

GMDSS Basic Concepts

A System Overview

Functional requirements

The GMDSS (**Global Maritime Distress and Safety System**) is specifically designed to automate a ship's radio distress alerting function, and, as a consequence, removes the requirement for manual (ie: human) watchkeeping on distress channels.

The GMDSS regulations (chapter IV of the International SOLAS Convention), require that every GMDSS equipped ship shall be capable of;

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

Application

The GMDSS applies to vessels subject to the SOLAS Convention - that is:

*Commercial vessels of 300 Gross Registered Tons (GRT) and above, engaged on international voyages. **The GMDSS became mandatory for such vessels as at 1st February 1999.***

Commercial vessels under 300 GRT, or those above 300 GRT engaged on domestic voyages only are subject to the requirements of their Flag State. Some Flag States have incorporated GMDSS requirements into their domestic marine radio legislation - however many have not.

Equipment vs Operational requirements

The major difference between the GMDSS and its predecessor systems is that the radio communications **equipment to be fitted to a GMDSS ship is determined by the ship's area of operation, rather than by its size.**

Because the various radio systems used in the GMDSS have different limitations with regards to range and services provided, the new system divides the world's oceans into 4 areas:

- **Area A1** lies within range of shore-based VHF coast stations (20 to 30 nautical miles);
- **Area A2** lies within range of shore based MF coast stations (excluding A1 areas) (approximately 100 - 150 nautical miles);
- **Area A3** lies within the coverage area of Inmarsat communications satellites (excluding A1 and A2 areas - approximately latitude 70 degrees north to latitude 70 degrees south); and
- **Area A4** comprises the remaining sea areas outside areas A1, A2 and A3 (the Polar Regions).

GMDSS communication systems

The GMDSS utilises both satellite and terrestrial (ie: conventional) radio systems.

Sea Area A1 requires short range radio services - VHF is used to provide voice and automated distress alerting via Digital Selective Calling (DSC).

Sea Area A2 requires medium range services - Medium Frequencies (MF - 2 MHz) are used for voice and DSC.

Sea Areas A3 and A4 require long range alerting - High Frequencies (HF - 3 to 30 MHz) are used for voice, DSC and Narrow Band Direct Printing (NBDP - aka radio telex).

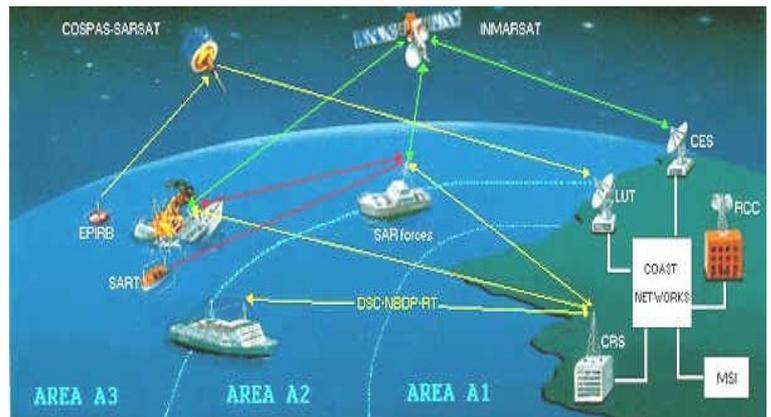
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Equipment requirements vary according to the area the ship is trading to or through. Accordingly, it is quite possible that a small 300 ton cargo vessel may carry the same amount of communications equipment as a 300,000 ton oil tanker, if they are both operating in the same area....this is a marked change from the pre-GMDSS systems.

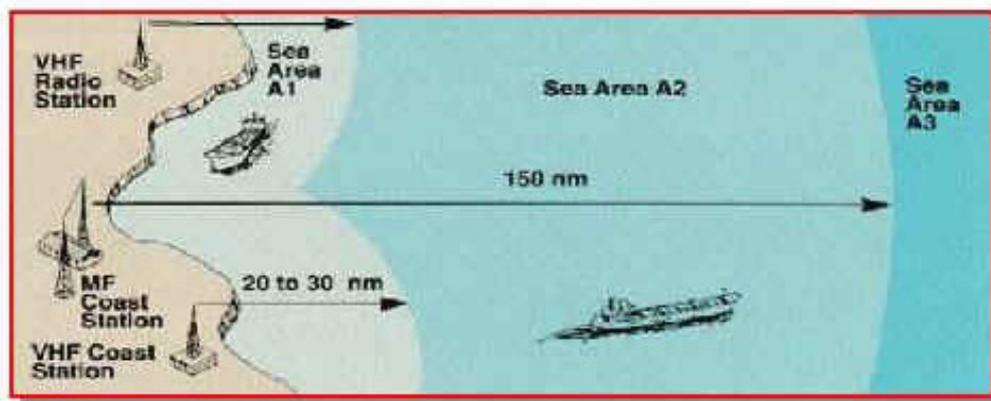
This is illustrated in the diagram below:

Equipment requirements

As discussed above, equipment fit requirements vary according to the Sea Area(s) a vessel operates in or through. It should be noted that the requirements are cumulative in nature - ie: an A4 vessel is also equipped, by definition, with equipment for A1, A2 and A3 Sea Areas. In areas where A1 Services are provided, coastal vessels are only required to fit VHF equipment, provided of course that they remain within the declared Sea Area - normally within 20 to 30 nautical miles of the coast. Vessels that trade further from land are required to carry MF equipment, in addition to VHF. However, it should be noted that the above examples assume a linear transition from A1 to A4 sea areas - in many areas of the world, (such as Australia) A3 areas extend right up to the coast line. GMDSS vessels operating in or through those areas are required to fit A3 equipment.



Ocean going vessels fit VHF, MF, HF and Inmarsat equipment. The process is depicted below:



Shore Infrastructure

Each of the countries contracting to the SOLAS Convention (basically, all of the world's major shipping nations) are required to enforce the equipping of vessels sailing under their flag with GMDSS and also provide suitable GMDSS shore-based infrastructure.

GMDSS operational requirements

General

The GMDSS enables a ship in distress to send an alert using various radio systems. These systems are designed such that the alert has a very high probability of being received by either shore rescue authorities and/or other vessels in the area.

Equipment performing GMDSS functions must be simple to operate and (wherever appropriate) be designed for unattended operation.

Distress Alerts must be able to be initiated from the position from which the ship is normally navigated (i.e. the bridge).

EPIRBs are required to be installed close to, or capable of remote activation from the position from which the ship is normally navigated.

Equipment to be carried

The SOLAS GMDSS regulations are structured such that all GMDSS ships are required to carry a minimum set of equipment, with (basically) more equipment being required the further the ship travels from land.

The SOLAS GMDSS regulations do not make particularly easy reading - a simplified version of the equipment required to be carried for each sea area is detailed below

Minimum requirements

GMDSS ships are required to carry the following minimum equipment:

- **A VHF radio installation capable of transmitting DSC on channel 70, and radiotelephony on channels 16, 13 and 6. (see Note 1).**
- **One SART if under 500 GRT, 2 SARTs if over 500 GRT.**
- **Two portable VHF transceivers for use in survival craft if under 500 GRT, three if over 500 GRT.**
- **A NAVTEX receiver, if the ship is engaged on voyages in any area where a NAVTEX service is provided.**
- **An Inmarsat EGC receiver, if the ship is engaged on voyages in any area of Inmarsat coverage where MSI services are not provided by NAVTEX or HF NBDP (see note 2).**
- **A 406 MHz or 1.6 GHz EPIRB**

Note 1 - Voice watch required on channel 16 until 2005.

Note 2 - in practice, this means that all GMDSS A3 and A4 vessels are required to carry at least one Inmarsat C system.

Radio equipment - Sea area A1

Every ship engaged on voyages exclusively in sea area A1 shall be provided with the minimum equipment specified previously, with the option to replace the 406 EPIRB with a VHF DSC EPIRB.



GMDSS VHF equipment

Radio equipment - Sea areas A1 and A2

Every ship engaged on voyages **beyond sea area A1, but remaining within sea area A2**, shall be provided with the minimum equipment specified previously, plus:

- **An MF/HF radio installation** capable of transmitting and receiving on the frequencies 2187.5 kHz using DSC and 2182 kHz using radiotelephony;
- **A DSC watchkeeping receiver** operating on 2187.5 kHz
- **A 406 MHz EPIRB**



Typical GMDSS A2 station

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

- **A HF radio installation** operating on working frequencies in the (marine) bands between 1,605 kHz and 27,500 kHz. (This requirement is normally fulfilled by the addition of this capability in the MF equipment referred to earlier).

Radio equipment - Sea areas A1, A2 and A3

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

Every ship engaged on voyages **beyond sea areas A1 and A2, but remaining within sea area A3** shall be provided with the minimum equipment specified previously, plus

either:

- **An Inmarsat C ship earth station**
- **An MF radio installation and 2187.5 kHz DSC watchkeeping receiver;**
- **A 406 MHz EPIRB**

or

- **An MF/HF radio installation** capable of transmitting and receiving on all distress and safety frequencies in the (marine) bands between 1,605 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
- **A 406 MHz EPIRB**
- **An Inmarsat ship earth station**



Typical GMDSS A3 station

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

In practice, MF only transceivers are not produced - all marine MF radio equipment is also fitted with HF facilities.

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

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

- An MF/HF radio installation as described earlier
- An MF/HF DSC watchkeeping receiver as described earlier
- A 406 MHz EPIRB

In addition, ships shall be capable of transmitting and receiving general radio communications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation as described earlier.

Means of ensuring availability of ship station equipment

Regulation 15 of the SOLAS GMDSS regulations defines 3 methods to ensure availability of GMDSS equipment at sea;

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

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 administration. Ships engaged on voyages in sea areas A3 and A4 are required to use at least two of the methods outlined above. And of course what all that means is that 99% of A3 GMDSS ships, along with probably 100% of A1 and A2 GMDSS ships do not opt for at sea maintenance - they either duplicate the equipment and use shore based maintenance (for A3 ships), or use shore based maintenance only (A1 and A2 ships).

Equipment to be duplicated for area A3 vessels

GMDSS ships operating in A3 areas are required to provide the following duplicated equipment;

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

Many GMDSS ships opt for the latter option (1 Inmarsat C and one MF/HF DSC system), on cost grounds. Unfortunately, this has proven to be one of the underlying causes of the present extremely high [false alerting rate](#) on some GMDSS systems.

Power supply requirements

GMDSS equipment is required to be powered from three sources of supply:

- ship's normal alternators/generators;
- ship's emergency alternator/generator (if fitted); and
- a dedicated radio battery supply.

The batteries are required to have a capacity to power the equipment for 1 hour on ships with an emergency generator, and 6 hours on ships not fitted with an emergency generator.

The batteries must be charged by an automatic charger, which is also required to be powered from the main and emergency generators.

Changeover from AC to battery supply must be automatic, and effected in such a way that any data held by the equipment is not corrupted (i.e. "no break").

Operator qualifications

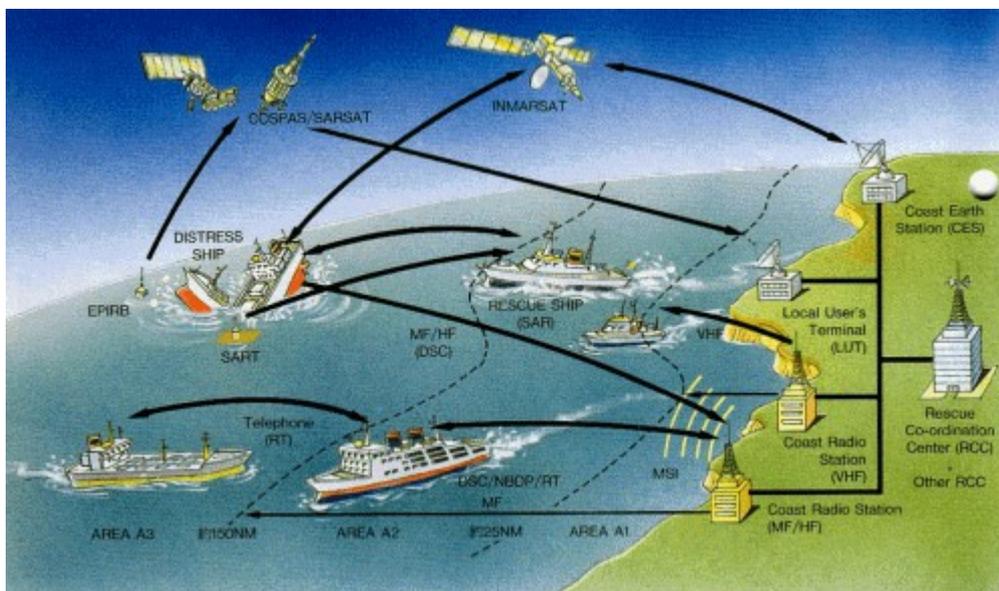
There are a number of different types of GMDSS qualifications, as follows:

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

The First and Second Radio-Electronic Certificates are diploma and associate diploma level technical qualifications. They are designed for Ship's Radio-Electronic Officers, who sail on GMDSS ships which use the option of at-sea electronic maintenance.

The GMDSS General Operator's Certificate is a non-technical operator qualification, designed for Navigating Officers.

The GMDSS General Operator's Certificate is normally awarded after a ten day course and examination.



ASHCOM Systems Ltd.

19 Apex Business Centre, Boscombe Road
Dunstable, Beds LU5 4SB
United Kingdom

Tel: +44 (0)1582 475555, Fax: +44 (0)1582 475553

Email: sales@ashcomsys.com