safety of navigation and radio equipment) 2016 require 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
- 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

10.9.1 EPIRB DISPOSAL

When an EPIRB needs to be disposed of, for any reason, it should be made inoperable and disposed of correctly. Some reasons for disposal maybe:

- EPIRB is damaged
- Ship sold for scrap
- EPIRB replaced, etc.

The most effective method to disable an EPIRB is to remove the battery. Alternatively, it can be returned to the manufacturer for disposal.

Note: If the EPIRB is returned to the manufacturer, it should be wrapped in tin foil to prevent transmission of signals during shipment (extract from IMO Resolution A.814 (19)).

10.10 TERMINATION OF INMARSAT –E/E+ EPIRBS

The Inmarsat–E or E+ EPIRB (also known as an L band EPIRB) used the Inmarsat geostationary satellite system. Due to the high cost of maintaining a system that had not been widely used as an element of the GMDSS, this service was discontinued from 1 December 2006. IMO Circular MSC/Circ. 1171 refers.

10.11 VHF DSC EPIRBS

10.11.1 Carriage of VHF DSC EPIRB in lieu of satellite EPIRB

The GMDSS regulations allow ships trading exclusively within Sea Area 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 DSC. In order that it may be located by searching vessels and aircraft the EPIRB must also be capable of transmitting X-band radar locating signals.

No VHF DSC EPIRBs have been produced. They are being removed from the GMDSS regulations.

10.12 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 SAR aircraft or suitably equipped ships.

These devices have yet to be brought into service, although an international numbering format for the numerical identities (MMSI) to be used has been agreed (974xxyyyy), as has the associated text to be transmitted by the AIS transmitter in active (EPIRB–ACTIVE) or test (EPIRB-TEST) modes.

11 SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS)

11.1 WHAT IS AIS?

AIS is included in the SOLAS Convention, and certain ships began fitting AIS in July 2002. AIS, automatically and at set intervals, transmits;

- dynamic information relating to the ship's:
  - Course
  - Speed
  - Heading
- static information related to the ship's:
  - name
  - length
  - breadth
- voyage-related details such as:
  - destination
  - cargo information
  - navigational status (eg underway or at anchor).

The AIS is a data exchange system that transfers packets of data over the VHF data link (VDL). It enables AIS equipped vessels and shore-based stations to send and receive identification and other information that can be displayed on a navigational display.

When used with appropriate graphical displays, this information can help in situational awareness, and provide a means to assist in collision avoidance.

AIS units are often interfaced to radars and electronic chart display and information system (ECDIS) displays. When interfaced to a radar, AIS provides a source of target information, additional to that provided by ARPA (Automatic Radar Plotting Aid).

AIS can be fitted to physical aids to navigation (AtoN) 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 (eg. 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 may be considered part of the GMDSS due to the advent of AIS–SARTs (AIS Search and Rescue Transmitters). Since 1 January 2010, these can be used in lieu of Radar SARTs.

AIS transceivers on ships also have a simple text communications capability called short safety related messaging (SSRM) using the VHF maritime mobile band. This does not constitute a distress alerting system.

11.2 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.

11.2.1 Classes of AIS

There are two classes of shipborne AIS:

AIS Class A — Class A has been mandated by the IMO for ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and all passenger ships (more than 12 passengers) irrespective of size, i.e. all SOLAS ships.

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

11.2.2 Types of AIS

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 Base Station — Base stations are established 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 a navigational display.

AIS-SART — Search and rescue transmitters using AIS can be used to assist with homing in to the location of a vessel or life raft as part of the 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 or 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	

Table 8 — Types of AIS stations and MMSI format

11.3 HOW IT WORKS

AIS works in an autonomous and continuous mode no matter where the vessel is located. AIS uses a time-division multiple access (TDMA) scheme to share the common VHF frequency.

There are two dedicated frequencies used for AIS: AIS 1(161.975 MHz) and AIS 2 (162.025 MHz). Each frequency of the VDL is divided into 2 250 time slots that are repeated every 60 seconds, and accurately synchronised using GNSS timing information.

AIS units transmit packets of information in these slots. At the same time, other AIS units in range are listening to the timeslots and can receive the information.

Each station determines its own transmission slot, based on historical data link traffic and knowledge of future actions by other stations. A position report from an AIS station fits into one or more slots (some messages require more than one slot), as shown in figure 22.

For example, the system operates by a ship determining its geographical position with a GNSS device which is fed into, or integral to, the AIS. The AIS station then transmits this and other information via the VHF radio link, to other AIS equipped ships and 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 27 identified AIS message types (see Table 9 on page 65 for message types).

There are different technical means of transmitting in these slots.

- AIS class A uses a self-organised approach (STDMA or SOTDMA)
- AIS class B units may use a carrier-sense approach (CSTDMA) or SOTDMA
- AIS base stations use fixed slots (known as FATDMA)
- AIS AtoN have an option to use FATDMA or a random access process called RATDMA, depending on the type of unit.

11.4 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
- as a VTS tool, ie 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

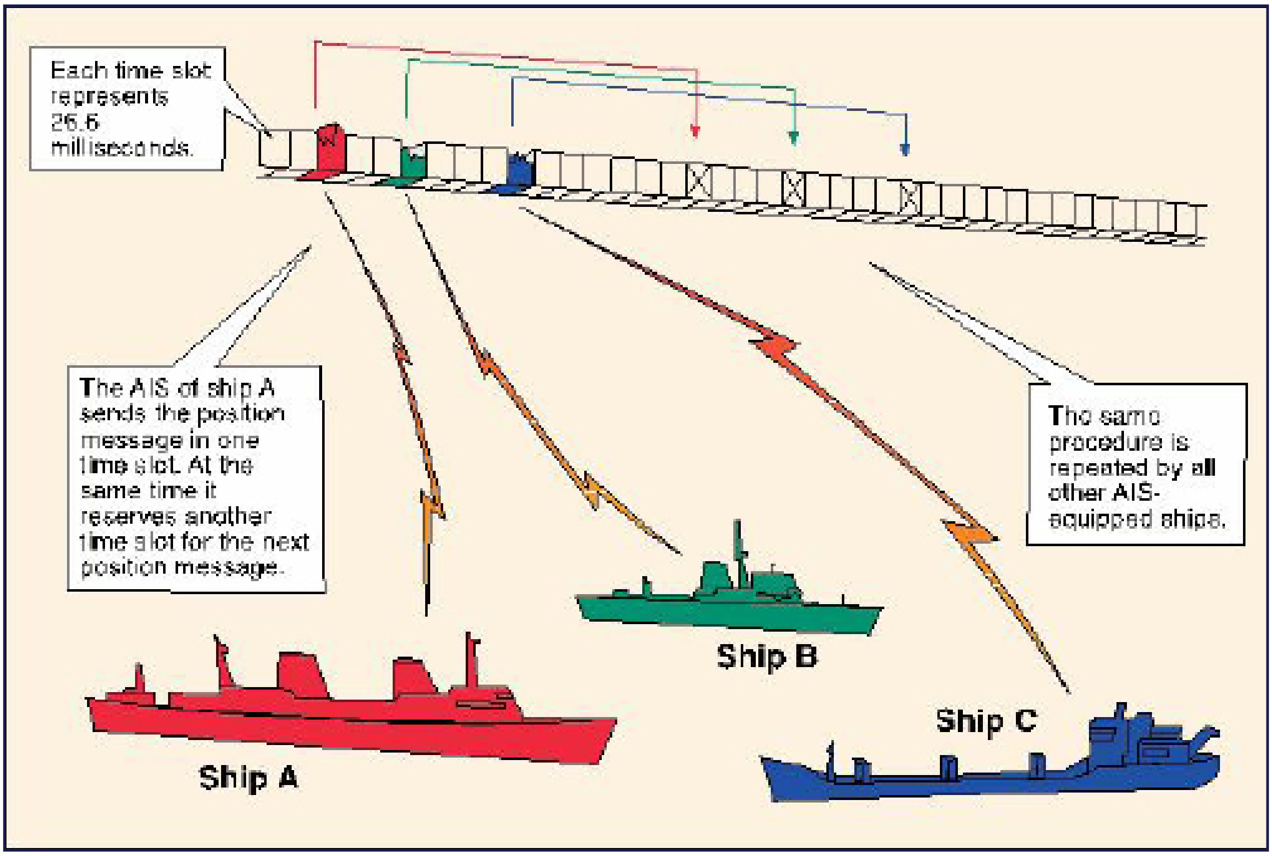


Figure 22 — Principles of SOTDMA

- 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
- providing positional and manoeuvreing information at a data rate adequate to facilitate accurate tracking by a competent authority and other ships.

11.4.1 Main component parts of a class A shipborne AIS station

GNSS receiver — A GNSS receiver provides positional information. Additionally it supplies the time reference for the AIS station to ensure all transmissions are synchronised.

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, which interconnect the AIS station to each other. Data is transmitted and received in short time slots (26.6 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 vertically polarised 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 practical to minimise 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 BIIT controls the integrity and 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
- 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, ie 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
  - Ship's call sign, name, length and beam
- display safety related messages
- input safety related messages.

11.5 MESSAGE TYPES AND FORMATS

AIS employs the principle of using a ship's speed and rate of turn as a means of governing information update rates and ensuring the appropriate levels of positional accuracy for ship tracking. This is shown in Table 9. 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 different time periods and thus require a different update rate.

Information in the various message types includes:

- Static information: Every six minutes and on request:
  - MMSI
  - IMO number (where available)
  - call sign and name
  - length and beam
  - type of ship
  - location of the position–fixing antenna on the ship (aft of bow/port or starboard of centerline)
- dynamic information: Dependent on speed and course alteration (see Appendix 8 of this handbook):
  - 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)
  - rate of turn (where available)
- Voyage–related information: every 6 minutes, when data is amended or on request:
  - ship's draught
  - hazardous cargo (type)
  - destination and ETA (at Master's discretion)
  - route plan (waypoints)
- short safety related messages
- free–format text message — sent as required.

11.6 DISPLAY REQUIREMENTS

If there is navigational equipment capable of processing and displaying AIS information such as ECDIS, radar or an integrated navigation system, then the AIS Class A mobile station 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 provide text and/or basic graphic display elements.

The revised IMO radar performance standards (IMO Resolution MSC.192 (79)), 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 ECDIS, it is unlikely that the MKD will evolve.

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	
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 9 — AIS Message IDs

*M = transmitted by mobile,

*B = transmitted by base station

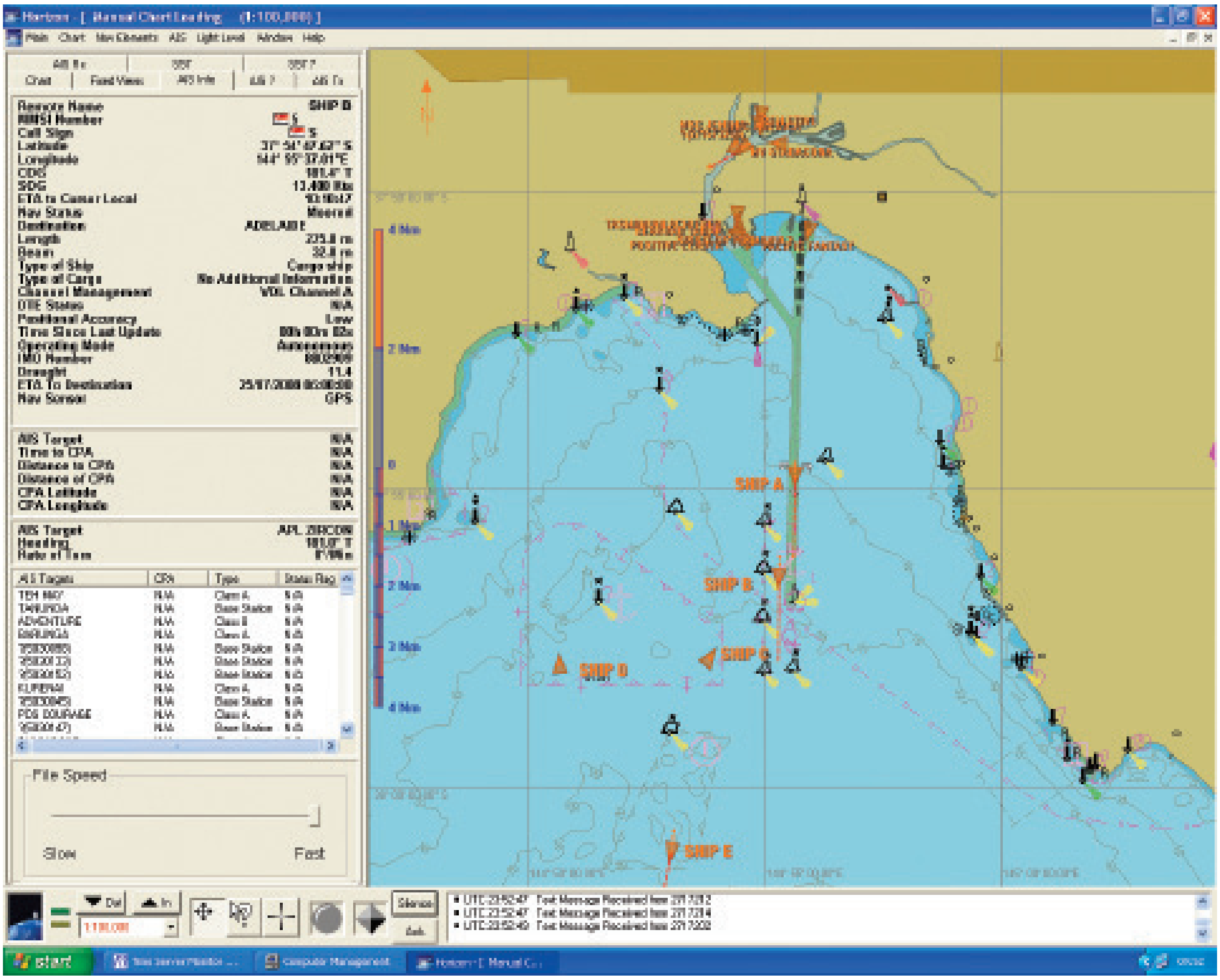


Figure 23 — Screen capture of AIS data

11.7 AIS BENEFITS

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:

- AIS uses the VHF band, which can allow vessels to be 'seen' when not visible, or at an extended range
- information on position, course and speed 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
- the static and voyage-related data can help, 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. The content of these messages is intended to relate to the safety of navigation (eg 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) from AIS-AtoN or AIS base stations. AIS ASMs can be addressed or broadcast.

IMO Circular SN.1/Circ.289 of January 2013 details 14 ASM types:

- 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
- text description.

Within each of these messages a large amount of data can be encoded.

11.8 AIS ERRORS AND DRAWBACKS

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 (ie GNSS; datum)
- Display systems using only the MKD are quite limited and AIS may not be used to full advantage.

11.9 DESTINATION CODE TO BE USED IN AIS

In IMO Circular SN/Circ.244, IMO recommends the manually-entered ‘Destination’ field in the AIS voyage-related data field should not be coded 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 ALRS, Vol 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)

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)

JP YOK (Yokohama).

11.9.1 Use of AIS in MASTREP

Since 1 July 2013, ships AIS information can be used to fulfill MASTREP reporting obligations. AIS data transmissions include both static and dynamic data which provides timely and detailed information, while eliminating manual reporting obligations. Refer to Section 14.5 for more information.

11.10 CONTRIBUTION OF AIS

The AIS station, with its ability to exchange large blocks of information at high data rates, offers a 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, VTSs 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. 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.

Reference should be made to the IMO Resolution Res.917(22), Guidelines for the Onboard Operational Use of Shipborne AIS (which is reproduced in Appendix 8 of this handbook).

11.11 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 for example a VTS. A copy of the test report shall be retained on board the ship.'*

12 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 ship.

12.1 SEARCH AND RESCUE RADAR TRANSPONDERS (SARTS)

12.1.1 Description

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 hours and a further 8 hours whilst being interrogated.

12.1.2 Purpose and method of operation of a SART

A SART operates in the 9 GHz (3 cm or X-band) radar frequency band. On receiving a signal from a ship or aircraft radar, it 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 from model to model, but instructions will be marked on the sides of all SARTs.

The response signals will be seen on the ship or aircraft radar screen as a line of 12 dots (0.64 nautical miles apart) extending approximately 8 nautical miles outward from the SARTs 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 nautical miles apart (see Section 12.1.4).

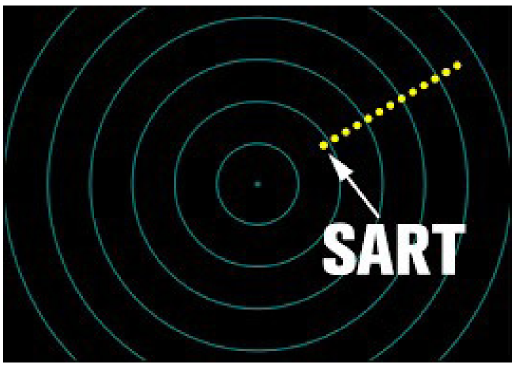


Figure 24 — SART Radar Display

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

12.1.3 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 vessel or aircraft.

12.1.4 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 nautical 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.

12.1.5 Location errors

When a SART is switched on the SARTs receiver is sweeping the radar band continuously, searching for radar signals. Once interrogated (or triggered) by an X-band radar in range, the sweeps become 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 another small delay as the SART switches from receive to transmit mode, and it continues to sweep.

When the range between the search unit and the SART closes so that the fast sweep responses are seen the first dot of the SART response displayed will be no more than 150 metres 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 nautical mile) the first dot of the SART response displayed will be as much as 0.64 nautical miles beyond the true position of the SART.

12.1.5.1 Operating radar for SART detection

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

12.1.6 GMDSS carriage requirement

The GMDSS regulations require ships 300 GT and upwards, but less than 500 GT, to carry one SART (or AIS-SART). Ships 500 GT and over must carry two SARTs.

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 ships have SARTs stowed on the bridge, near the bridge wing doors. Alternatively they may be stowed in survival craft.

12.1.6.1 Passenger ships

One SAR locating device (ie SART or AIS-SART) is required on each side of the ship and must be capable of being rapidly placed in any survival craft.

12.1.6.2 RO-RO passenger ships

Life rafts 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 life rafts. The SAR locating device must be mounted inside the life raft in accordance with *Marine Order 25 (Equipment — lifesaving) 2014*. This Marine Order gives effect to Regulation 26, Chapter III of SOLAS). Containers of life rafts fitted with SAR locating devices must be clearly marked.

12.1.6.3 Free-fall lifeboats

If the ship carries at least two SAR locating devices (ie 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.

12.1.6.4 High speed craft

Under the High Speed Craft (HSC) Code all passenger high speed craft and cargo high speed craft 500 GT and upwards must have one SART or AIS-SART on each side of the ship.

12.1.6.5 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.

12.1.7 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 in its mounting and for signs of damage. It is not necessary to test the SART aboard ship routinely (refer to the AMSA GMDSS Radio Log).

12.1.8 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 nautical mile from the transponder's position along its line of bearing.

12.1.9 Radar target enhancers

Small craft sometimes install additional anti-collision devices called radar target enhancers (RTEs), which may be either 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.

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

Since 1 January 2010, AIS-SARTs can be carried in lieu of SARTs on ships subject to the 1974 SOLAS Convention.

12.2.1 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 (eg 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 metre 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.

Image courtesy of McMurdo

Figure 25 — A typical AIS-SART

12.2.2 Indication of operation

An AIS-SART is to be equipped with a means which is either visual, audible or both, 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 the text only will be seen, together with range and bearing.

12.2.3 Detection distances

Detection range of an AIS-SART 1 metre above the sea surface by a Class A mobile AIS station antenna at 15 metres above the sea surface over water is to be at least 5 nautical miles, but have been found to be 9.5 nautical 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 nautical miles (at 20 000 feet), 81 - 95 nautical miles (at 10 000 feet), 60 nautical miles (at 5 000 feet) and 25 nautical miles (at 1 000 feet).

12.2.4 AIS–SART unique identification

An AIS–SART, being an AIS transmitter, has a unique identifier (a 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 of this handbook for further information issued by the IMO Circular SN.1/Circ.322 on display of AIS-SARTs, AIS-MOB devices and EPIRB-AIS devices.

12.2.5 AIS-SART symbol

The IMO agreed symbol for an AIS–SART is  (a circle containing a cross drawn with solid lines).

12.2.5.1 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.

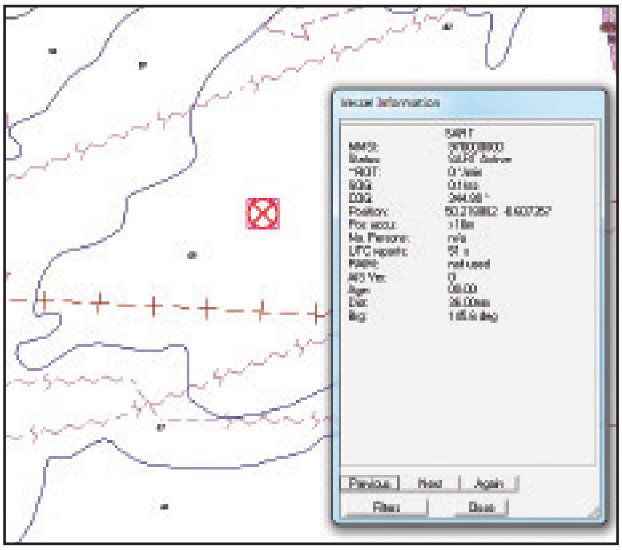


Figure 26 — AIS-SART indication on chart display

12.2.6 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 eight messages once per minute. The duration of the burst is 14 seconds (beginning to end). A burst consists of eight 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 one 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 minutes.

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 five min in each subsequent hour.

Message one (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 four minutes, and replaces one of the position reports on both channels. So, in a burst of eight messages the first four messages will be position reports, then messages messages of 'SART ACTIVE', then 2 messages of position reports. This sequence is then repeated.

If position and time synchronization is lost the AIS-SART continues to transmit with the last known position and indicates that the position system is inoperative.

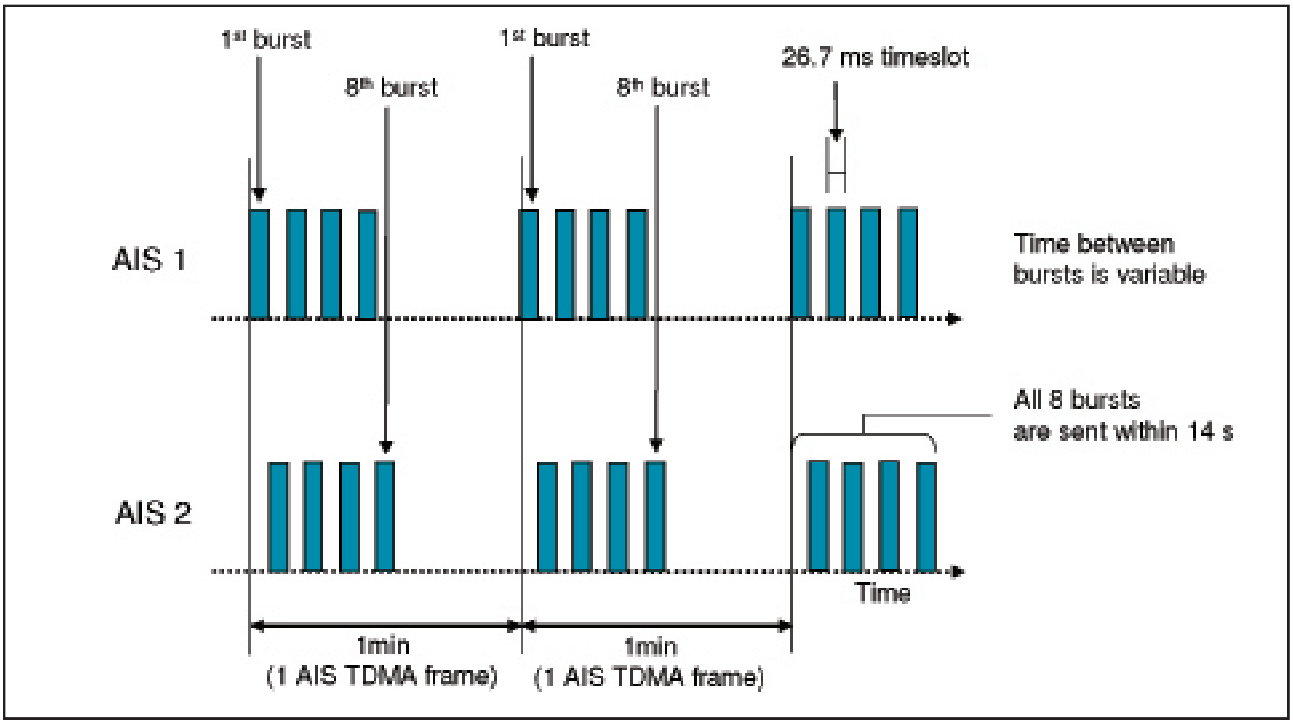


Figure 27 — AIS-SART transmit burst sequence in Active Mode

12.2.7 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.

12.2.7.1 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.

12.2.7.2 Physical requirements

The environmental requirements are similar to a SART. It is to be watertight to a depth of 10 metres for 5 minutes, float (not necessarily in an operating position), survive a drop into water from 20 metres, 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 hours (-20°C to +55°C).

The unit will be have a durable label with brief operating and test instructions, expiry date (replacement date) for the primary (ie non-rechargeable) battery used, and the unique identifier (MMSI).

12.2.7.3 Routine testing of AIS–SARTs

AMSA recommends testing of AIS–SARTs be done sparingly in order to prolong battery life, and to avoid accidental activation and confusion. If testing is required in port the port authorities should be informed prior to activation. They can also confirm successful testing. The AIS–SART should be physically examined at least monthly with a view to ensure there is no obvious physical damage, battery expiry date has not passed and the support cradle is intact.

12.3 PORTABLE SURVIVAL CRAFT VHF RADIOTELEPHONE APPARATUS

12.3.1 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.

12.3.2 IMO performance standards

The equipment should comprise at least:

- a transmitter and receiver
- an antenna which may be fixed or mounted separately
- 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 or immersion suits
- be capable of single–handed operation except for channel selection
- withstand drops on to a hard surface from a height of 1 metres
- be watertight to a depth of 1 metre for at least 5 minutes
- maintain water tightness when subjected to a thermal shock of 45°C under conditions of immersion
- not be unduly affected by seawater, 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 (Australian ships require channels 6, 13, 16 and 73 at least)
- be fitted with channels for single–frequency voice communication only (ie 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 seconds of switching on
- not be damaged by the effects of open or short circuiting the antenna.

12.3.2.1 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 seconds transmission, 6 seconds reception above squelch opening level and 48 seconds 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.

12.3.3 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 and reception is controlled by a push-to-talk switch located on the side of the unit.

12.3.4 Carriage requirements

GMDSS ships 500 GT and upwards are required to carry three portable survival craft VHF transceivers. Ships of over 300 GT but less than 500 GT are required to 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.

12.3.5 Class 'H' hand-held VHF

Although not part of the GMDSS there is a new class 'H' VHF DSC handheld defined in ITU-R M.493-14. They are a simplified VHF DSC hand-held radios for use by people with no radio training. They are capable of transmitting a DSC Distress Alert and conducting voice communications on channel 16. Being a simplified version, it is likely they will be relatively cheap to produce, which may make them a viable option for permanent installation in life-boats, etc. They are likely to find their way onto non-SOLAS vessels.

12.4 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 ships and non-GMDSS vessels.

12.4.1 VHF DSC MOB devices

One example is a device transmitting on VHF Ch.70 using DSC with an integral GNSS receiver. It periodically transmits an automated distress 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 vessels 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 authorised 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 which 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. In some cases it may also be used for homing purposes, to guide rescuers back to the casualty.

In Australia until July 2012, these devices used a MMSI of the format 5038XXXXX, where x could be any number between 0 and 9.

Since July 2012, these devices have used the 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'. 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 hours, which is also the main battery operation requirement. It may also be capable of being water activated.

12.4.2 The transmitter duty cycle

- When activated, no transmission is to occur for the first 20 seconds, but can occur between 20 seconds and 30 seconds.
- An initial DSC MAN OVERBOARD alert (symbol 110) message is then transmitted, followed by the type of subsequent communication. In this case '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) it 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 minutes for a period of 30 min. After 30 minutes has elapsed, the duty cycle shall change to 10 minutes, and will continue until the battery is exhausted or the MSLS is switched off.
- For a MSLS transmitters 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.

Transmission in 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, and then goes to 'Open-loop' mode to all stations. MSLSs of this type may also be programmed as members of a group by using the group MMSI format specified in the ITU Recommendation ITU-R M.585. This allows a group of ships to monitor MSLSs 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 IMO Circular COMSAR/Circ. 25. The relevant extract 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 a 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 ship or person responsible for the vessel is to decide whether it is able to render assistance.

Figure 28 — Maritime survivor locating device (Man Overboard Device) using AIS and VHF DSC

12.4.3 VHF AIS MOB devices

Some 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 a maritime identity of the format 970xxyyyy, but newer units starting from 2011 use the format 972xxyyyy, which has been internationally agreed in Recommendation ITU-R M.585, Annex 2, Section 2.

The AS/NZS 4869 series of standards covers these devices. Alternatively, certification 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).

12.4.4 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. IMO 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: eg 972xxyyyy, as described above.

12.4.5 Class ‘M’ MOB devices

Although not part of the GMDSS system there are new Class M (as defined in ITU-R M.493-14 and ITU-R M.541-10) MOB devices that combine DSC (VHF channel 70) and AIS burst transmitters with inbuilt GNSS receivers. With the exception of the GNSS receiver these are transmitters only that provide an indication on a ship’s GMDSS equipment that they have been activated. The transmission may also help with location of the device by vessels or aircraft involved in the search. As they do not have a receiver there is no need to respond to a DSC distress alert as they cannot receive it.

Both the AIS and DSC components of these devices should be encoded with an MMSI starting with 972 (indicating to a receiving platform that they are a man-overboard device) and operate in accordance with Recommendation ITU-R M.1371.

13 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 manual(s) carried on board your ship.

NAVTEX is not used in Australia.

13.1 INTRODUCTION

13.1.1 System overview

The NAVTEX system provides automatic dissemination of local MSI by NBDP operating in the forward error correction (FEC) broadcast mode (see Section 6.2.2 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 maritime safety information, including weather warnings and forecasts relevant to ships within specified coastal areas.

The range is generally 300 — 400 nautical miles.

13.1.2 Areas of coverage

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 EGC. The NAVTEX system is presently used by countries in Asia, the Middle East, Europe and North America.

13.1.3 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 national NAVTEX transmissions. There is also provision for transmissions on other nationally assigned frequencies for national transmissions, which may also be in language other than English. Some of these are on 424 kHz (refer to ALRS for details).

13.1.4 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 messages that are 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 aids to navigation 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.

13.1.5 Format of a NAVTEX message

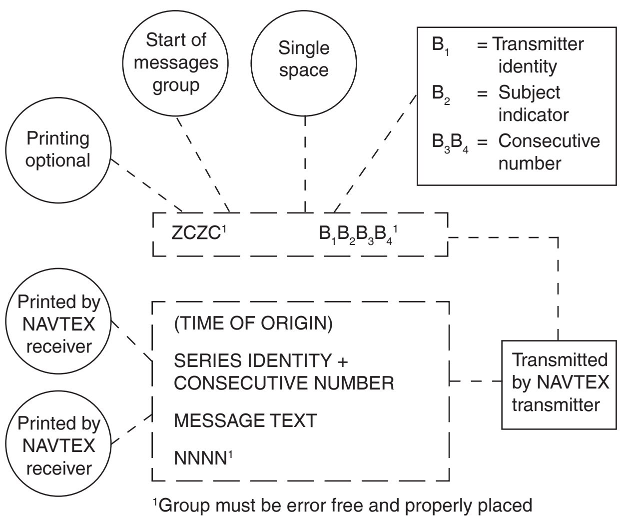


Figure 29 — Format of NAVTEX Message

13.1.6 Broadcast schedules

As there is only one frequency presently used for NAVTEX transmissions, mutual interference between stations is avoided using time sharing arrangement. In general, each NAVTEX station in an area is allocated a designated 10 minutes period every 4 hours 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 ALRS. 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 hours old.

13.2 SHIPBOARD EQUIPMENT

13.2.1 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 watchkeeper 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.

13.2.2 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.

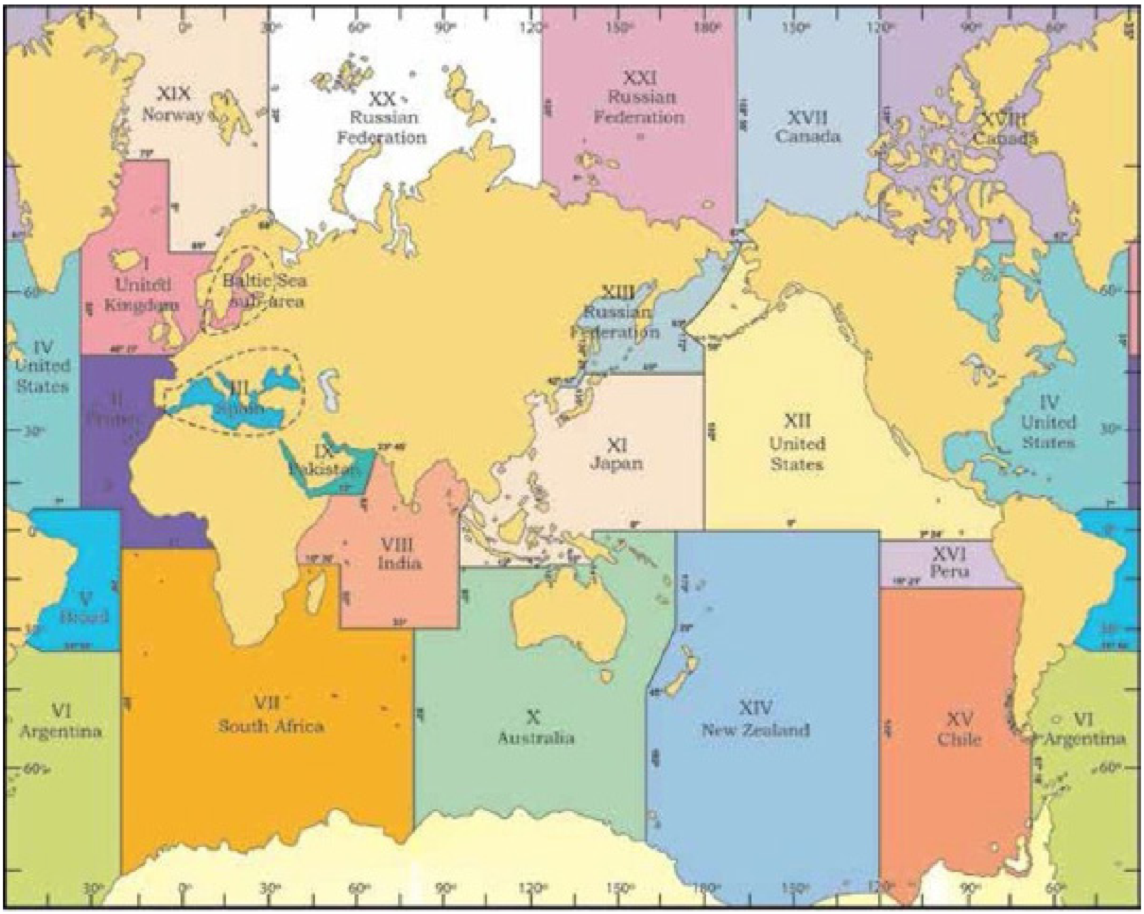


Figure 30 — NAVAREAS of the World-Wide Navigational Warning Service (WWNWS)

14 SEARCH AND RESCUE (SAR) OPERATIONS

14.1 SHORE BASED SAR NETWORK

14.1.1 Communications links

Exploitation of 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 LES(s), coast radio station(s) and Cospas–Sarsat ground station(s).

The interconnecting links between MRCCs will typically use the public switched telecommunications network for telephone, facsimile and data communications. Some MRCCs may also be provided with an Inmarsat SES.

14.1.2 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 ALRS, Vol 5.

14.1.3 Coordination of distress traffic

The MRCC which is responsible for controlling the search and rescue operation, will also be responsible for coordinating the distress traffic relating to that incident, or may appoint another station to do so.

14.2 THE IAMSAR MANUAL

The IMO and the ICAO jointly publish the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR). The Manual has three volumes:

Volume I Organisation 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 coordinate 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 mandated for carriage by all SOLAS ships.

14.3 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 (ie transmission and reception on the same frequency) will be used in order that all stations concerned may share information concerning the distress incident.

14.3.1 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.

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 watch will be maintained by all participating stations on that frequency or frequencies.

14.4 LOCATING AND HOMING SIGNALS

14.4.1 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 and by survival craft radar transponders (SARTs).

14.4.2 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 and AIS-SARTs operating on 161.975 and 162.025 MHz
- **406 to 406.1 MHz** — 406 MHz EPIRBs
- **9.2 to 9.5 GHz** — X band radar and radar SARTs.

14.4.3 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 vessels and aircraft with a signal that can be used to determine the bearing of the transmitting station.

Homing signals include the 121.5 MHz transmissions from a 406 MHz EPIRB.

15 SHIP REPORTING SYSTEMS

15.1 MASTREP

The Australian Ship Reporting System (AUSREP) transitioned to the Modernised Australian Ship Tracking and Reporting System (MASTREP) on 1 July 2013.

15.1.1 Application

The requirement to report applies to the each of the following ships while in the MASTREP area:

- a regulated Australian ship
- a foreign ship 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.

15.1.2 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 and type
- position, course and speed
- navigational status
- 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 JRCC 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 and Australian Mandatory Reporting Guide. Copies of this guide can be accessed from the AMSA website: www.amsa.gov.au or from JRCC Australia directly.

> JRCC Australia contact details
>
> (Full details are provided in the IAMSAR Manual, the MASTREP booklet and ReefVTS User Manual)
>
> Joint Rescue Coordination Centre Australia (JRCC Australia) 24 hour emergency contact telephone numbers:
>
> 1800 641 792 (Maritime)
>
> 1800 815 257 (Aviation)
>
> MMSI: 005030001

15.2 THE REEFREP SYSTEM

The Great Barrier Reef and Torres Strait Ship Reporting System (REEFREP) was established in 1996 as a mandatory ship reporting system to improve the safety and efficiency of shipping traffic transiting the region. *Marine Order 63 (Vessel reporting systems) 2015* states that ships which are required to report to Reef VTS must do so irrespective of the nature of their journey ie international, interstate or intrastate.

Reef VTS manages and operates REEFREP.

REEFREP provides the Reef Vessel Traffic Service (Reef VTS) with information about a ship, its characteristics and intended passage. This information, together with the monitoring and surveillance systems used by Reef VTS, assists with the proactive monitoring of a ships transit through the Great Barrier Reef and Torres Strait.

Reef VTS is operated by Maritime Safety Queensland (MSQ), as an AMSA authorised VTS under Marine Order 64 (Vessel Traffic Services).

Its purpose is to:

- assist the navigation of ships through the Torres Strait and the Inner Route of the Great Barrier Reef safely, by engaging 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 occurs.

It is manned on a 24 hours basis from the VTS centre, situated at Townsville on the Queensland coast.

15.2.1 Main features of the system

Where Reef VTS advises that the ship's position is being tracked by sensors (ie AIS) then intermediate position reports at the mandatory reporting points are not required. If the ship's position is not being tracked by sensors, then a brief position report must be given as advised by Reef VTS.

A ship must send the following reports to Reef VTS at the time and place specified:

- Pre–entry position report at least 1 hour prior to entering the Reef VTS Area
- Final report (FR) on leaving the Reef VTS area or arrival at an Australian port.

Additional Reports must be sent to Reef VTS where applicable:

- Intermediate position reports where automatic positioning data (Sat C), radar positional data and AIS positional data is not available
- Route deviation report
- Defect report.

Inmarsat–C is the preferred option for providing automated position reporting and transmission of ship information services. Messages to Reef VTS sent via Sat C will be reverse charged to Reef VTS if ships use special access code (SAC) 861 via POR LES 212.

Ships are provided with MSI and ship encounter information (SEI) on the position, identity and intentions of other traffic. Additionally they are provided with information on hazards or other factors (eg defective aid to navigation).

Reef VTS may also provide navigation assistance to an individual ship to assist on-board decision-making, where information available to Reef VTS suggests a ship may be standing into shallow water or is deviating from a recommended route.

Full details are included in the Reef VTS User Guide which is available from Reef VTS or on the Great Barrier Reef and Torres Strait Vessel Traffic Service page of the MSQ website www.msq.qld.gov.au.

ReefVTS Contact Details

Telephone +61 1300 721 293

Facsimile +61 7 4721 0633

Email: reefvts@vtm.qld.gov.au

15.2.2 Ships required to participate in the REEFREP system

The following categories of ships are required to report to Reef VTS 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
- 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 ship to the after end of the tow.

15.3 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 ships 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 ships while they are within the plotting area. Characteristics of ships, 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 ship 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.

15.4 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), and many others.

Details of these are published in the ALRS, Vol 6.

16 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 ships.

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 assistance?

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.

16.1 GENERAL

16.1.1 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 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.

16.1.2 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.

16.1.3 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.

16.1.4 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.

16.1.5 Obligation to acknowledge receipt of a Distress Alert

Ship stations which receive a Distress Alert 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 Alert 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.

16.1.6 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.

16.1.7 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
- when the Master or person responsible for the ship not in distress considers that further help is necessary.

See also section 16.10.6.

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.

16.2 GENERAL INMARSAT DISTRESS, URGENCY AND SAFETY PROCEDURES

16.2.1 Introduction

The Inmarsat system provides priority access to satellite communications channels in emergency situations.

Each 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 SES which initiated the distress priority call.

The English language is used for international maritime distress messages.

16.2.2 Routing of distress alerts

The distress priority applies not only with respect to allocation of satellite channels but also to automatic routing of the alert to the appropriate rescue authority. Each LES is required to provide reliable telecommunications connections with an associated MRCC.

Australia's LES located in Perth has dedicated connections to the JRCC in Canberra, which performs the duties of an MRCC in Australia.

16.2.3 MRCCs

A MRCC is equipped with specialised facilities to organise and coordinate 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.

16.2.4 Initiation of a Distress alert

Initiation of a distress alert from most SESs 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.

16.3 FLEET77 SESs

16.3.1 Generation of distress alerts

The issue of a Fleet77 distress alert by a ship may be made by using the telephony communication channels.

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 minute. On being connected to the duty officer at the MRCC the ship's operator should clearly state details of the distress, using the MAYDAY voice procedures described later in this Chapter.

16.4 INMARSAT 505 EMERGENCY CALLING (FLEETBROADBAND)

Note: Inmarsat FleetBroadband SESs are not GMDSS approved as yet.

Inmarsat has 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 dialing facility that provides direct access to maritime relief. In time of distress a seafarer dials 505 (selected for its similarity to SOS) to contact a 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: JRCC Australia (Canberra, Australia), JRCC Norfolk (Virginia, USA) and JRCC Den Helder (Netherlands).

16.5 INMARSAT-C SESs

Reference should be made to specific manufacturers' instructions on how to send both pre-programmed Distress Alerts and detailed Distress Messages.

16.5.1 Generation of distress calls

An Inmarsat–C SES allows an operator to send two different types of distress call, a brief Distress Alert or a detailed Distress Priority Message.

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 SES
- the nature of the distress (chosen from a menu or maritime unspecified if not chosen)
- 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 minutes, 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.

16.5.2 Routing of a distress calls

Some SES 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 SES.

Other types of SES 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 ship. If a LES is not specified either by the equipment or the operator the Distress Alert will be routed via the NCS and may result in an unnecessary delay.

16.5.3 Position information

Usually a shipboard Inmarsat–C terminal will be interfaced with the ships 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 hours.

The regular entry of position information to Inmarsat–C equipment is also vital to ensure that the integral EGC facility responds to MSI which is relevant to the ship's position.

16.5.4 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 ship is normally navigated. This equipment is known as a remote distress initiation device (RDID) or a dedicated distress button (DDB), 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 16.5.1.

16.5.5 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.

16.5.6 Two digit service codes

A range of special safety and general maritime services, known as the two digit service codes, special access codes or short address codes (SACs) may be available through some LESs. These are summarised as follows:

Service	Two 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 navigational reports	42
Position reports	43

It should be noted that these services are not available through all LESs.

Note: The host called LES 22 is no longer available or selectable via Inmarsat-C. AMSA MSI 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 Fleet77.

16.6 GENERAL DSC DISTRESS, URGENCY AND SAFETY PROCEDURES

16.6.1 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 ship's 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).

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 spread over 6 DSC distress frequencies (multi-frequency call attempts). The process of sending a DSC distress using the single frequency call attempt, multi-frequency call attempt or a combination of the two, is given in Section 16.8.2. 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 minutes, unless stopped by switching off the transceiver, receiving an acknowledgement via DSC or if the 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.

16.7 MF/VHF DSC AND RADIOTELEPHONE DISTRESS URGENCY AND SAFETY PROCEDURES

16.7.1 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.

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.

16.7.2 Distress procedures using a 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 (in accordance with the DSC equipment manufacturers instructions):
  - the nature of distress
  - the ship's last known position (latitude and longitude)
  - the time (in UTC) the position was valid; and
  - type of subsequent distress communication (most equipment defaults to telephony mode)
- 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, ie 2 182 kHz on MF, channel 16 on VHF. (The 2 182 kHz 2-tone alarm, if fitted, may be used to attract attention).

16.7.2.1 Subsequent voice procedure

Send the following spoken message on the radiotelephone channel:

- the distress signal MAYDAY, spoken three times
- the words THIS IS
- the name of the ship in distress, spoken three times
- the call sign or other identification
- the MMSI (if the initial alert has been sent by DSC).

Example

Distress signal (x3)	MAYDAY MAYDAY MAYDAY
Words 'this is'	THIS IS
Name of Ship (x3)	WILTSHIRE WILTSHIRE WILTSHIRE
Call sign or other identification	VJEK
MMSI (if the initial alert has been sent by DSC)	503123000
Distress message	
Distress signal	MAYDAY
Name of ship	WILTSHIRE
Call sign or other identification	VJEK
MMSI (if the initial alert has been sent by DSC)	503123000
Position	5 MILES EAST OF GREEN CAPE
Nature of distress	ON FIRE OUT OF CONTROL
Other information	SHIP IS A GAS TANKER, CREW TAKING TO LIFEBOATS
To signify end of message	OVER

16.7.3 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 respectively.

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 of this handbook) 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.

16.7.3.1 Acknowledgement by radiotelephone

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, ie 2 182 kHz on MF, channel 16 on VHF:

- the distress signal MAYDAY
- the name followed by the call sign, MMSI or other identification of the station sending the distress message
- the words THIS IS
- the name and call sign of the station acknowledging receipt
- the word RECEIVED
- the distress signal MAYDAY.

As soon as possible after this acknowledgment a ship station should transmit the following information:

- it's position
- 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 15.7.2):

Distress signal	MAYDAY
Name of station sending	
Distress message	WILTSHIRE
Call sign (or other identification)	VJEK
MMSI (if the initial alert	
has been sent by DSC)	503123000
Words 'this is'	THIS IS
Name	LAKE BARRINE
Call sign or other identification	VLLB
MMSI	503543000
Words	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 JRCC 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 or name of ship in distress
- position, time and nature of distress received in the message
- position of your ship
- your actions and intentions.

16.7.4 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 eg 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:

- on receiving a Distress Alert or call which is not acknowledged by a coast station or another ship within 5 minutes
- 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 SES.

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 should follow the procedures described in Section 16.7.2 for Distress Alerts, except that the Distress Relay is sent manually as a single call on a single frequency. Ship stations not provided with the DSC Distress Alert Relay function should relay the alert by radio telephony. Further details can be found at ITU-R M.541 Section 3.4.

Ships making a Distress Alert Relay or a Distress Call Relay should ensure that a suitable coast station or RCC 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, eg as in Section 16.7.4 above, the DSC Distress Alert relay 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 MMSI of the appropriate coast station
  - the MMSI 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, ie 2 182 kHz on MF and channel 16 on VHF, while waiting for the DSC Distress Acknowledgment.

16.7.5 Acknowledgment of a DSC Distress Alert Relay 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 MMSI or the call sign or other identification of the calling coast station
'THIS IS' —	The MMSI or call sign or other identification of own ship
'RECEIVED MAYDAY'	

16.7.6 Acknowledgment of a DSC Distress Alert Relay received from another ship

Ships receiving a Distress Alert Relay from another ship shall follow the same procedure as for acknowledgment of a distress alert.

IMO Circular 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 31).

16.7.7 Urgency procedures

Transmission of Urgency Messages is carried out in two steps:

- announcement of the Urgency Message
- transmission of the Urgency Message.

The announcement is carried out by broadcast of a DSC Urgency Call on the DSC distress and safety channel (2 187.5 kHz on MF, channel 70 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 Urgency Message is transmitted on the radiotelephone distress channel (2 182 kHz on MF, channel 16 on VHF).

This process 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 MMSI 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)
- send the DSC Urgency Announcement Message
- tune the transmitter to the frequency or channel indicated in the DSC Urgency Announcement Message
- transmit the Urgency Message as follows:

'PAN PAN'	Repeated 3 times
'ALL STATIONS'	
or Called Station	Repeated 3 times
'THIS IS'	The MMSI, call sign or other identification of own ship
	The text of the urgency message.

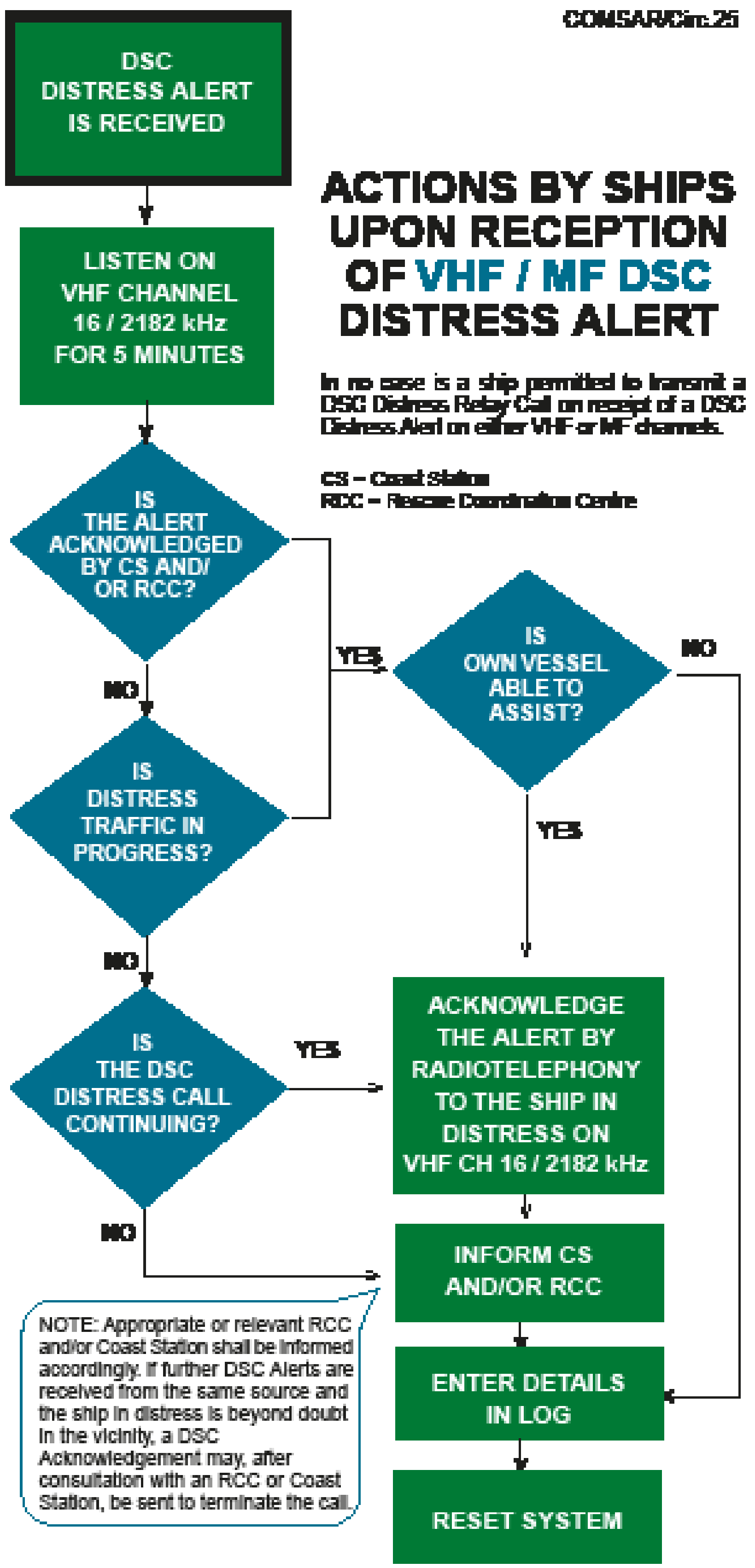


Figure 31 — Action on receipt of a MF or VHF DSC Distress Alert

16.7.8 Reception of an urgency message

Ships receiving a DSC Urgent Priority 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.

16.7.9 Transmission of Safety Messages

Transmission of Safety Messages is carried out in two steps:

- announcement of the Safety Message
- transmission of the Safety Message.

The announcement is carried out by broadcast of a DSC Safety Announcement on the DSC distress and safety channel (2 187.5 kHz on MF, channel 70 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 Safety Message is normally transmitted on the radiotelephone distress channel in the same band in which the DSC call was sent (2 182 kHz on MF, channel 16 on VHF).

The above process 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)
- 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 MMSI 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)
- send 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 MMSI, call sign or other identification of own ship;
	The text of the Safety Message.

16.7.10 Reception of a Safety Message

Ships receiving a DSC Safety Priority 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.

16.8 HF DSC PROCEDURES

16.8.1 Introduction

HF DSC is primarily designed for long range ship-to-shore alerting. HF DSC Distress Alerts are normally directed to coast radio stations.

The DSC Distress Alert should include the ship's last known position and the time (in UTC) it was valid. If the position and time are 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.

16.8.2 Ship-to-shore Distress Alert

16.8.2.1 Choice of HF band

As a general rule the DSC distress channel in the 8 MHz maritime band (8 4l4.5 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 to receive acknowledgment by a coast station. If no acknowledgment is received within 5 minutes the process is repeated by transmitting the DSC Distress Alert on another appropriate HF band etc.

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.

16.8.2.2 Transmitting the Distress 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
- transmit the DSC Distress Alert.

16.8.3 Preparation for the subsequent distress traffic

As HF DSC is primarily a ship–shore alerting technique ships 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 b) described in section 15.8.2.1 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
- if acknowledgments have been received on more than one HF band commence the transmission of distress traffic on one of these bands. If no response is received from a coast station then the other bands should be used in turn.

16.8.4 Distress traffic via NBDP after the DSC Alert

The procedures described in Section 16.7.2 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 MMSI, call sign 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
- the word OVER.

16.8.5 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 radiocommunication 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 radiocommunication 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 radiocommunication 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.

> HF DSC Distress Relays are primarily used by coast stations. If it appears that no coast station is taking action a ship can relay a Distress Alert in accordance with the flow diagram in COMSAR/ Circ. 25 (reproduced in Figure 32 of this handbook).

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
- no DSC Acknowledgment Message is received from another ship or coast station within 5 minutes.

Then the 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.**

16.8.6 Transmission of DSC Distress Alert Relay

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 Alert Relay.

16.8.7 Acknowledgment of a HF DSC Distress Alert Relay received from a coast station

Ships receiving a DSC Distress Alert Relay 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 alert relay was received.

Figure 32 summarises the actions to be taken on receipt of an HF DSC Distress Alert.

16.8.8 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.

16.8.8.1 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 Urgency Announcement.

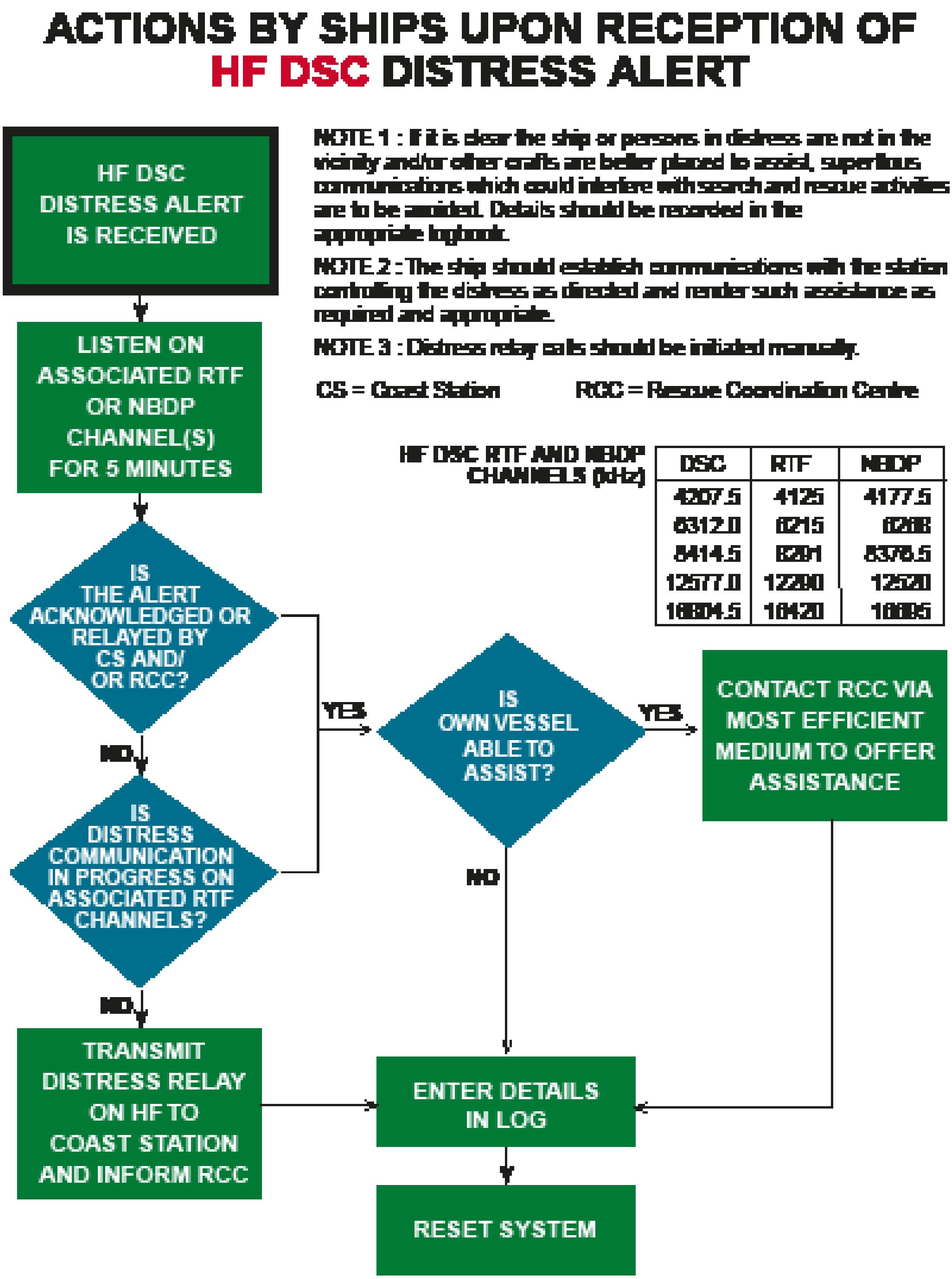


Figure 32 — Action on receipt of an HF DSC distress alert

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 16.7.7.

16.8.8.2 Urgency Message 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 MMSI, the call sign or other identification of the ship
- 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.

16.8.9 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.

16.8.10 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
- in the Safety Message the safety signal SECURITE is used instead of the urgency signal PAN PAN.

16.9 AUSTRALIAN DSC, NBDP AND R/T DISTRESS AND SAFETY SHORE FACILITIES

16.9.1 Introduction

Terrestrial GMDSS radio services are provided on behalf of the AMSA by Kordia Solutions Pty Ltd. These 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).

16.9.2 DSC watchkeeping

The Charleville and Wiluna stations maintain continuous watch on the 4, 6, 8, 12 and 16 MHz DSC distress and safety channels.

16.9.3 R/T watchkeeping

The Charleville and Wiluna stations maintain watch on the 4, 6, and 8 MHz R/T distress and safety channels continuously, and the 12 MHz channel from 0700-1900 Canberra time.

16.9.4 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.

16.10 RADIOTELEPHONY COMMUNICATIONS WITH NON–GMDSS SHIP STATIONS

16.10.1 Procedures

- The following radiotelephony procedures are used when communicating with non-GMDSS vessels on 2 182 kHz (they similar to those used for communicating with other GMDSS ships on any of the radiotelephony distress channels subsequent to a DSC Distress Alert).

16.10.2 Distress Message acknowledgment

Non-GMDSS vessels will use the voice procedures outlined in Section16.7.2 to send Distress Messages.

The voice procedures outlined in Section 16.7.2.1 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.

16.10.3 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.

16.10.4 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 (Seelonce) on any or all stations interfering with distress traffic by sending the instruction SEELONCE MAYDAY.

16.10.4.1 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.

16.10.5 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), name and call sign of the mobile station which was in distress
- the words SEELONCE FEENEE.

16.10.6 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 ship within 5 minutes
- 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 RCC 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 ship 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 or 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 ship (the Distress Message from Section 16.7.2 is used in this example):

Distress signal relay (x3)	MAYDAY RELAY
	MAYDAY RELAY
	MAYDAY RELAY
The words 'all stations' or	ALL STATIONS
'coast all stations'	ALL STATIONS
as appropriate (x3)	ALL STATIONS
The words 'this is'	THIS IS
Name of acknowledging station (x3)	
	LAKE BARRINE
	LAKE BARRINE
	LAKE BARRINE
Call sign or other identification	VLLB
MMSI	503543000
Distress signal	MAYDAY
Name of ship in distress	WILTSHIRE
Call sign or other identification	VJEK
MMSI (station in distress)	503123000

POSITION 5 MILES EAST OF GREEN CAPE

ON FIRE OUT OF CONTROL SHIP 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.

16.10.7 Urgency and safety procedures

Non-GMDSS vessels sending an Urgency or Safety Message will use the voice procedures outlined in Sections 16.7.7 and 16.7.9.

16.11 PROTECTION OF DISTRESS FREQUENCIES

16.11.1 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 Radiocommunications 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.

16.11.2 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
- keep test signals to a minimum.

16.11.3 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.

16.11.4 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 authorised bands between 1 605 kHz and 2 850 kHz should keep watch on the international distress frequency 2 182 kHz for 3 minutes 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 determined for GMDSS ships 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.

16.11.5 Safety calling

The HF 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 RCCs 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.

16.12 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 'medical') in radiotelephony, or by the addition of the single word MEDICAL in NBDP.

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 recognised 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 times as appropriate
- 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, it 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.

16.13 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. Through the JRCC 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 International Medical Guide for Ships, 3rd edition. 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 ALRS, Vol 1.

In Australia the arrangements for seeking medical advice via special access codes, using Inmarsat GMDSS equipment, are described in Appendix 14 of this handbook, and initially may be to a service in the Netherlands which may then refer back to JRCC 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 JRCC Australia calls are connected to Careflight*(Queensland). (*at the time of publication)

JRCC 24 hour emergency contact:

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/sito_eng/index.htm.

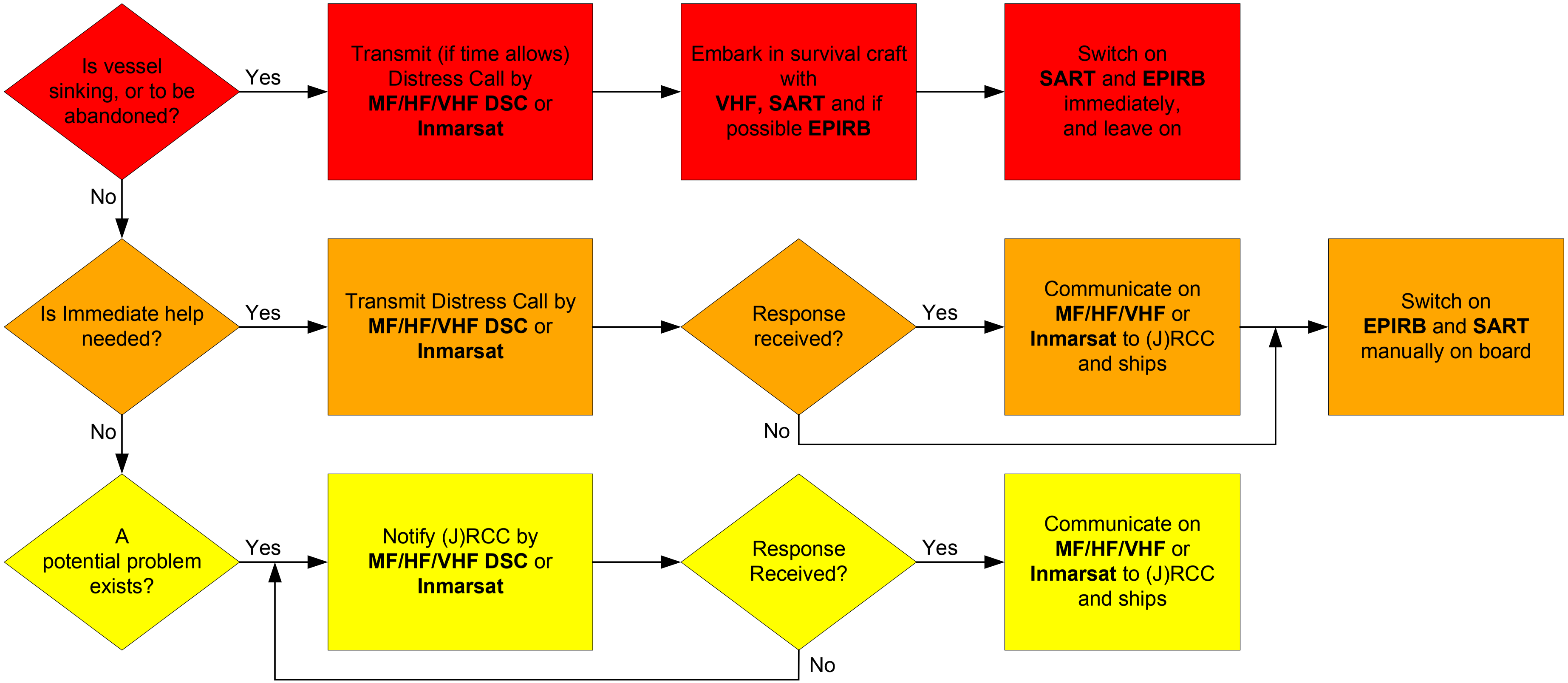
In addition there are private companies providing complete medical services for ships at sea, which include 24/7 radiomedical advice and can arrange other services. An example is Medlink's Medical Advisory Systems (MedAire Ltd). For details, refer to www.medaire.com.

16.14 MARITIME ASSISTANCE SERVICES

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 in a distress situation that could lead to a search and rescue operation
- 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.

GMDSS OPERATING GUIDANCE FOR MASTERS OF SHIPS IN DISTRESS SITUATIONS



1. EPIRB should be float-free and activate automatically if it cannot be taken into survival craft
2. Where necessary, ships should use any appropriate means to alert other ships
3. Nothing above is intended to preclude the use of any and all available means of distress alerting

RADIO DISTRESS COMMUNICATION			
	DSC	Radiotelephone	Radiotelex
VHF	Channel 70	Channel 16	
MF	2 187.5 kHz	2 182 kHz	2 174.5 kHz
HF 4	4 207.5 kHz	4 125 kHz	4 177.5 kHz
HF 6	6 312 kHz	6 215 kHz	6 268 kHz
HF 8	8 414.5 kHz	8 291 kHz	8 376.5 kHz
HF 12	12 577 kHz	12 290 kHz	12 520 kHz
HF 16	16 804.5 kHz	16 420 kHz	16 695 kHz

17 ROUTINE TESTING

This chapter provides guidance on routine testing procedures to be followed by operators of GMDSS ship stations.

17.1 GENERAL REQUIREMENTS

The routine testing requirements for Australian GMDSS ships are contained in the AMSA GMDSS Radio Log (relevant extract included in Appendix 11 of this handbook).

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.

17.2 VHF DSC SYSTEMS

It is recommended in the IMO STCW 95 Code, Section B–VIII/2 that VHF DSC systems be tested daily using the built-in test facility.

17.2.1 VHF DSC test procedures

VHF DSC can be tested by selectively calling the duplicate set on one's own ship, 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 (eg United States Coast Guard MMSI 003669999). A routine selective call to another station can also be used.

17.3 MF/HF DSC SYSTEMS

17.3.1 Introduction

The IMO recommends that ships regularly test their DSC system with a coast station for both system verification and operator familiarization. This is also required as set out in the AMSA GMDSS radio log. To achieve this, live testing on DSC distress and safety frequencies with coast stations should be limited to once a week. Refer to IMO Circular 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, recognizing 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 ship and automatically acknowledged by a suitably equipped coast station.

The DSC installations at Charleville and Wiluna provide fully automatic testing facilities on all HF channels.

Ship's DSC systems may be tested with Charleville and Wiluna on any of the DSC distress and safety channels between 4 and 16 MHz. The frequency used for testing should be determined by your ships location and time of day.

17.3.2 Frequency for DSC test calls

The following DSC channels (in kHz) are suggested as a guide for the appropriate frequency to be used for test calls from various locations on the Australian coast.

- Bass Strait ships:

  DAY 12 577 or 16 804.5

  NIGHT 4 207.5 or 6 312
- Ships 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
- Ships 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 minutes try again on another DSC channel, or use another station in the GMDSS.

17.4 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 JRCC Australia, etc.

17.5 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 18.

17.6 406 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.

17.7 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 SARTs self-test is in fact a live test. 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 ships 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.

17.8 AIS-SARTS

AMSA recommends testing of AIS-SARTs be done sparingly in order to prolong battery life and to avoid accidental 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 VHF DSC or channel 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
- to ensure the support cradle is intact.

17.9 SUMMARY OF ROUTINE TESTING

Equipment	Required routine test requirements
VHF DSC	Daily with built-in test equipment (without radiating signals)
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	Once between ports, which can be by the use of routine calls

Table 10 — Summary of Routine Testing — Equipment

Survival Craft Equipment	
Handheld VHF	Monthly on a 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

Table 11 — Summary of Routine Testing — Survival Craft

GMDSS Reserve Source of Energy	
GMDSS batteries[1]	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 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[1]	Daily test, or in the case of UPS batteries, in accordance with the UPS manufacturer's recommendations

Table 12 — Summary of routine testing — reserve power

[1] Testing to be done in accordance with the manufacturer's user manual.

Communications Equipment	Daily	Weekly	Monthly
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 13 — Summary of routine testing — communications equipment

18 BATTERY MAINTENANCE

This chapter provides guidance on the procedures to be followed for basic maintenance of battery systems fitted to GMDSS ship stations.

18.1 BATTERY REQUIREMENTS

18.1.1 Reserve power source

As described in 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 hour or 6 hours. Ships not carrying an approved emergency generator must provide a reserve source with a capacity of 6 hours.

Rechargeable accumulator batteries are the most convenient and efficient means of providing the required reserve source.

18.2 TYPES OF BATTERIES

18.2.1 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 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.

18.3 LEAD-ACID BATTERIES

18.3.1 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 two 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).

18.3.2 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.

18.4 CARE AND MAINTENANCE OF LEAD–ACID BATTERIES

18.4.1 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
- is kept correctly charged.

18.4.2 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.

18.4.3 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 ships 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.

18.4.4 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 it condition.

18.4.5 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
- overcharging.

18.4.6 Electrolyte level

Most batteries will be what's called 'maintenance-free'. This term generally means there is no need to check the electrolyte level or specific gravity (see Section 18.4.7). It DOES NOT negate the requirements of the previous paragraphs. A simple way to identify a maintenance free battery is that it does not provide access to the electrolyte.

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.

18.4.7 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.

Expansion and contraction of electrolyte in hot and cold ambient temperatures will affect hydrometer readings. Manufacturers normally provide specifications at the industry standard of 25°C, and a correction should be applied if the temperature is significantly above or below this value.

For every 3°C above 25°C, the correct specific gravity is 2 points (0.002) more than the hydrometer reading, and for every 3°C below the correct specific gravity is 2 points (0.002) less than the hydrometer reading. For example:

Hydrometer reading is 1250 (suggesting fully charged)

Ambient temperature is 10°C (ie. 15°C below 25°C)

Subtract 0.010 (0.002×(15÷3)) from hydrometer reading

Correct specific gravity is 1240 (ie. only 90% 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.

18.5 ALKALINE BATTERIES

18.5.1 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 series (ie as 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.

18.5.2 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.

18.5.3 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.

Seawater must not be used to top up batteries.

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.

18.5.4 Basic maintenance

Nickel cadmium batteries must be kept clean, dry and correctly topped-up. Terminals and connectors should be kept clean and 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.

18.6 BATTERY HAZARDS

18.6.1 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
- 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 may be 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 on charge.

18.6.2 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, deck head 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.

18.6.3 Uninterruptible power supplies (UPS)

Uninterruptible power supplies (UPS) can be used to supply mains power to GMDSS installations, or elements of it (such as 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 under-voltage 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 of this handbook. Ships can use a single and a separate battery installation, and UPS units must be operational within 5 seconds after turn on.

Figure 33 shows some typical arrangements.

Despite their advantages, GMDSS operators should examine their ship'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 (and 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?
- 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
- observe all safety instructions provided by maker.

18.6.4 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
- recycle only as directed.

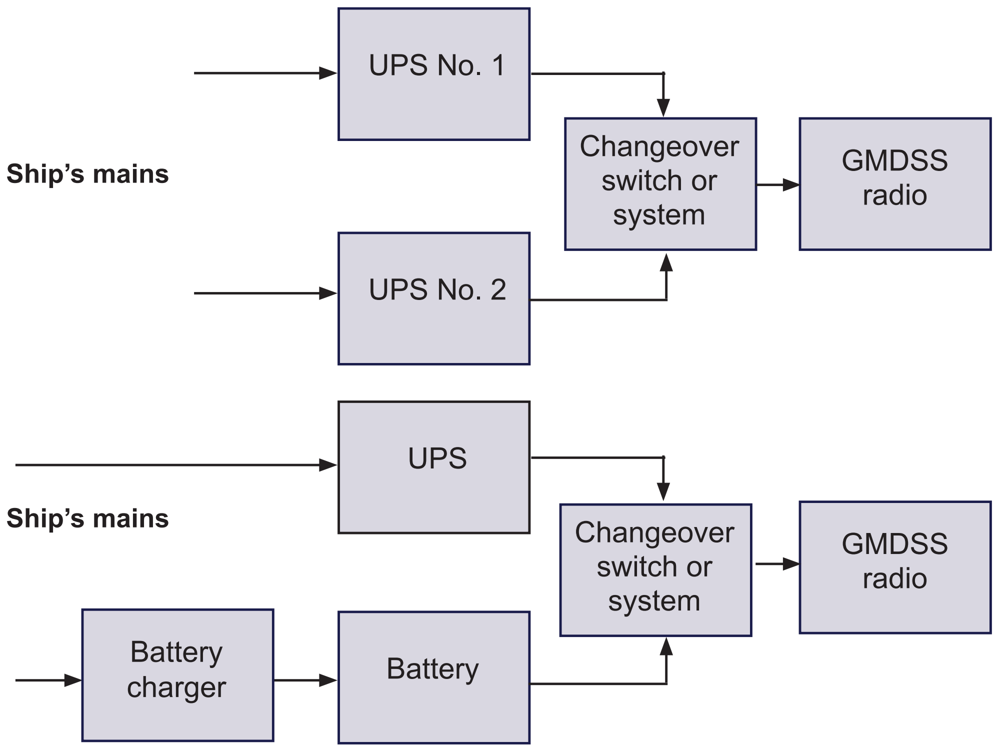


Figure 33 — Typical Uninterruptible Power Supplies

19 EQUIPMENT MAINTENANCE

This chapter provides guidance on the procedures to be followed for basic maintenance of GMDSS ship station equipment.

19.1 ANTENNA SYSTEMS

19.1.1 Introduction

A properly performing antenna system is a fundamental requirement for effective communications. Although antenna systems fitted to GMDSS ships are specifically designed for the maritime environment they still require routine maintenance to ensure proper performance.

19.1.2 VHF antennas

Antennas used for operation at VHF are the vertical whip type. They are constructed of either fibreglass or aluminum. 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.

19.1.3 MF/HF wire antennas

GMDSS ships that have been converted from original wireless telegraphy ships 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 ship is subject to a collision or some other severe impact. They should be inspected regularly for signs of wear or damage.

19.1.4 MF/HF vertical antennas

MF/HF antennas on modern GMDSS ships are usually large vertical whip types. Some may be in excess of 10 metres 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.

19.1.5 Emergency wire antennas

Ships with two transmitting antennas are often provided with an antenna switch which allows the MF/HF transceiver to be connected to either antenna. On older ships this could be the ship's original antenna switch box mounted in the radio room. Simplified operating instructions are provided either on or near the switch box.

Some ships 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 ships 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 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.

19.2 RADIO EQUIPMENT

19.2.1 Software

As radio and satellite equipment becomes increasingly software and firmware dependent updates to application software and firmware, to meet changes in IMO and ITU regulatory requirements, are needed. This applies in the case of retrospective changes to regulations which apply to all relevant ships.

Ship owners, operators and crew should ensure that the latest versions of relevant software and firmware are uploaded to equipment as required. IMO Circulars MSC.1/Circ.1389 and MSC.1/Circ.1460 provide further guidance.

19.2.2 Power supplies

The most common faults with GMDSS radio equipment are those related to power supply systems. Most GMDSS ships 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/or replacement.

If a circuit breaker continues to trip or replacement fuses continue to blow, technical help must be sought.

19.2.3 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 ship sinking
- how secure is its mounting
- for signs of damage.

If there is any doubt it is strongly recommended that these checks be carried out by a shore-based maintainer at the earliest opportunity. For further advice refer to IMO Circular MSC/Circ.1039.

Refer to Section 17.9 for a summary all routine testing requirements, and to the AMSA GMDSS Radio Log (included as Appendix 11 in this handbook).

19.2.4 SARTs

A physical examination of the SART(s) should be carried out monthly. Refer to section 17.9 for a summary of all routine testing requirements, and to AMSA GMDSS Radio Log (included in Appendix A9.2 of this handbook).

19.2.5 AIS-SARTs

A physical examination of the AIS-SART(s) should be carried out monthly. Refer to section 17.9 for a summary all routine testing requirements, and to AMSA GMDSS Radio Log (included as Appendix 11 of this handbook).

Please refer to section 18.6.3 for information relating to Uninterruptible Power Supplies (UPS).

20 ROUTINE COMMUNICATIONS PROCEDURES

This chapter provides guidance in procedures to be followed during routine and commercial communications.

20.1 RADIO RECORDS

20.1.1 Radio log books

Every ship which is compulsorily fitted with a radio installation must carry a radio log book. The radio log book must be retained onboard for a period of at least two years from the last entry. The log must be available for inspection by an officer appointed under the *Navigation Act 2012*, or an authorised official in a country other than Australia who is carrying out an inspection in accordance with Article X of the STCW Convention.

The radio services of 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.

20.1.2 Completion of radio log book

Section A — Particulars of ship, 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 ship's radio station and must be completed in duplicate. The following entries must be made in chronological order:

- summary of distress, urgency or safety traffic received either by radio telephone or DSC
- records for distress, urgency or safety traffic received by Inmarsat satellite systems, NAVTEX and/or NBDP. These should be noted in, and kept with, the log
- electronic records of communications relating to distress, urgency, safety and receipts of weather reports, and navigation warnings, form part of the log, and must be retained and not overwritten
- any incident connected with the radio service which appears to be of importance to the safety of life at sea
- tests of the GMDSS equipment (as carried to comply with Marine Order 27 (Safety of navigation and radio equipment) 2016) as detailed in the GMDSS Radio Log Book
- if the ship's rules permit, the position of the ship at least once a day.

In addition, the Master must inspect and sign each day's entries in 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 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 two years. 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.

20.1.3 Retention of logs

Once completed, the original Log(s) must be retained onboard 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.

An example of a GMDSS Radio Log book format is shown in Figure 34 on page 118 and includes an example of a completed page. A copy of the AMSA Radio Log book can be found in Appendix 9 of this handbook.

20.2 SERVICE DOCUMENTS

20.2.1 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. It details the 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 ships. Regular updates are issued through weekly UKHO Notices to Mariners (Australian Notices to Mariners are issued fortnightly).

20.2.2 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 ships providing details such as radio equipment fitted, radio call signs 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 (Safety of navigation and radio equipment) 2016* 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, MSI, notices to navigators, radio time signals. Also contains stations transmitting radio time signals, AIS and information on port stations, pilot stations, LESs, VTS stations, SAR agencies and NAVAREA coordinators, which 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 printed or electronic form (CD-ROM).

These publications are required to be carried by all Australian GMDSS ships, but can be carried in paper or electronic form where available.

List IV is published on CD-ROM annually and there are 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 is published on CD-ROM every two years and there is no paper supplements printed, but amendments will be available free-of-charge from the ITU MARS webpage at: http://www.itu.int/en/ITU-R/terrestrial/mars/Pages/default.aspx.

20.2.3 Inmarsat global Satcom services

Customer service for matters associated with Inmarsat Global Satcom Services can be obtained from their Customer Services Centre direct on:

Toll free	+61 7 5498 0000 or dial 33# from handset
E-mail:	customer.support@stratosglobal.com
WEB:	www.inmarsat.com

20.2.4 Marine Order 27

In addition to the publications mentioned above, AMSA *Marine Order 27 (Safety of navigation and radio equipment) 2016* requires the following publications be carried on Australian GMDSS ships:

- 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 (this book), published by AMSA
- a copy of AMSA *Marine Order 27 (Safety of navigation and radio equipment) 2016*
- a current edition of the ALRS, published by the UK Hydrographic Office
- the ship's GMDSS Radio Log.

20.3 GENERAL ROUTINE COMMUNICATIONS PROCEDURES

20.3.1 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. For example, a frequency listed for communicating with coast stations is not to be used for communicating with other ships.

20.3.2 Secrecy of communications

Under Article 37 of the Constitution of the International Telecommunication Union, and ITU Radio Regulations No. 18.4 the unauthorised 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 authorisation 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 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 in accordance with the Regulations. These provisions also apply to operators of SESs.

20.3.3 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.

20.3.4 Calling and working frequencies

Frequencies assigned to ship and coast stations are designated as either:

- calling channels/frequencies — used to establish communications
- 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.

20.3.5 Calling channels

The main frequencies used for establishing routine radio telephone communications are 2 182, 4 125, 6 215 kHz and Channel 16 in the VHF band.

8 291 kHz is reserved for distress, urgency and safety communications only. If there is a necessity to call in the 8 MHz band then reference should be made to ITU Radio Regulations Appendix 17.

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 the maritime HF bands from 4 to 22 MHz. These are used for radiotelephone calls between ships and telephone subscribers ashore.

20.3.6 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, and the ALRS, Vol 1, along with their hours of operation.

20.3.7 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
- harmful interference will not be caused to any routine transmissions already in progress.

Silence periods must also be observed (see Section 16.11.4) where national arrangements require silence periods. Silence periods are not observed as part of the GMDSS, and do not apply in Australia, however the observance of such is not discouraged.

The initial call should be spoken clearly and slowly using the following procedures:

- the name and/or call sign of the station being called, spoken not more than three times
- the words THIS IS
- the name and/or call sign of the calling station, spoken not more than three times
- the frequency (or channel number) of the channel being used
- 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.

20.3.8 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 call sign of the station being called spoken once
- the words THIS IS
- the name and/or call sign of the station calling, spoken twice.

On all bands, once communications have been established names and/or call-signs need only be spoken once.

20.3.9 Repeating calls

When a station being called does not reply to a complete call sent three times at intervals of 2 minutes, calling must cease for 3 minutes.

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 MSI, by listening on the working channel for the band in use at the time.

If after 3 minutes 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 minutes calling must once again cease for 3 minutes.

Where communications are between maritime mobile station and an aircraft station the interval between call attempts is 5 minutes.

20.3.10 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.

20.3.11 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 of this handbook. In the ITU Radio Regulations, these codes are listed in Appendix 14.

20.3.12 Standard Marine Communications Phrases (SMCP)

The SMCP is an IMO publication, and contained in IMO Resolution A.918(22). A small portion is included as Appendix 4 of this handbook.

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
- standardise the language used in communication for navigation at sea, in port approaches, waterways and harbours, and on board ships with multilingual crews
- 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 ship's routing. Neither are they intended to supersede the International Code of Signals. 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 14.2), 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 stations 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.

20.3.13 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 metres 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.

20.4 RADIO TELEX SERVICES

20.4.1 General

Radiotelex as a commercial service has significantly declined in recent years. However, services remain in some parts of the world, including for the dissemination of MSI. Refer to the ALRS, or the ITU List of Coast Stations and Special Service Stations for listings of stations currently in operation.

20.5 TRAFFIC CHARGES

20.5.1 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
- 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 Administrations is allocated 25 AAIC codes. These are prefixed with two letters representing the country of origin. Australia's 25 codes are prefixed with 'AA' — eg 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 ships 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 coordinates traffic charging.

20.5.2 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 ship's accounting authorities.

20.5.3 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
- 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.

20.6 TIME SIGNALS

20.6.1 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.

20.6.2 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 ALRS or the ITU List of Radiodetermination and Special Service Stations (List VI).

20.7 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 position 41-46N 50-14W sinking*	*16804.5*
0603/15			*Monitored R/T channel — no traffic*	*16420*
0615	*VNSZ*	*RCC*	*DSC alert information passed via Inmarsat C Position of vessel in distress well out of this vessel's 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*	

Figure 34 — Sample of GMDSS Radio Log page

APPENDIX 1

FREQUENCIES FOR USE BY GMDSS SHIP STATIONS

1 DISTRESS, URGENCY, SAFETY AND CALLING FREQUENCIES

Radiotelephone	DSC	NBDP
2 182 kHz	2 187.5 kHz	2 174.5 kHz
4 125 kHz	4 207.5 kHz	4 177.5 kHz
6 215 kHz	6 312.0 kHz	6 268.0 kHz
8 291 kHz*	8 414.5 kHz	8 376.5 kHz
12 290 kHz+	12 577.0 kHz	12 520.0 kHz
16 420 kHz+	16 804.5 kHz	16 695.0 kHz
VHF Ch. 16 (156.8 MHz)	VHF Ch. 70 (156.525 MHz)	Not used

Table 14 — Distress, urgency, safety and calling frequencies

* The frequency 8 291 kHz is reserved for distress, urgency and safety communications only. If there is a necessity to call in the 8 MHz band then reference should be made to ITU Radio Regulations Appendix 17.

\+ 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. This includes radio checks, provided of course that no other distress, urgency or safety traffic is in progress.

2 FREQUENCES FOR ON-SCENE SEARCH AND RESCUE FOR R/T AND NBDP

2 174.5 kHz (maritime NBDP FEC mode)

2 182.0 kHz (maritime R/T frequency)

3 023.0 kHz (aeronautical R/T frequency)

4 125.0 kHz (maritime and aeronautical R/T frequency)

5 680.0 kHz (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)

3 FREQUENCES FOR INTERSHIP NAVIGATION SAFETY COMMUNICATIONS

156.65 MHz (VHF Ch. 13 R/T)

4 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 MSI)

5 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)

6 FREQUENCIES FOR INMARSAT C SATELLITE COMMUNICATIONS

1 530.0 to 1 545.0 MHz (downlink: commercial, distress & safety)

1 626.5 to 1 645.5 MHz (uplink: commercial, distress & safety)

7 FREQUENCIES FOR COSPAS–SARSAT SATELLITE COMMUNICATIONS

1 544.0 to 1 545.0 MHz (downlink: distress & safety only)

8 PRIMARY FREQUENCIES FOR GENERAL SHIP–SHIP VOICE COMMUNICATIONS

2 638 kHz

4 146 kHz

4 149 kHz

6 224 kHz

6 230 kHz

8 297 kHz

12 353 kHz

12 356 kHz

16 528 kHz

16 531 kHz

22 159 kHz

156.875 MHz (VHF Ch. 77)

9 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.

10 COMMON IDENTIFICATION OF FREQUENCY BANDS ABOVE 1 GHZ

L-band 1–2 GHz (eg GPS, Inmarsat-C mobile)

S-band 2–3 GHz (eg 10 cm radar)

C-band 4–8 GHz (eg Inmarsat-C mobile feeder links)

X-band 8–12 GHz (eg SART, 3 cm radar)

Ku band 12–18 GHz (eg 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.

APPENDIX 2

PROMULGATION OF MARITIME SAFETY INFORMATION

1 INTRODUCTION

MSI is promulgated under the GMDSS within the Australian search and rescue region (SRR) and NAVAREA X by JRCC Australia.

The MSI Notice also contains a section, approved by the Bureau of Meteorology, on meteorological information promulgated in a similar manner under GMDSS.

The JRCC 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.

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)
- IMO Resolution A.1051(27) (IMO/WMO Worldwide Met-Ocean Information and Warning Service)
- Joint IMO/IHO/WMO Manual on Maritime Safety Information
- IMO International SafetyNET Manual
- IMO NAVTEX Manual (not relevant for Australia).

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 EGC service called SafetyNET.

In addition to SafetyNET, the JRCC may avail itself of the 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.

Every GMDSS compliant ship must meet the following legal requirements for receiving MSI broadcasts:

- watchkeeping — every ship, while at sea, shall maintain a radio watch for broadcasts of MSI on the appropriate frequencies on which such information is broadcast for the area in which the ship is navigating
- logging messages — 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 NBDP 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 JRCC Australia initiated broadcasts

- Distress Messages (MAYDAY)
- Urgency Messages (PAN PAN)
- NAVAREA X warnings (SECURITE)
- Local Sea Safety Message (SSM) warnings
- General messages (ALL SHIPS/CQ)

2.2 Bureau of Meteorology initiated broadcasts

- METAREA X warnings (SECURITE)
- Coastal warnings (SECURITE)

2.3 Distress Messages

Distress Messages will be directed to a circular area. The radius of the area will be dependent on the nearest known vessel from MASTREP or from other intelligence.

The text of the message will commence with the distress signal, MAYDAY.

At the conclusion of the distress incident, the JRCC will initiate a message including the words SILENCE FINI, amongst other information, to indicate distress traffic has ceased.

The SES will provide an aural alarm and visual indication to indicate receipt of a Distress Call or a call having a distress category.

2.4 Urgency messages

Urgency Messages can be directed to a circular, rectangular or coastal area, or an ocean region.

The text of the message will commence with the urgency signal, PAN PAN.

The SES will provide an aural alarm and visual indication to indicate receipt of an Urgency Call.

2.5 NAVAREA/METAREA X warnings

NAVAREA/METAREA X warnings will be broadcast through the POR and IOR satellites. The text will commence with the signal SECURITE.

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.

The Bureau of Meteorology's high seas forecasts and Ocean Wind Warnings cover the METAREA X area.

2.6 Coastal (AUSCOAST) warnings

AUSCOAST warnings will be broadcast through the POR and IOR satellites. The text will commence with the signal 'SECURITE'.

The Australian coastal area has been divided up as per the attached schematic diagram in Figure 35 to facilitate the broadcast of AUSCOAST warnings. All warnings about aids to navigation within the coastal area, other than those mentioned in Appendix A2.2.5 of this handbook, will be issued as AUSCOAST warnings.

2.7 Local (SSM) warnings

Local (SSM) warnings refer to hazards which are considered to be of a temporary nature, eg floating logs, temporary buoys, etc.

The text will commence with the signal SECURITE.

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.

2.8 General messages

General messages (eg ship overdue) can be directed to a circular, rectangular or coastal area, or an ocean region.

The text of the message will commence with the signal, ALL SHIPS.

2.9 EGC message to an individual SES

JRCC Australia will use this SafetyNET feature to contact individual ships as required using the appropriate priority. A Distress Priority Message sent to a SES with a will result in an alarm being raised at the SES to alert the officer of the watch.

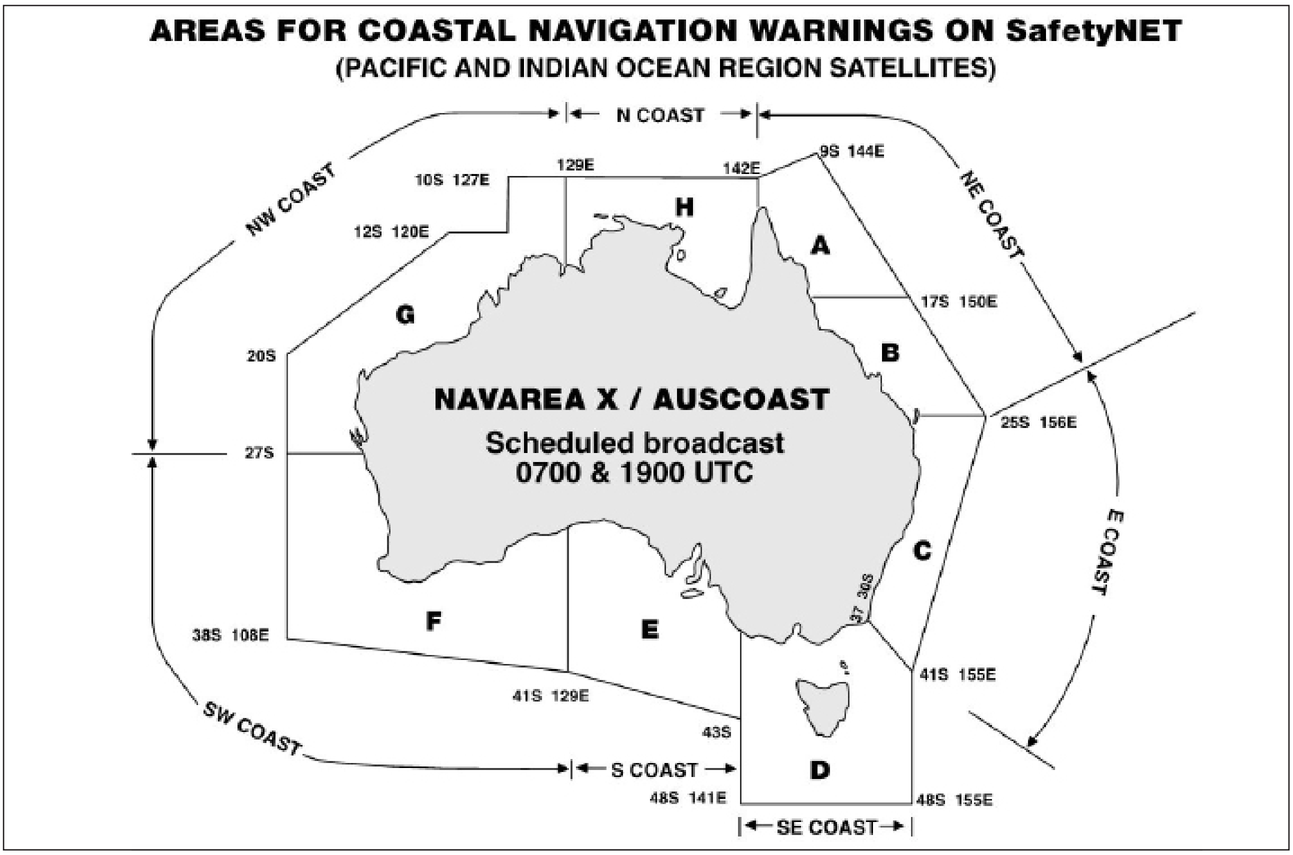


Figure 35 — Areas for Coastal Navigation Warnings on SafetyNET (POR and IOR Satellites)

3 BROADCAST PROCEDURES

All messages from the JRCC will identify the originator as: 'JRCC AUSTRALIA DTG ...' (DTG — Date Time Group). Ships responding to broadcasts should include this DTG. The DTG provides a unique way of identifying messages at the JRCC.

Most broadcasts will be echoed, ie. repeated 6 min after the initial broadcast. This will give ships which were transmitting at the time of the initial broadcast another opportunity to receive the message.

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 SES. The scheduled broadcast, if previously received error free, will not be printed again.

It is possible that due to operational requirements some scheduled broadcasts may not occur at the precise time stated above.

If a message has to be resubmitted to the LES by the information provider, then ships already in receipt of the message will receive the message again when it is retransmitted.

4 INMARSAT SERVICE CODE MESSAGE ROUTING VIA SACS

Refer to Appendix 14 of this handbook in respect of the Inmarsat Network Inmarsat–C Special Access Codes / Short Address Codes (SACs) and their message distribution.

The following types of messages and corresponding SACs provide access to the appropriate services if sent through the Inmarsat 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 REPORTS4 SAC 1243 INFORMATION REPORTS TO JRCC AUSTRALIA (eg. semi-submerged container sighted) [2]
SAC 1243	INFORMATION REPORTS TO JRCC AUSTRALIA (eg semi-submerged container sighted) [2]
SAC 1250	ROUTINE TRAFFIC TO JRCC 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 Inmarsat 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).

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 Fleet77, etc.

Ships should discriminate between medical advice and medical assistance. Medical advice (Code 32) is provided by doctors and concerns diagnosis, on board treatment, etc. Medical assistance (Code 38), provided by the JRCC, involves evacuation of a patient subsequent to medical advice being obtained.

Ships unable to use the above Inmarsat Special Access Codes (SACs) should direct traffic to the JRCC on telephone +61 2 6230 6811.

5 WEATHER

The Bureau of Meteorology will initiate two types of broadcasts: forecasts and warnings.

5.1 Forecasts

There are four high seas forecast areas: Western, Northern, North Eastern and South Eastern. See Figure 35.

High seas forecasts will be issued in one EGC message and promulgated at the following scheduled times:

- POR — North East, South East, Western and Northern at 1100 UTC and 2300 UTC
- IOR — Western area only at 1030 UTC and 2330 UTC.

Coastal waters forecasts are issued for the Bass Strait, Torres Strait, Western Australia and the Northern Territory.

These messages are addressed to the AUSCOAST areas covering Bass Strait, WA and NT, as shown in Figure 36 (B1 Code) and have message type codes (B2 Codes): meteorological forecasts — Code E; meteorological warnings — Code B.

5.2 Warnings

Warnings to shipping on the high seas are issued whenever gale, storm force or hurricane-force winds are expected.

There are four ocean wind warning areas; Western, Northern, North Eastern, South Eastern. See Figure 36.

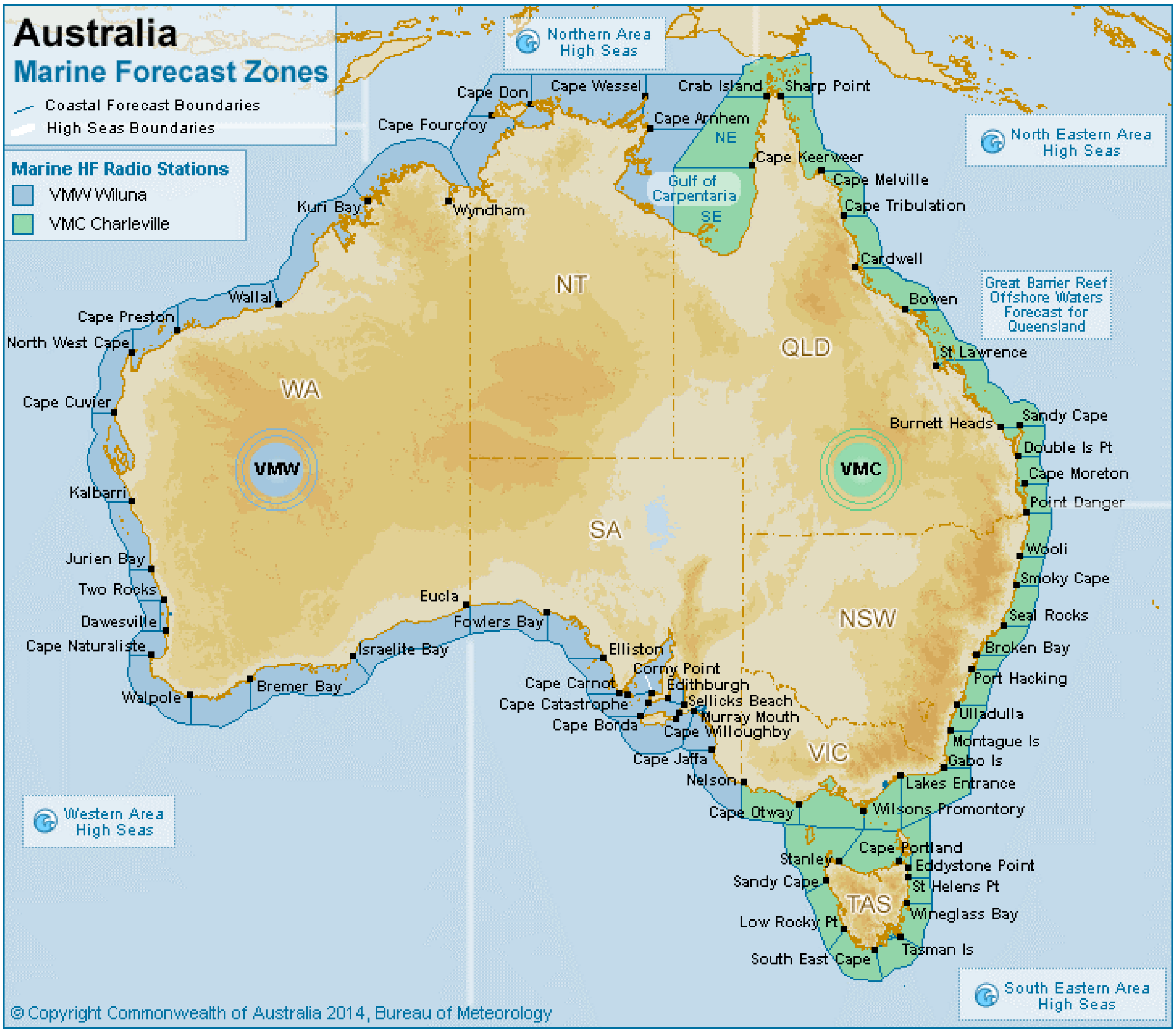


Figure 36 — Forecast areas for high seas

Warnings will be addressed to rectangular areas as required as follows:

- POR — North East, South East, Western and Northern; and
- IOR — Western area only.

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.

Tropical cyclone information is included in high seas and coastal waters forecasts and warnings (when applicable).

Visit the Bureau of Meteorology's website, www.bom.gov.au/marine/index.shtml for current weather information and marine radio broadcast schedules.

5.3 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
	n/a	Torres Strait	1910 UTC 0700 UTC
	G,H	Northern Territory	2015 UTC 0815 UTC
IOR	F, G	Western Australia	2030 UTC 0830 UTC
* One hour earlier during Australian Eastern daylight time			

Table 15 — Schedule of Australian SafetyNET weather bulletins

6 TERRESTRIAL ROUTING OF WEATHER REPORTS

The Perth LES will accept weather reports from ships equipped with Inmarsat Fleet77 or C terminals.

All weather reports relayed through the Perth LES will be forwarded to the Bureau of Meteorology free of charge to the reporting ship, providing service code 41+ is used for their Meteorological Reports.

7 HF MARINE RADIO SERVICES

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.

7.1 Voice services

The HF voice services comprise:

- marine weather warnings are broadcast every hour
- weather forecasts and coastal observations for coastal waters zones and high seas areas are repeated every 4 hours
- navigational MSI for each state/territory.

Navigational warnings are mandatory and cannot be suppressed.

VMC transmissions cover Qld, NSW, Vic and Tas coastal waters zones and Northern, Northeast and Southeast high seas areas.

The VMC broadcasts on the following frequencies:

0700 to 1800 (day) (eastern standard time)

4 426, 8 176, 12 365 and 16 546 kHz

1800 to 0700 (night) (eastern standard time)

2 201, 6 507, 8 176 and 12 365 kHz

VMW transmissions cover Qld Gulf, NT, WA and SA coastal waters and for Northern and Western high seas areas.

The VMW broadcasts on the following frequencies:

0700 to 1800 (day) (western standard time)

4 149, 8 113, 12 362 and 16 528 kHz

1800 to 0700 (night) (western standard time)

2 056, 6 230, 8 113, and 12 362 kHz

7.2 Fax services

The HF Fax service comprises weather, wave and ocean maps for the Australia, Pacific Ocean and Indian Ocean regions.

	Frequency (kHz)	Time (UTC)
VMC	2 628	0900 – 1900
	5 100	0000 – 2400
	11 030	0000 – 2400
	13 920	0000 – 2400
	20 469	1900 – 0900
VMW	5 755	1100 – 2100
	7 535	0000 – 2400
	10 555	0000 – 2400
	15 615	0000 – 2400
	18 060	2100 – 1100

Fax broadcasts run on a 24 hour cycle.

8 SHIP TO SHORE TRAFFIC

Distress Alerts and Messages initiated by ships through Inmarsat on the Pacific or Indian Ocean region satellites and routed through the Perth LES will be directed to JRCC Australia.

9 SAFETYNET

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 SOLAS Convention 1974.

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/METAREA, 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 who's SES has been set to one or more fixed areas or recognises a temporary area by the latitude and longitude entered into the SES.

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.

Users of the SafetyNET system should be aware that the latest version of the Inmarsat-C software should be installed on their SES. Equipment suppliers should be consulted for further information.

Users are requested to provide feedback on any aspect of the implementation of the SafetyNET system with the view to improving the MSI service.

In addition to the manuals supplied by the SES manufacturers it is recommended that ships also hold a copy of the SafetyNET user handbook, published by Inmarsat. This publication is available for downloading from the Inmarsat website:

http://www.inmarsat.com/wp-content/uploads/2013/10/Inmarsat_SNET_Handbook_5th_Edition.pdf.

In addition, a useful resource on Inmarsat information is available at:

http://www.inmarsat.com/service/maritime-safety/.

10 RECEPTION OF SAFETYNET

In order to receive SafetyNET traffic automatically the ship's EGC receiver must be configured as follows.

If operating in an area covered by two satellite ocean regions users should elect to receive SafetyNET traffic from the appropriate satellite.

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.

If the ship's position has not been updated for more than 12 hours, all geographically addressed messages with priorities higher than routine within the entire ocean region will be printed out. SOLAS ships 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.

Configure the SES to receive coastal warnings as per the instruction manual, noting that the JRCC and Bureau of Meteorology will utilise the following codes for coastal coverage area as per Figure 35:

- Nav. Warnings for Coastal (AUSCOAST) warnings
- Additional Nav. Warnings for Local (SSM) warnings
- SAR for search and rescue messages
- Met forecasts for weather in the Bass Strait, and coastal Western Australia and Northern Territory.

APPENDIX 3

PHONETIC ALPHABET AND FIGURE CODE

1 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	Alpha	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	Juliet	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 16 — Phonetic Alphabet

2 FIGURE CODE

When it is necessary to spell out figures or marks, the following table should be used.

Figure or Mark to be Transmitted	Spelling	Pronounciation
0	zero	ZEERO
1	one	WUN
2	TWO	TOO
3	three	TREE
4	four	FOWER
5	five	FIFE
6	six	SIX
7	seven	SEVEN
8	eight	AIT
9	nine	NINER
1000	thousand	TOUSAND
Decimal	decimal	DAY-SEE-MAL
Full stop	stop	STOP

Table 17 — Figure Codes

Source: IMO Standard Marine Communication Phrases IMO Assembly 22nd Session, Resolution A.918(22) Agenda Item 9.

APPENDIX 4

STANDARD MARINE COMMUNICATION PHRASES

1 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 are contained in the following paragraphs.

1.1 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.

1.2 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'.

1.3 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..../ frequency…

Standing by on channel.... / frequency…

Change to channel.... / frequency….

Advise (you) change to channel.... / frequency….

Advise (you) try channel.... / frequency….

Changing to channel…. / frequency….

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....

1.4 Correction

If a mistake is made in a message, say:

'Mistake' followed by the word, or

'Correction', plus the correct message.

Example: My present speed is 14 knots — mistake. Correction, my present speed is 12, one-two, knots.

1.5 Repetition

If any parts of the message are considered sufficiently important to need particular emphasis, use the word 'repeat'.

Example: 'Do not overtake — repeat — do not overtake'.

1.6 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.

1.7 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.

1.8 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.

1.9 Distances

Distances should be expressed in n miles or cables (tenths of a nautical mile). The unit should always be stated.

1.10 Speed

Speed should be expressed in knots (without further notation meaning speed through the water). 'Ground speed' meaning speed over the ground.

1.11 Numbers

Numbers should be transmitted by speaking each digit separately, eg. 'one five zero' for 150.

1.12 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.

1.13 Time

Times should be expressed in the 24 hour UTC notation. If local time will be used in ports or harbours it should be clearly stated.

1.14 Ambiguous words

Some words in English have meanings depending on the context in which they appear. Misunderstandings frequently occur, especially in VTS communications, and have produced accidents. Such words are:

May:

Do not say: 'May I enter the fairway?'

Say: 'QUESTION. Do I have permission to enter the fairway?'

Do not say: 'You may enter the fairway.'

Say: 'ANSWER. You have permission to enter the fairway.'

Might:

Do not say: 'I might enter the fairway.'

Say: 'INTENTION. I will enter the fairway.'

Should

Do not say: 'You should anchor in anchorage B 3.'

Say: 'ADVICE. Anchor in anchorage B 3.'

Could:

Do not say: 'You could be running into danger.'

Say: 'WARNING. You are running into danger.'

Source:

IMO Standard Marine Communication Phrases IMO Assembly 22nd Session, Resolution A.918(22) Agenda Item 9.

APPENDIX 5

MARITIME IDENTIFICATION DIGITS (MIDS)

1 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	Portugal - Azores
205	Belgium
206	Belarus (Republic of)
207	Bulgaria (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	Denmark — Faroe Islands
232	United Kingdom of Great Britain and Northern Ireland
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	United Kingdom of Great Britain and Northern Ireland — Gibraltar
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	Portugal — Madeira
256	Malta
257	Norway
258	Norway
259	Norway
260	Not allocated
261	Poland (Republic of)
262	Montenegro
263	Portugal
264	Romania
265	Sweden

MID	ALLOCATED TO
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	United Kingdom of Great Britain and Northern Ireland — Anguilla
302	Not allocated
303	United States of America — Alaska (State of)
304	Antigua and Barbuda
305	Antigua and Barbuda
306	Netherlands (Kingdom of the) — Bonaire, Sint Eustatius and Saba
306	Netherlands (Kingdom of the) — Curaçao
306	Netherlands (Kingdom of the) — Sint Maarten (Dutch part)
307	Netherlands (Kingdom of the) — Aruba
308	Bahamas (Commonwealth of the)
309	Bahamas (Commonwealth of the)
310	United Kingdom of Great Britain and Northern Ireland — Bermuda
311	Bahamas (Commonwealth of the)
312	Belize
313	Not allocated
314	Barbados
315	Not allocated
316	Canada
317 – 318	Not allocated

MID	ALLOCATED TO
319	United Kingdom of Great Britain and Northern Ireland — Cayman Islands
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	France — Guadeloupe (French Department of)
330	Grenada
331	Denmark — Greenland
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	France — Martinique (French Department of)
348	United Kingdom of Great Britain and Northern Ireland — Montserrat
349	Not allocated
350	Nicaragua
351	Panama (Republic of)
352	Panama (Republic of)
353	Panama (Republic of)
354	Panama (Republic of)

MID	ALLOCATED TO
355	Panama (Republic of)
356	Panama (Republic of)
357	Panama (Republic of)
358	United States of America — Puerto Rico
359	El Salvador (Republic of)
360	Not allocated
361	France — Saint Pierre and Miquelon (Territorial Collectivity of)
362	Trinidad and Tobago
363	Not allocated
364	United Kingdom of Great Britain and Northern Ireland — Turks and Caicos Islands
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	Panama (Republic of)
375	Saint Vincent and the Grenadines
376	Saint Vincent and the Grenadines
377	Saint Vincent and the Grenadines
378	United Kingdom of Great Britain and Northern Ireland — British Virgin Islands
379	United States of America — United States Virgin Islands
380 – 400	Not allocated
401	Afghanistan
402	Not allocated
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

MID	ALLOCATED TO
412	China (People's Republic of)
413	China (People's Republic of)
414	China (People's Republic of)
415	Not allocated
416	China (People's Republic of) — Taiwan (Province of China)
417	Sri Lanka (Democratic Socialist Republic of)
418	Not allocated
419	India (Republic of)
420 – 421	Not allocated
422	Iran (Islamic Republic of)
423	Azerbaijan 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
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

MID	ALLOCATED TO
453	China (People's Republic of) — Macao (Special Administrative Region of China)
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	United Arab Emirates
472	Tajikistan (Republic of)
473	Yemen (Republic of)
474	Yemen (Republic of)
475	Yemen (Republic of)
476	Not allocated
477	China (People's Republic of) — Hong Kong (Special Administrative Region of China)
478	Bosnia and Herzegovina
479 – 500	Not allocated
501	France — Adélie Land
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

MID	ALLOCATED TO
513	Not allocated
514	Cambodia (Kingdom of)
515	Cambodia (Kingdom of)
516	Australia - Christmas Islands (Indian Ocean)
517	Not allocated
518	New Zealand - Cook Islands
519	Not allocated
520	Fiji (Republic of)
521 – 522	Not allocated
523	Australia - Cocos (Keeling) Islands
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	United States of America — Northern Mariana Islands (Commonwealth of the)
537	Not allocated
538	Marshall Islands (Republic of the)
539	Not allocated
540	France — New Caledonia
541	Not allocated
542	New Zealand — Niue
543	Not allocated
544	Nauru (Republic of)
545	Not allocated
546	France — French Polynesia
547	Not allocated
548	Philippines (Republic of the)
549 – 552	Not allocated
553	Papua New Guinea
554	Not allocated
555	United Kingdom of Great Britain and Northern Ireland — Pitcairn Island
556	Not allocated

MID	ALLOCATED TO
557	Solomon Islands
558	Not allocated
559	United States of America — American Samoa
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	France — Wallis and Futuna Islands
579 – 600	Not allocated
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	France — Saint Paul and Amsterdam Islands
608	United Kingdom of Great Britain and Northern Ireland — Ascension Island
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)

MID	ALLOCATED TO
616	Comoros (Union of the)
617	Cape Verde (Republic of)
618	France — Crozet Archipelago
619	Côte d'Ivoire (Republic of)
620	Comoros (Union of the)
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)
635	France — Kerguelen Islands
636	Liberia (Republic of)
637	Liberia (Republic of)
638	South Sudan (Republic of)
639 – 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

MID	ALLOCATED TO
659	Namibia (Republic of)
660	France — Reunion (French Department of)
661	Rwanda (Republic of)
662	Sudan (Republic of the)
663	Senegal (Republic of)
664	Seychelles (Republic of)
665	United Kingdom of Great Britain and Northern Ireland — Saint Helena
666	Somalia (Federal Republic of)
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)
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

MID	ALLOCATED TO
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	United Kingdom of Great Britain and Northern Ireland — Falkland Islands (Malvinas)
741 – 744	Not allocated
745	France — Guiana (French Department of)
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 COC COURSE

Detailed syllabus and hours required for each subject.

The following GOC course content is taken directly from the IMO publication ‘Model Course 1.25 — General Operator’s Certificate for the Global Maritime Distress and Safety System, 2015 Edition, course + Compendium’.

Some content from the IMO publication has been ~~struck out~~, as the relevant Inmarsat services are no longer available and therefore no longer relevant from an instructional perspective.

The timings are indicative as dependent on the course structure different components may be taught concurrently. They have been modified from the IMO publication to allow completion of the course, on a full time basis, over ten 7.5 hour days, or four 7.5 hour days for the refresher course.

Learning Objective	Course hours	
	GOC Full	GOC Refresher
1. Introduction	1:00	0:20
2. Statutory framework of the maritime mobile service		
2.1. International Convention of Safety of Life at Sea	2:00	0:35
2.1.1. Function requirements		
2.1.2. Sea areas		
2.1.2.1. Definitions of sea areas		
2.1.3. Carriage requirements		
2.1.3.1. Details of equipment specifications A1, A2, A3 and A4		
2.1.3.2. Details of carriage requirements		
2.1.3.3. Means of ensuring availability of ship station equipment		
2.1.3.4. Primary and secondary means of alerting		
2.1.3.5. Bridge alarm panel and its purpose		
2.1.3.6. Requirements for safety certificates		
2.1.4. Watchkeeping procedures as defined in the radio regulations		
2.1.4.1. Other watchkeeping procedures		
2.1.4.2. Radio operators		
2.1.5. Sources of power		
2.1.6. Reserve power supplies, capacity and duration as defined in SOLAS Convention		
2.1.6.1. Reserve source of energy		
2.1.6.2. Prohibitions on the connection of non-GMDSS equipment		
2.2. Radio regulations	2:00	0:20
2.2.1. Authority of the Master		
2.2.2. Secrecy of correspondence		
2.2.3. Ship station licences		
2.2.4. Inspection of stations		

Learning Objective	Course hours	
	GOC Full	GOC Refresher
2.2.5. Radio operator's certificates 2.2.6. Frequencies 2.2.6.1. Interferences 2.2.6.2. Use of and restrictions for different emissions according to frequencies in the Maritime Mobile Service (MMS) 2.2.6.3. Roles of various modes of communications 2.2.6.4. Use of bands of MF, HF, VHF, UHF and SHF frequencies 2.2.6.5. Concept of HF frequency management 2.2.6.6. VHF telephony 2.2.6.7. Frequencies for distress, urgency and safety communications 2.2.6.8. Frequencies for routine communication and reply 2.2.7. Call categories 2.2.7.1. Distress 2.2.7.2. Urgency 2.2.7.3. Safety 2.2.7.4. Routine 2.2.8. Watchkeeping and radio recordkeeping (logbook)	2:00	0:20
3. Identification of radio stations	1:30	0:10
3.1. Identification of ship stations 3.1.1. Ships name 3.1.2. Call sign 3.1.3. Maritime mobile service identity 3.1.4. Group calling number **3.2. Identification of coast stations** **3.3. Identification of search and rescue stations** **3.4. Identification of vessel traffic service stations** **3.5. Identification of aids to navigation** **3.6. Identification of aircraft stations** **3.7. Identification of associated craft with parent ship** **3.8 Identification of ship earth stations and coast earth stations**		

Learning Objective	Course hours	
	GOC Full	GOC Refresher
4. Service publications		
4.1. List of Coast Stations and Special Service Stations **4.2. List of ship stations and maritime mobile service identity assignments** **4.3. Manual for use by maritime mobile and maritime mobile satellite services** **4.4. Admiralty list of radio signals**	1:30	0:40
5. Technical		
5.1. Radio wave propagation 5.1.1. Basics 5.1.2. Line of sight propagation 5.1.3. Ground waves and sky waves 5.1.4. Ionosphere structure 5.1.5. UHF and VHF propagation 5.1.6. MF propagation 5.1.7. HF propagation 5.1.8. VLF propagation 5.1.9. LF propagation	1:30	0:20
5.2. Modulation basics 5.2.1. Frequency modulation 5.2.2. Amplitude modulation 5.2.3. Bandwidth of different types of modulation 5.2.4. Carrier and assigned frequencies 5.2.5. Official designations of emissions 5.2.6. Unofficial designations of emissions	1:00	0:20
5.3. Transmitter and receiver basics 5.3.1. Transmitter structure 5.3.2. Receiver structure	1:00	0:15
5.4. Batteries 5.4.1. Basics 5.4.2. Different kinds of batteries – UPS system 5.4.3. Characteristics of different battery types 5.4.3.1. Primary batteries 5.4.3.2. Secondary batteries 5.4.4. Charging batteries, battery charging methods 5.4.5. Maintenance and monitoring of batteries	1:00	0:30

<table>
<tr><th rowspan="2">Learning Objective</th><th colspan="2">Course hours</th></tr>
<tr><th>GOC Full</th><th>GOC Refresher</th></tr>
<tr><td>5.5. Antennas
5.5.1. VHF antennas
5.5.2. MF/HF antennas
5.5.3. Satellite antennas
5.5.4. Antenna maintenance</td><td>1:00</td><td>0:50</td></tr>
<tr><td>5.6. DSC basics</td><td>1:00</td><td>0:40</td></tr>
<tr><td>5.7. Radiotelex basics
5.7.1. Automatic request for repeat (ARQ)
5.7.2. Forward error correction (FEC)</td><td>1:00</td><td>0:10</td></tr>
<tr><td>5.8. Fault location and service on GMDSS marine electronic equipment</td><td>2:00</td><td>0:50</td></tr>
<tr><td>6. GMDSS components</td><td rowspan="2">2:00</td><td rowspan="2"></td></tr>
<tr><td>6.1. General including safety precautions (preventive measures for the safety of ship and personnel for hazards related to radio equipment, including electrical and non-ionizing radiation hazards)</td></tr>
<tr><td>6.2. VHF DSC
6.2.1. Basics
6.2.2. Use and functions of the VHF radio station installation
6.2.3. DSC possibilities
6.2.4. Operational VHF DSC procedures in the GMDSS
6.2.4.1. Telecommand and traffic information
6.2.4.2. Channel selection in call format
6.2.4.3. DSC acknowledgment
6.2.4.4. DSC relay process
6.2.4.5. Test transmissions
6.2.5. Alerting and announcement
6.2.5.1. Distress alert
6.2.5.2. Distress alert relay
6.2.5.3. Announcement for all ships (distress, urgency and safety)
6.2.5.4. Announcement to individual station (distress, urgency and safety)
6.2.5.5. Group announcement (distress, urgency and safety)
6.2.5.6. Polling and position request
6.2.5.7. Automatic/semi-automatic service with coast station
6.2.5.8. Practical VHF tasks</td><td>5:00</td><td>1:50</td></tr>
</table>

Learning Objective	Course hours	
	GOC Full	GOC Refresher
6.3. MF/HF DSC 6.3.1. Basics 6.3.2. Use and functions of the MF/HF radio station installation 6.3.3. DSC possibilities 6.3.4. Operational MF/HF DSC procedures in the GMDSS 6.3.4.1. Telecommand and traffic information 6.3.4.2. Frequency selection in call format 6.3.4.3. Acknowledgment 6.3.4.4. Distress alert relay 6.3.4.5. Use of frequencies 6.3.4.6. Test transmissions 6.3.5. Alerting and announcement 6.3.5.1. Distress alert 6.3.5.2. Distress alert relay 6.3.5.3. Announcement to individual station (urgency, safety and routine) 6.3.5.4. Geographic area announcement (urgency and safety) 6.3.5.5. Group announcement (distress, urgency, safety and routine) 6.3.5.6. Polling and position request 6.3.5.7. Automatic service with coast station 6.3.5.8. Practical MF/HF tasks	5:00	1:55
6.4. VHF/MF/HF voice procedures 6.4.1. Distress procedure 6.4.2. Urgency procedure 6.4.3. Safety procedure 6.4.4. Port operation and ship movement communication 6.4.5. Routine communication 6.4.5.1. Calling a subscriber (ship-to-shore) 6.4.5.2. Phone call from ashore (shore-to-ship) 6.4.5.3. Transmission of a telegram 6.4.6. Intership communication 6.4.7. Onboard communication 6.4.8. Practical VHF/MF/HF voice tasks	5:00	2:10

Learning Objective	Course hours	
	GOC Full	GOC Refresher
6.5. Radiotelex 6.5.1. Basics 6.5.2. Numbering 6.5.3. Automatic and manual calling 6.5.4. Radiotelex equipment 6.5.5. Details of telex message 6.5.6. Operational MF/HF Radiotelex procedures in the GMDSS 6.5.6.1. Distress procedure 6.5.6.2. Urgency procedure 6.5.6.3. Safety procedure 6.5.6.4. Routine procedure 6.5.6.5. Practical MF/HF Radiotelex tasks	1:30	0:40
6.6. Inmarsat 6.6.1. Basics 6.6.1.1. Inmarsat space segment 6.6.1.2. Inmarsat ground segment 6.6.1.3. Different Inmarsat systems and their functions 6.6.2. ~~Inmarsat-B system~~ (NOT required as Inmarsat-B ceased operation 30 December 2016) 6.6.3. Inmarsat-C system 6.6.3.1. Use of Inmarsat-C system 6.6.3.2. Selecting an ocean region 6.6.3.3. Logging in to an ocean region / NCS Common Signaling Channel 6.6.3.4. Use of two digit code service via Inmarsat-C 6.6.3.5. Routing via a CES 6.6.3.6. Navigational areas (NAVAREA) / meteorological areas (METAREA) 6.6.3.7. Logging out before switching off 6.6.3.8. Routine operational tasks 6.6.3.9. Quick reference Inmarsat-C guide 6.6.3.10. Components of an Inmarsat-C/Mini-C SES 6.6.3.11. Practical Inmarsat-C tasks 6.6.4. ~~Inmarsat-M system~~ (NOT required as Inmarsat-M ceased operation 30 December 2016)	9:00	2:00

Learning Objective	Course hours	
	GOC Full	GOC Refresher
6.6.5. Inmarsat Fleet 77 6.6.5.1. Components of an Inmarsat fleet ship earth station 6.6.5.2. Method of acquiring satellite both manually and automatically 6.6.5.3. Handling of Inmarsat Fleet 77 SES 6.6.5.4. Use of two digit code service via Inmarsat Fleet 6.6.5.5. Practical Inmarsat Fleet 77 tasks 6.6.6. Inmarsat D and D+ 6.6.7. Inmarsat Numbers (IMN) 6.6.8. Overview of SafetyNET and FleetNET services 6.6.9. Operational voice procedures via Inmarsat 6.6.9.1. Distress, urgency, safety and routine communication 6.6.9.2. Procedure for sending a distress alert, call and message via ~~Inmarsat-B~~ (see 6.6.2) and Inmarsat Fleet 77 6.6.9.3. Procedure for sending a urgency call and message via ~~Inmarsat-B~~ (see 6.6.2) and Inmarsat Fleet 77 6.6.9.4. Procedure for sending a safety announcement, call and message via ~~Inmarsat-B~~ (see 6.6.2) and Inmarsat Fleet 77 6.6.9.5. Routine communication via ~~Inmarsat-B~~ (see 6.6.2) and Inmarsat Fleet 77 6.6.10. Operational Inmarsat telex procedure 6.6.10.1. ~~Distress via Inmarsat-B telex~~ (see 6.6.2) 6.6.10.2. Distress via Inmarsat-C telex 6.6.10.3. ~~Urgency/Safety Inmarsat-B telex~~ (see 6.6.2) 6.6.10.4. Urgency/safety via Inmarsat-C telex 6.6.10.5. Routine communication 6.6.11. Inmarsat email procedure 6.6.11.1. Procedure for sending an email to shore	9:00	2:00
6.7. Cospas/Sarsat 6.7.1. Structure 6.7.1.1. Cospas/Sarsat space segment 6.7.1.2. Cospas/Sarsat ground segment	1:30	0:20

Learning Objective	Course hours	
	GOC Full	GOC Refresher
6.8. Emergency Position Indicating Radio Beacon (EPIRB) 6.8.1. Basic operation of the Cospas/Sarsat satellite system and signal routing/path 6.8.2. Essential parts of Cospas/Sarsat EPIRBs 6.8.3. Basic characteristics of operation on 406 MHz EPIRB and 121.5 MHz (homing) 6.8.4. Registration and coding of a 406 MHz EPIRB 6.8.5. Information contents of a distress alert 6.8.6. Operation 6.8.7. Float-free function 6.8.8. Correct use of the lanyard 6.8.9. Routine maintenance, testing requirements and test operation 6.8.10. Additional EPIRB features (VHF DSC-EPIRB) 6.8.11. Withdrawal of an unintended false distress transmission tests 6.8.12. Practical EPIRB tasks	1:30	0:20
6.9. Search and Rescue (radar) Transponder and AIS Search and Rescue Transmitter 6.9.1. Different types of Search and Rescue Transponders/Transmitters and their operation 6.9.1.1. Search and Rescue (radar) Transponder 6.9.1.2. AIS Search and Rescue Transmitter (AIS-SART) 6.9.2. Routine maintenance, testing requirements and test operation 6.9.3. Practical SART/AIS-SART tasks	1:00	0:25
6.10. Maritime Safety Information (MSI) 6.10.1. Basics 6.10.2. NAVTEX 6.10.2.1. NAVTEX frequencies 6.10.2.2. NAVTEX system 6.10.2.3. Responsibilities of NAVTEX coordinator 6.10.2.4. Messages 6.10.2.5. Operation of NAVTEX receiver 6.10.2.6. Selection of transmitters, message type 6.10.2.7. Practical NAVTEX tasks 6.10.3. EGC (Enhanced Group Call) 6.10.3.1. Geographic area messages and Inmarsat system messages 6.10.3.2. Classes of Inmarsat-C receiver types 6.10.3.3. EGC setup 6.10.4. MSI via VHF/MF/HF	2:00	0:40

Learning Objective	Course hours	
	GOC Full	GOC Refresher
6.11. Use and functions of portable VHF radio	1:30	0:15
6.12. Portable VHF aeronautical radio for 121.5 and 123.1 MHz	1:00	0:10
7. Other Systems Used Onboard **7.1. Ultra High Frequency (UHF) handhelds** **7.2. Automatic Identification System (AIS)** **7.3. Ship Security Alert System**	1:00	0:50
8. Search and Rescue Operation **8.1. Role of the Maritime Rescue Coordination Centre (MRCC)** 8.1.1. Maritime rescue organisations 8.1.2. Knowledge of SAR worldwide	3:00	0:40
8.2. International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual	1:00	
9. Role and Method of Use of Ship Reporting Systems **9.1. Automated Mutual-assistance Vessel Rescue System (AMVER)** **9.2. Japanese Ship Reporting System (JASREP)** **9.3. Modernised Australian Ship Tracking and Reporting System (MASTREP)** **9.4. Long Range Identification and Tracking of Ships (LRIT)**	2:00	0:25
10. Miscellaneous skills and operational procedures for general communications **10.1. Use of English in written and oral form for safety communications** 10.1.1. Use of the IMO Standard Marine Communication Phrases 10.1.2. Use of the International Code of Signals 10.1.3. Recognition of standard abbreviations and commonly used service codes 10.1.4. Use of the International Phonetic Alphabet	2:00	0:10
10.2. Procedure for traffic charging 10.2.1. International charging and accounting system 10.2.2. AAIC code and its use 10.2.3. Coast station landline and ship station charge 10.2.4. Currencies used for the account of international radiocommunications 10.2.5. Inmarsat communication charging systems	0:30	0:10
Examination A Theoretical examination B Practical examination	2:00 10:00	1:00 10:00
TOTAL HOURS	**75:00**	**30:00**

APPENDIX

7 RESERVE SOURCE OF ENERGY

INTERNATIONAL MARITIME ORGANIZATION

4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 0171-735 7611
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E

Ref. T2/6.03

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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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.

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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).

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 energised 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

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

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 22½? 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 C_1 and capacity for 5 hours discharge C_5), 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.

ANNEX 2

AUTOMATIC BATTERY CHARGERS

1 INTRODUCTION

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 over charging 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

The automatic charger should be operational within five seconds of switching on or after a power supply interruption.

5 SAFETY PRECAUTIONS

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.

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ANNEX 3

UNINTERRUPTABLE POWER SUPPLIES (UPS)

1 INTRODUCTION

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

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

The UPS should be operational within 5 s of switching on.

5 SAFETY PRECAUTIONS

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

E

ASSEMBLY
29th session
Agenda item 10

A 29/Res.1106
14 December 2015
Original: ENGLISH

Resolution A.1106(29)

Adopted on 2 December 2015
(Agenda item 10)

REVISED 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, 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/19.2.4, taking into account the recommendations adopted by the Organization,

RECALLING FURTHER resolution A.917(22), as amended by resolution A.956(23), by which it adopted *Guidelines for the onboard operational use of shipborne automatic identification systems (AIS)*,

HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its ninety-fourth session,

1 ADOPTS the *Revised 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 the annexed revised guidelines when implementing SOLAS regulations V/11, 12 and 19;

3 ALSO INVITES Governments which are considering setting or have set regional frequencies or otherwise make use of AIS channel management, including changing to narrow-band operation for whatever reason, to take into account the possible impact on the use of AIS at sea and that it should only be used for urgent temporary situations. In such cases Governments should notify the Organization of such areas and designated frequencies, for urgent circulation of that information to all Member Governments;

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4 REQUESTS the Maritime Safety Committee to keep the revised guidelines under review and amend them as appropriate;

5 REVOKES resolution A.917(22), as amended by resolution A.956(23).

Annex

REVISED GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (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 1.

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 1 July 2002 to 1 July 2008. In addition, specific ship types (e.g. warships, naval auxiliaries and ships owned/operated by Governments) are not required to be fitted with AIS. Also, small ships (e.g. leisure craft, fishing boats) and certain other ships may be 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 40 to 44) should therefore be observed.

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 ships, assist in target tracking, *assist in search and rescue operation*, 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 is a useful source of supplementary information to that derived from navigational systems (including radar) and therefore an important "tool" in enhancing situation awareness of traffic confronting users.

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DESCRIPTION OF AIS

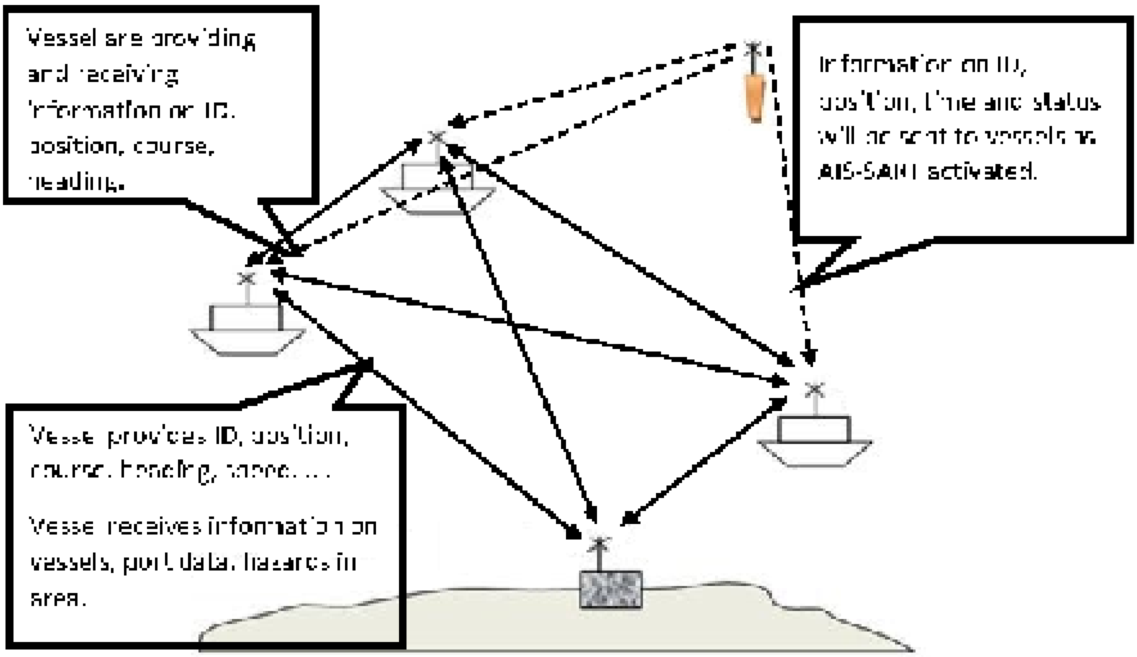

Figure 1 – AIS system overview

5 Class A shipborne equipment complies with relevant IMO AIS carriage requirement. Class B shipborne equipment provides functionalities not in full accordance with IMO AIS carriage requirement. Class B devices may be carried on ships which are not subject to the SOLAS carriage requirements.

6 Shipborne AIS (see figure 1):

- transmits ship's own data to other ships and vessel traffic service (VTS) stations; and

- receives and makes available data of other ships and VTS stations and other AIS stations, such as AIS-SARTs, AIS-ATON, etc.

7 When used with the appropriate 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.

8 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 Global Maritime Distress and Safety System (GMDSS) Sea Area A1 station is in place, the AIS should be switched manually. However, this capability should only be considered for use in urgent, temporary situations, noting the possible adverse effects on AIS at sea.

9 The capacity of the system allows for a great number of ships to be accommodated at the same time. Priority in the system is given to Class A devices. Class B devices operate at a reduced reporting rate or when free time slots are available.

10 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 to 30 nautical miles depending on antenna height. With the help of repeater stations, the coverage for both ship and VTS stations can be improved.

11 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 from 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.

AIS INFORMATION SENT BY SHIPS

Ship's data content

12 The AIS information transmitted by a ship is of three different types:

- static information, which is entered into the AIS on installation and need only be changed if the ship changes its name, Maritime Mobile Service Identity (MMSI), location of the electronic position fixing system (EPFS) antenna, 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.

13 Details of the information referred to above are given in table 1 below:

Information item	**Information generation, type and quality of information**
Static	
MMSI	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 electronic position fixing system (EPFS) antenna	Set on installation or may be changed for bi-directional vessels or those fitted with multiple antennas

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Dynamic	
Ship's position with accuracy indication and integrity status	Automatically updated from the position sensor connected to AIS The accuracy indication is approximately 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 - 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

Safety-related	
Short safety-related messages	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

**Due to the amendment of MARPOL categorization of hazardous cargo by resolution MEPC.118(52), cargo type may be categorized as A, B, C or D, rather than X, Y, Z or OS on older AIS equipment, as described in SN.1/Circ.227 and SN.1/Circ.227/Corr.1.*

The table below indicates the equivalence of the old and new category indications:

Current MARPOL category	Equivalent category on older AIS units
X	A
Y	B
Z	C
OS	D

14 The data is autonomously sent at different update rates:

- dynamic information: dependent on speed and course alteration (see tables 2 and 3);
- static and voyage-related data: every 6 minutes or on request (AIS responds automatically without user action); and
- safety-related text message: as required.

Type of ship	General reporting interval
Ship at anchor or moored and not moving faster than 3 knots	3 min
Ship at anchor or moored and moving faster than 3 knots	10 s
Ship 0-14 knots	10 s
Ship 0-14 knots and changing course	3 1/3 s
Ship 14-23 knots	6 s
Ship 14-23 knots and changing course	2 s
Ship >23 knots	2 s
Ship >23 knots and changing course	2 s

Table 2 – Class A shipborne equipment reporting intervals

Crafts not subject to SOLAS	Nominal reporting interval
Class B "SO" shipborne equipment not moving faster than 2 knots	3 min
Class B "SO" shipborne equipment moving 2-14 knots	30 s
Class B "SO" shipborne equipment moving 14-23 knots	15 s
Class B "SO" shipborne equipment moving > 23 knots	5 s
Class B "CS" shipborne equipment not moving faster than 2 knots	3 min
Class B "CS" shipborne equipment moving faster than 2 knots	30 s

Table 3 – Class B shipborne equipment reporting intervals

Short safety-related messages

15 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.

16 Operator acknowledgement may be requested by a text message. The operator should be aware that there are special safety-related messages and special user identities form devices such as the AIS-SART. Details are given in SN.1/Circ.322, as amended. There is no need for acknowledgement by a text message.

17 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 GMDSS.

18 The operator should ensure that he displays and considers incoming safety-related messages and should send safety-related messages as required.

19 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...*"

20 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

21 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

22 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

23 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;
- departure, destination and ETA;
- route plan (way points);
- the correct navigational status; and
- short safety-related text messages.

It is recommended to use the United Nations Code for Trade and Transport Locations (UN/LOCODE) for the entry of the port of destination. In addition, it is recommended that the existing destination field be used for entering both the port of departure and the next port of call (space for 20 characters of 6 bit ASCII is available) using the UN/LOCODE.[1]

Check of information

24 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.

25 The OOW should also periodically check the following dynamic information:

- positions given according to WGS 84;
- speed over ground; and
- sensor information.

26 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.

27 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

28 The AIS provides data that can be presented on the minimum display or on any suitable display device, as described in annex 1.

[1] SN/Circ.244.

Minimum display

29 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

30 Where AIS information is used with a graphical display, the following target types may be displayed:

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, the target (sleeping) may be activated 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), it may be selected. 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 preset 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 preset value is not received, a lost target symbol will appear at the latest position and an alarm will be given.

Other targets Other targets such as AIS-SART, AIS-AToN, may be displayed with special symbols (see SN.1/Circ.243/Rev.1 on *Guidelines for the presentation of navigational-related symbols, terms and abbreviations*).

Symbols

31 The user should be familiar with the symbology used in the graphical display provided.

INHERENT LIMITATIONS OF AIS

32 The OOW should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including VTS centres, might not be fitted with AIS.

33 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.

34 In other words, the information given by the AIS may not be a complete picture of the situation around the ship.

35 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.

36 The accuracy of AIS information received is only as good as the accuracy of the AIS information transmitted.

37 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.

38 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.

39 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 its own ship.

USE OF AIS IN COLLISION AVOIDANCE SITUATIONS

40 The potential of AIS as an assistance for anti-collision device is recognized and AIS may be recommended as such a device in due time.

41 Nevertheless, AIS information may merely 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, particularly rule 7 when determining whether risk of collisions exists.

42 The user should not rely on AIS as the sole information system, but should make use of all safety-relevant information available.

43 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.

44 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. 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 POSSIBLE FUTURE APPLICATIONS

AIS IN VTS OPERATIONS

Pseudo Targets broadcast by VTS

45 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 VTS/generated/synthetic 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

46 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.

47 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

48 (D)GNSS corrections may be sent by VTS centres via AIS.

MANDATORY SHIP REPORTING SYSTEMS

49 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

50 AIS may be used in search and rescue operations. By receiving messages from AIS-SART, operators get more accurate information, especially on the position of survival craft. In combined aerial and surface searches AIS may allow the direct presentation of the position on other displays such as radar or ECS/ECDIS, which facilitates the task of SAR craft. For ships in distress without AIS, the On Scene Coordinator (OSC) could create an AIS target.

AIDS TO NAVIGATION

51 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

52 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.

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REFERENCE DOCUMENTS

- SOLAS Convention, chapter V

- Recommendation on performance standards for a universal shipborne Automatic Identification System (AIS), (MSC.74(69), annex 3)

- Performance Standards for survival craft AIS search and rescue transmitters (AIS-SART) for use in search and rescue operations (resolution MSC.246(83))

- Guidance on the use of the UN/LOCODE in the destination field in AIS messages (SN/Circ.244)

- ITU Radio Regulations, appendix 18, table of transmitting frequencies in the VHF maritime mobile band

- Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band (Recommendation ITU-R M.1371-5)

- IEC Standard 61993 Part 2: Class A shipborne equipment of the Universal Shipborne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and required Test Results

APPENDIX 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);
- built-in integrity test (BIIT); 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 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.

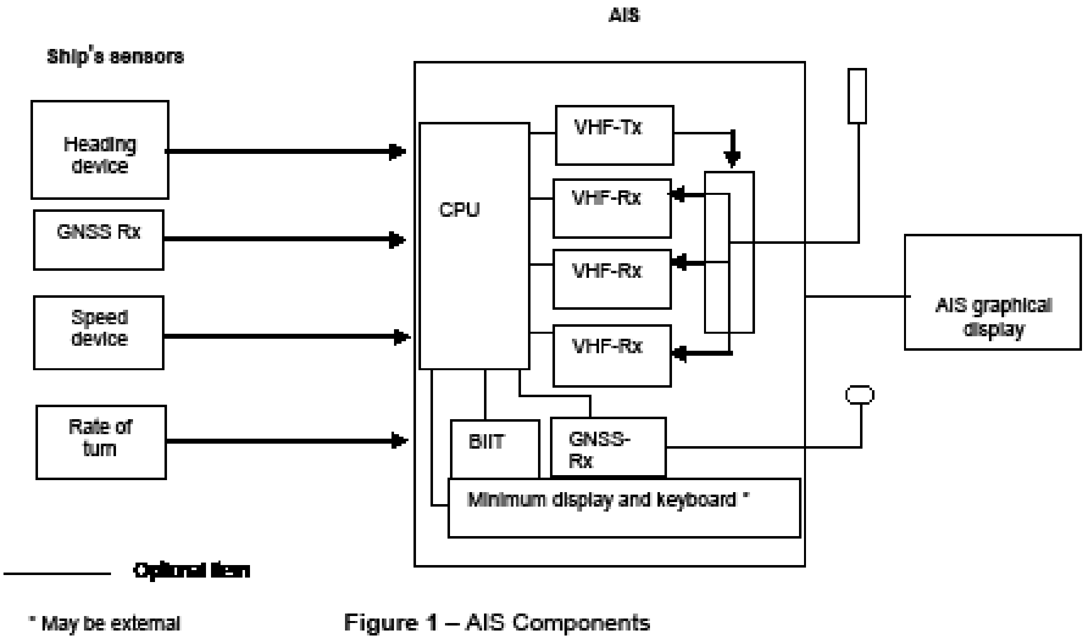

Figure 1 – AIS Components

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 as an input to existing navigational system devices such as a radar display, ECS, ECDIS, or INS. Such system interconnection and data integration is recommended."

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. Some Administrations require this connection to be provided at the bridge front.

APPENDIX 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. However, this capability should only be considered for use in urgent, temporary situations, noting the possible adverse effects on AIS at sea.

2 The required ship reporting capacity according to the IMO performance standard amounts to a minimum of 2000 time slots per minute (see figure 1 below). 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 allows for a great number of ships to be accommodated at the same time.

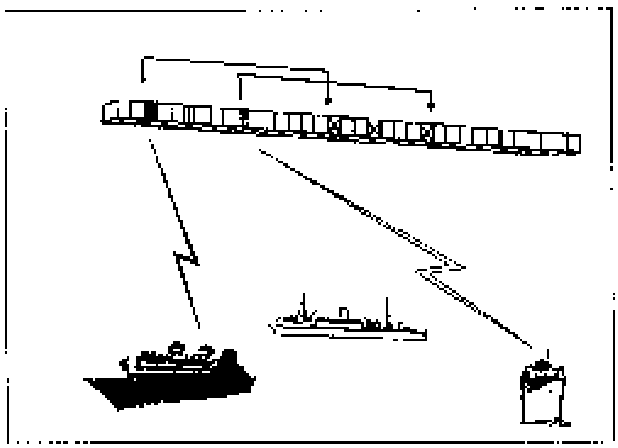

Figure 1 – Principles of TDMA

APPENDIX 9

FORMS

9.1 BEACON REGISTRATION FORM AMSA 6

Australian Government
Australian Maritime Safety Authority

406 MHz Distress Beacon Registration

(Australian coded beacons only)

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

This form is to be used for registering 406MHz Distress Beacons that are coded with Australian codes.

Registration is Free

If you have a beacon coded with a foreign country code, or if you do not know what country code has been used, please contact the Beacon Registration Section:

Email: ausbeacon@amsa.gov.au

Phone: **+61 2 6279 5766 or 1800 406 406**

Fax: **International +61 2 9332 6323**
Local 1800 406 329

Post: **Beacon Registration Section**
Australian Maritime Safety Authority
GPO Box 2181 Canberra City ACT 2601

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;
  - Owner/Operator details;
  - 24 Hour Emergency contact details;
  - Retailer details; and
  - Vessel, vehicle 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 this information for the purpose of assisting search and rescue operations through the registration of your beacon or your MMSI. AMSA collects this information in accordance with its functions under the *Australian Maritime Safety Authority Act 1990*. The information may be passed to other government agencies assisting in search and rescue operations. AMSA will use your contact details, including your email address and mobile phone number, to prompt you to update your registration details and for other purposes related to maintaining your registration. Failure to provide the information may result in delays processing your registration. To contact us, or for more information on how to access or correct your personal information, how to make a privacy complaint, or how your information may be used or disclosed, refer to the contact details shown on this form.

AMSA 6 (12/14)

Australian Government
Australian Maritime Safety Authority

406 MHz Distress Beacon Registration
(Australian coded beacons only)

Please Note: Mandatory fields are marked with an*
Other fields are optional, but will greatly assist with the coordination of a search and rescue response

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.

Beacon battery expiry date

Owner/operator details

Name*		Postal address*		Postcode*
Home phone^	Work phone^	Mobile/other phone^	Email address	

^ At least one phone number must be provided

Emergency contacts (mandatory)
If possible, please supply up to 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^			

^ At least one phone number must be provided for each contact

Retailer details ie: where you purchased the beacon (see receipt for details)

Name*	Business address
Phone	Email address

Vessel details (if applicable)

Name		Callsign	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 ☐ MF/HF ☐ VHF ☐ 27MHz ☐ Handheld VHF	Other equipment ☐ AIS Class A ☐ AIS Class B	Maximum No. of persons on board	No. of liferafts

Vehicle details (if applicable)

Make and model*	Year*	Registration No.*	Colour*

Aircraft Details (if applicable)

Aircraft registration/tail number*	Make/type (use ICAO abbreviation if known)
Type of aircraft (owner's description)*	Satellite and/or mobile phone number used in aircraft

AMSA 6 (12/14)

9.2 GMDSS RADIO LOG BOOK

Australian Government
Australian Maritime Safety Authority

GMDSS
Radio Log Book

Marine Order 27 (Safety of navigation and radio equipment)

Name of vessel	IMO number or Official number	Call sign

This log-book covers the period from: .... / .... / 20........ to .... / .... / 20........
(DD/MM/YYYY) (DD/MM/YYYY)

This publication is available on AMSA's website:
http://www.amsa.gov.au/forms-and-publications/international/publications/Ship-Safety/index.asp

AMSA 343 (7/16)

Instructions for keeping the radio log

Marine Order 27 requires a radio log-book to be carried on board vessels subject to the *Navigation Act 2012*. The GMDSS Radio Log Book (the radio log) should be kept in a location close to the radio station.

Pages from this form should be printed as required and kept as a hard-copy.

The log must be available for inspection by an officer appointed under the *Navigation Act 2012* or an authorised official in a country other than Australia, who is carrying out an inspection in accordance with Article X of the STCW Convention.

Notes on maintaining the radio log

The Master must nominate one or more crew members, normally the person/s qualified for distress and safety radio communications, to maintain the radio log and to carry out the tests and checks of the equipment required by Marine Order 27.

The radio log must contain a summary of communications relating to distress, urgency and safety messages. The summary must include dates and times in Coordinated Universal Time (UTC), details of the vessels involved and their positions.

Distress alerts and distress-related communications received as hard copy via INMARSAT satellite systems, NAVTEX or Narrow Band Direct Printing, VHF or MF/HF DSC should be noted in, and kept with, the log. Hard copy weather reports and navigation warnings need not be retained, but their receipt must be noted in the radio log, if not recorded in electronic form.

Electronic records of communications relating to distress, urgency, safety and receipts of weather reports, and navigation warnings, form part of the log, and must be retained and not overwritten.

Details of commercial communications exchanged via GMDSS communications equipment may also be recorded in the radio log.

The radio log should contain a record of important incidents connected with the radio service, for example:

a. a breakdown or serious malfunction of the equipment;

b. a breakdown of communications with coast stations, land earth stations or satellites;

c. adverse propagation conditions, such as ionospheric, static, atmospheric noise or general interference;

d. serious breaches of radio procedures by other stations;

e. any incident connected with the radio service, which appears to be of importance to the safety of life at sea..

Tests

Tests and checks of equipment and reserve power at intervals specified by the equipment manufacturer must be entered into the log. A summary of the operational capability of the equipment, together with the names of any station contacted during tests, should be recorded. If any of the radio equipment is found not to be operating satisfactorily, the Master must be notified and details of the deficiencies recorded in the log.

Note: The tests and checks of equipment may include daily, weekly or monthly tests. The operating manuals for the equipment should provide guidance on what tests and checks are recommended.

Batteries

a. A list of all batteries used as a source of emergency power for the radio equipment must be entered in Annex 1.

b. Once a month, a full examination of each battery must be made, and a report on the general condition entered in Annex 2. If the batteries have sealed cells, then the general condition of the batteries is to be recorded, and the batteries replaced at the intervals recommended by the manufacturer.

c. 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. At intervals specified by the manufacturer, the capacity of the batteries should be checked, using an appropriate method (such as a full discharge and recharge, using normal operating current and period (e.g. 10 h), when the ship is not at sea. At sea, assessment of battery condition should be done without significant discharge of the batteries. In the case of GMDSS UPS units, the in-built battery discharge test facilities should be exercised, when the ship is not at sea. If the battery or UPS manufacturer does not specify an interval for a discharge test, the test should be done at least annually.

Inspection of the log

The Master must inspect the log and sign each day's entries.

Keeping of records

The radio log, and associated records, must be kept onboard for at least 2 years.

Particulars of vessel

Name		IMO No. or Official No.
Port of registry	Call sign	MMSI
Sea area(s) in which ship / vessel is certified to operate	Date keel was laid	
Expiry date of current Safety Radio Certificate		

Methods used to ensure availability of radio facilities

Duplication of equipment No ☐ Yes ☐

At-sea maintenance capability No ☐ Yes ☐

Shore based maintenance No ☐ Yes ☐

Details of service company

Name
Address

Name and address of owner (with overall general control and management of the vessel (see section 14 of the *Navigation Act 2012*))

Name
Address

Qualified personnel

Details of the qualified personnel on board

Name	Dates onboard or dates of attachment		Class and number of certificate and date of issue
	From	To	

Name and rank or muster number of designated personnel with responsibility for radio communications during emergencies (see Section B-VIII/2 of the STCW Code)

Name of personnel nominated to carry out appropriate tests and checks and log entries (if different from above)

GMDSS Radio Log

Name of vessel	Call sign	MMSI

Date and time UTC	Station from	Station to	Operator's actions or remarks	Frequency, channel or satellite system

Annex 1 - Particulars of batteries onboard

Battery number	Number of cells	Manufacturer	Type of battery	Date supplied	Voltage and ampere-hour capacity	Purpose for which used

Annex 2 - Monthly report of batteries

Date	Battery number and cell number	Specific gravity as measured		Remarks	Date	Battery number and cell number	Specific gravity as measured		Remarks
		Before charge	After charge				Before charge	After charge	

APPENDIX

10 TABLE OF TRANSMITTING FREQUENCIES IN THE VHF MARITIME MOBILE BAND

Extracted from the ITU Radio Regulations 2016, Appendix 18 (REV.WRC-15). See Article 52

NOTE A — For assistance in understanding the table, see notes a) to zz) below. (WRC-15)

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.1084-5 Annex 4, tables 1 and 3. The table below also describes the harmonised channels where the digital technologies defined in the most recent version of Recommendation ITU-R M.1842 could be deployed. (WRC-15).

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		
77		156.875		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	
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
1024	*w), ww) x), xx)*	157.200					
2024	*w), ww) x), xx)*	161.800	161.800	X (digital only)			
84	*w), ww) x), y)*	157.225	161.825		X	X	X
1084	*w), ww) x), xx)*	157.225					
25	*w), ww) x), y)*	157.250	161.850		X	X	X
1025	*w), ww) x), y)*	157.250					
2025	*w), ww) x), xx)*	161.850	161.850	X (digital only)			
85	*w), ww) x), y)*	157.275	161.875		X	X	X
1085		157.275					
2085	*w), ww) x), xx)*	161.875	161.875	X (digital only)			
26	*w), ww) x)*	157.300	161.900		X	X	X
1026	*w), ww) x)*	157.300					
2026	*w), ww) x)*		161.900				
86	*w), ww) x)*	157.325	161.925		X	X	X
1086	*w), ww) x)*	157.325					
2086	*w), ww) x)*		161.925				
27	*z), zx)*	157.350	161.950			X	X
1027	*z), zz)*	157.350	157.350		X		
2027*	*z)*	161.950	161.950				
87	*z), zz)*	157.375	157.375		X		
28	*z), zx)*	157.400	162.000			X	X
1028	*z)*	157.400	157.400		X		
2028*	*z)*	162.000	162.000				
88	*z), zz)*	157.425	157.425		X		
AIS 1	*f), l), p)*	161.975	161.975				
AIS 2	*f), l), p)*	162.025	162.025				

* From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.

1 NOTES REFERRING TO THE TABLE

1.1 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).

1.2 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. The following conditions apply for single frequency usage:

- The lower frequency portion of these channels may be operated as single frequency channels by ship and coast stations.
- Transmissions using the upper portion of these channels is limited to coast stations.
- If permitted by administrations and specified by national regulations, the upper frequency portions of these channels may be used by ship stations for transmission. All precautions should be taken to avoid harmful interference to channels AIS 1, AIS 2, 2027* and 2028*. (WRC-15).

  * From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.

mm) Transmission on these channels is limited to coast stations. If permitted by administrations and specified by national regulations, these channels may be used by ship stations for transmission. All precautions should be taken to avoid harmful interference to channels AIS 1, AIS 2, 2027* and 2028*. (WRC-15)

* From 1 January 2019, channel 2027 will be designated ASM 1 and channel 2028 will be designated ASM 2.

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 (eg. new AIS applications, man over board systems, etc.). If authorised 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) (SUP — WRC-15)

u) (SUP — WRC-15)

v) (SUP — WRC-15)

w) In Regions 1 and 3:

Until 1 January 2017, the frequency bands 157.200–157.325 MHz and 161.800–161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) may be used for digitally modulated emissions, subject to coordination with affected administrations. Stations using these channels or frequency bands for digitally modulated emissions 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 157.200–157.325 MHz and 161.800–161.925 MHz (corresponding to channels: 24, 84, 25, 85, 26 and 86) are identified for the utilization of the VHF Data Exchange System (VDES) described in the most recent version of Recommendation ITU-R M.2092. These frequency bands may 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 causing harmful interference to, or claiming protection from other stations in the maritime mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC-15)

wa) In regions 1 and 3:

Until 1 January 2017, the frequency bands 157.025–157.175 MHz and 161.625–161.775 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23 and 83) may be used for digitally modulated emissions, subject to coordination with affected administrations. Stations using these channels or frequency bands for digitally modulated emissions 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 157.025–157.100 MHz and 161.625–161.700 MHz (corresponding to channels: 80, 21, 81 and 22) are identified for utilization of the digital systems described in the most recent version of Recommendation ITU-R M.1842 using multiple 25 kHz contiguous channels.

From 1 January 2017, the frequency bands 157.150-157.175 MHz and 161.750-161.775 MHz (corresponding to channels: 23 and 83) are identified for the utilization of the digital systems described in the most recent version of ITU-R M.1842 using two 25 kHz contiguous channels. From 1 January 2017, the frequencies 157.125 MHz and 161.725 MHz (corresponding to channel: 82) are identified for utilization of the digital systems described in the most recent version of ITU-R M.1842.

The frequency bands 157.025-157.175 MHz and 161.625-161.775 MHz (corresponding to channels: 80, 21, 81, 22, 82, 23 and 83) can also be used for analogue modulation described in the most recent version of ITU-R M.1084 by an administration that wishes to do so, subject to not claiming protection from other stations in the marine mobile service using digitally modulated emissions and subject to coordination with affected administrations. (WRC-15)

ww) In Region 2, the frequency bands 157.200-157.325 MHz 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.

In Canada and Barbados, from 1 January 2019 the frequency bands 157.200-157.275 MHz and 161.800-161.875 MHz (corresponding to channels: 24, 84, 25 and 85) may be used for digitally modulated emissions, such as those described in the most recent version of Recommendation ITU-R M.2092, subject to coordination with affected administrations. (WRC-15)

x) From 1 January 2017, in Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Democratic Republic of 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)

xx) From 1 January 2019, the channels 24, 84, 25 and 85 may be merged in order to form a unique duplex channel with a bandwidth of 100 kHz in order to operate the VDES terrestrial component described in the most recent version of Recommendation ITU-R M.2092. (WRC-15)

y) These channels may be operated as single or duplex frequency channels, subject to coordination with affected administrations. (WRC-12)

z) Until 1 January 2019, 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.

From 1 January 2019, these channels are split into two simplex channels. The channels 2027 and 2028 designated as ASM 1 and ASM 2 are used for application specific messages (ASM) as described in the most recent version of Recommendation ITU-R M.2092. (WRC-15)

zx) In the United States, these channels are used for communication between ship stations and coast stations for the purpose of public correspondence. (WRC-15)

zz) From 1 January 2019, channels 1027, 1028, 87 and 88 are used as single-frequency analogue channels for port operation and ship movement. (WRC-15).

APPENDIX 11 ROUTINE TESTING (EXTRACT FROM GMDSS RADIO LOG)

TESTS

Tests and checks of equipment and reserve power at intervals specified by the equipment manufacturer must be entered into the log. A summary of the operational capability of the equipment, together with the names of any station contacted during tests, should be recorded. If any of the radio equipment is found not to be operating satisfactorily, the Master must be notified and details of the deficiencies recorded in the log.

Note: The tests and checks of equipment may include daily, weekly or monthly tests. The operating manuals for the equipment should provide guidance on what tests and checks are recommended.

BATTERIES

a. A list of all batteries used as a source of emergency power for the radio equipment must be entered in Annex 1.

b. Once a month, a full examination of each battery must be made, and a report on the general condition entered in Annex 2. If the batteries have sealed cells, then the general condition of the batteries is to be recorded, and the batteries replaced at the intervals recommended by the manufacturer.

c. 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. At intervals specified by the manufacturer, the capacity of the batteries should be checked, using an appropriate method (such as a full discharge and recharge, using normal operating current and period (eg. ten hours), when the ship is not at sea. At sea, assessment of battery condition should be done without significant discharge of the batteries. In the case of GMDSS UPS units, the in-built battery discharge test facilities should be exercised, when the ship is not at sea. If the battery or UPS manufacturer does not specify an interval for a discharge test, the test should be done at least annually.

APPENDIX 12

OPERATION OF MARINE RADAR FOR SART DETECTION

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.161 is revoked.

***

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.

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, MOB AND EPIRB DEVICES

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E

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.

***

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.

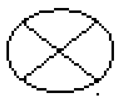
2 EPIRB-AIS devices will be 406 MHz distress alerting devices that contain an additional AIS transmitter developed using the same AIS-SART technology, where the AIS component is used as an aid in locating that EPIRB-AIS.

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.

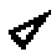
4 In order to protect the integrity of the VHF data link used by AIS, AIS devices, including AIS-MOB devices, are not intended to be used to routinely locate or track people not being in an emergency situation.

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.

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APPENDIX 14

INMARSAT–C SHORT ADDRESS CODES (SACs)

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	JRCC Aus	Dutch CG
38	UKCG	Dutch CG	UKCG	Dutch CG	Dutch CG	Dutch CG	JRCC Aus	Dutch CG
39	UKCG	UKCG	UKCG	UKCG	Cape Town Radio ZSC	JRCC Aus	JRCC Aus	JRCC Aus
41	UK Met	KNMI	UK Met	KNMI	UK Met	KNMI	UK Met	KNMI
42	NAV I Coord.	NAV I Coord.	NAV I Coord.	NAV I Coord.	Cape Town Radio ZSC	JRCC Aus/ NAV X Coord.	RCC NZ	RCC Aus/ NAV X Coord.
43	AMVER	AMVER	AMVER	AMVER	AMVER	AMVER	AMVER	AMVER
861	Not Used	Not used	Not Used	Not Used	Not Used	Aus REEFVTS	Not Used	Aus REEFVTS
1241	Not Used	JRCC Aus	Not Used	BoM	Not Used	BoM	Not Used	BoM
1243	Not Used	JRCC Aus	Not Used	JRCC Aus	Not Used	JRCC Aus	Not Used	JRCC Aus
1250	Not Used	JRCC Aus	Not Used	JRCC Aus	Not Used	JRCC Aus	Not Used	JRCC Aus

AMVER = Automated Mutual–assistance Vessel Rescue system (US Coast Guard)
BoM = Australian Bureau of Meteorology
Dutch CG = Netherlands Coastguard
KNMI = Royal Netherlands Meteorological Institute KNMI
JRCC Aus = Joint Rescue Coordination Centre Australia
JRCC NZ = Joint Rescue Coordination Centre New Zealand
ReefVTS = Great Barrier Reef & Torres Strait Vessel Traffic Service
UK Met = UK Meteorological Office
UKCG = Maritime and Coastguard Agency, UK
ZSC = Cape Town Radio (call sign ZSC)

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
   SAC 861 – Reports to ReefVTS (Australia)
   SAC 1241 – Australian Bureau of Meteorology (BoM)
   SAC 1243 – Information reports to JRCC Australia (eg. semi-submerged container sighted)
   SAC 1250 – Ordinary text messaging to JRCC Australia (paid by vessel)

2. RCC NZ can be contacted on (if SAC code messages cannot be delivered):

   Telephone (local): 0508 472 269
   Telephone (international): +64 4 577 8033
   Email: rccnz@maritimenz.govt.nz.

APPENDIX 15

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 — The 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. Not used in MASTREP or REEFREP which rely on AIS.

ARPA — Automatic Radar Plotting Aid. An automatic radar plotting aid that complies with 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. 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 weather warning, broadcast as long as the information is valid.

AUSREP — Australian Ship Reporting System (replaced by MASTREP).

AWQ — Australian Waters Qualification.

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 and other electronic 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. Typically one byte consists of 8, 16, 32, 64 or 128 bits, depending on the technology.

CCIR — The Consultative Committee on International Radio (Replaced by the ITU–R). Formulated new technical standards for radio equipment and the recommendations on the use of radio spectrum.

CIRM — Centro Internazionale Radio Medico. International Radio Medical Centre based in Rome.

Coast Station — A land station in the maritime mobile service providing terrestrial communications to and from ships at sea.

COMSAR — Communications Search and Rescue. IMO Sub–committee on Radiocommunications and Search and Rescue. Replaced by the NCSR.

COSPAS–SARSAT — Cosmicheskaya Sistyema Poiska Avariynich Sudov–Search and Rescue Satellite Aided Tracking. A satellite–aided search and rescue system. 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 DSC 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. It is sent using a DSC format in the bands used for terrestrial radiocommunications or a distress message format, in which case it is relayed through space stations. It is normally followed by a distress call on the associated R/T channel.

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. (ie. 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 IMO regulations.

EHF — Extra High Frequency. (30 to 300 GHz)

Enhanced Group Calling (EGC) — 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 simultaneously providing broadband data and voice (using internet protocol (IP)), whilst still supporting existing voice and ISDN data capability for legacy applications.

FleetNET — The international commercial service offered under Inmarsat–C's EGC capability, 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 kb/s 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 prioritization, as stipulated by IMO Resolution A.888 (21).

FM — Frequency Modulation. The frequency of a carrier wave is made to vary in sympathy with the frequency of the input signal. Used for VHF marine band transmissions

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 equaling 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 (eg. 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').

GT — Gross Tonnage (replaces Gross Registered Tonnage (GRT))

G3E — A phase—modulated mode of emission using analogue telephony (eg. 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 vessels 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 Organisation.

IMDG — International Maritime Dangerous Goods Code.

IMN — Inmarsat Mobile Number. The Inmarsat terminal identification number (ie: telephone number).

IMO — International Maritime Organisation.

IMSO — International Mobile Satellite Organisation.

Inmarsat — Inmarsat Ltd (formerly International Maritime Satellite Organisation)

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 Telecommunication 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'.

JASREP — Japanese Ship Reporting System

JRCC — Australian Joint Rescue Coordination Centre, located in Canberra.

kb/s — Kilobits per second. One kilobit equals 1 000 bits.

kHz — Kilohertz (1 000 hertz). A measurement unit of radio frequency, oscillations and vibrations equaling 1 000 cycles per second

km — Kilometre. (1 000 metres)

kn — Knot. One nautical mile per hour.

knots — nautical miles per hour (1 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. As used in the Cospas–Sarsat system. See also LUT.

LES — see Land Earth Station

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. Contain warnings which refer to hazards which are considered to be of a temporary nature, eg. 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 ships 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. On a ship it is more commonly referred to as a Ship Earth Station (SES).

METAREA — Meteorological Area: A meteorological service area with area limits similar to NAVAREA's 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, equaling 1 000 000 cycles per second.

MID — Maritime Identification Digit. A 3 digit decimal number used as the first part of ship station identity (MMSI) 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 Coordination Centre. The Australian MRCC is located in Canberra and operated by AMSA (see also RCC and JRCC).

MROCP — Marine Radio Operator's Certificate of Proficiency. Replaced by Long Range Operator Certificate of proficiency.

MROVCP — Marine Radio Operator's VHF Certificate of Proficiency. Replaced by Short Range Operator Certificate of Proficiency.

MSC — Maritime Safety Committee of the IMO.

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 nautical mile = 1 852 m)

NAVAREA — A Navigation Area in the world—wide navigational warning service, numbered using Roman numerals. ie. 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 coordinator 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 NBDP. The International NAVTEX service is the system for broadcast and automatic reception of 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.

NCSR – Navigation, Communication and Search and Rescue. An IMO sub—committee.

On—scene communications — Communications between the distressed ship or survival craft and assisting units.

OTF — Optimum Traffic Frequency. The optimal frequency for sustained radio reliability, approximately 85% MUF.

PM — Phase Modulation. A form of amplitude 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 Coordination Centre. JRCC 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 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 coordinating communications — Communications necessary for the coordination 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, 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 IMO, 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, eg. 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 — Temps Universel Coordonné (French). Coordinated 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. 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.

WWMIWS — World–wide Met–Ocean Information and Warning Service. A service established by the World Meteorological Organisation for the purpose of coordinating the transmissions of meteorological warnings in defined geographical areas.

WWNWS — World–wide Navigational Warning Service. A service established by the International Hydrographic Organisation for the purpose of coordinating the transmissions of navigational 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 16 REFERENCES

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