GLOBAL MARITIME DISTRESS and SAFETY SYSTEM (GMDSS): An Overview

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GMDSS
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* Introduction of the GMDSS.
* Implementation of The GMDSS.
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* Conclusion.
The “Old System”

The old system for distress and safety as specified by the 1974 SOLAS convention relies on:

1) Manual operation of:
   a) Morse telegraph on 500 kHz (MF range).
   b) Radiotelephone on 2182 kHz (MF range).
   c) Radiotelephone on 156.8 MHz (CH.16 on VHF range).

2) Audible reception of distress signals on the above frequencies.
Drawbacks of the Old System

* Distress signals are audible and need a well qualified operator.
* Rescue operations are possible within a range of 200 n.m. only.
* Ship in distress does not receive any acknowledgment in reply to its distress signals.
Introduction of The GMDSS

* Introduced by the IMO in 1979.


* Has become mandatory since Feb. 1999.
Implementation of the GMDSS System

* Objective.
* Functions.
* Subsystems.
Objective

The objective of the Global Maritime Distress and Safety System (GMDSS) is to provide an effective search and rescue system on a global basis using advanced technology of satellite and terrestrial communications.
Communication Functions of GMDSS

* Alerting.
* SAR coordinating communications.
* On-scene communications.
* Locating.
* Promulgation of MSI.
* General radio communications.
* Bridge- to- Bridge communications.
GMDSS Sub-systems

* Digital Selective Calling (DSC) \{MF, HF, VHF\}.
* INMARSAT.
* COSPAS-SARSAT.
* Search and Rescue Radar Transponder (SART).
* NAVTEX.
* Enhanced Group Call (EGC).
* MF/HF Radiotelephony (R/T).
* VHF Radiotelephony.
* HF Narrow Band Direct Printing (NBDP).
INMARSAT

COSPAS SARSAT

Rescue Co-ordination Centre

Coast Earth Station

EPIRB

SART

SAR Services

Local User Terminal/Mission Control Centre

National/International networks

Coast Radio Station HF, MF, VHF

General Radiocommunications eg: Ship Reporting, Medical Advice etc

Maritime Safety Information (MSI) eg: Navigational Warnings, SAR information etc

National/International networks
Sailing Areas

* Sea Areas A1:
  Within range of VHF coast station with continuous DSC alerting available (about 20-30 nautical miles).

* Sea Areas A2:
  Beyond area A1, about within range of MF coastal stations with continuous DSC alerting available (about 100 nautical miles).
Sailing Areas (cont’d)

* Sea Areas A3:
  Beyond the first two areas, but within coverage of geostationary maritime communication satellites (in practice this mean INMARSAT). This covers the area between roughly 70°N and 70°S.

* Sea Areas A4:
  the remaining sea areas. The most important of these is the sea around the North pole (the area around the South pole is mostly land). Geostationary satellites, which are positioned above the equator, cannot reach this far.
**Areas of operation for the GMDSS**

As the various sub-systems which make up the GMDSS have different limitations with respect to ocean coverage, the equipment required to be carried by a ship is determined by the ship’s area of operation. In all areas of operation a ship is required to have the continuous availability of alerting.

**Area 1**
Within range of VHF coast stations with continuous DSC alerting available. (about 20–30 miles)

**Area 2**
Beyond area 1 but within range of MF coastal stations with continuous DSC alerting available. (about 100 miles)

**Area 3**
Beyond the first two areas but within coverage of Inmarsat satellites. (roughly area between 70°N and 70°S)

**Area 4**
Remaining sea areas, the most important of which is the sea around the North Pole. (The area around the South Pole is mostly land.)

**EPIRB signal**
When a ship sinks, a float-free satellite emergency position-indicating radio beacon (EPIRB) is automatically activated.

**Ship in distress**
A distress alert is normally initiated manually and all distress alerts are acknowledged manually.

**General radiocommunications**
- Medical advice
- Vessel Traffic Services
- Ship reporting
- Public correspondence

**Maritime safety information (MSI)**
- Navigational warnings
- Meteorological warnings
- SAR information

**Graphic:** Liz Gould
GMDSS Sub-Systems
1. Digital Selective Calling (DSC)
2. INMARSAT
i. Space Segment
POR
Pacific Ocean Region

IOR
Indian Ocean Region

Equator

Orbit: 36,000 km above the equator

AOR-W
Atlantic Ocean Region – West

AOR-E
Atlantic Ocean Region – East
Each satellite has its own "country code" for telephony and for telex.

INMARSAT system:
- Global coverage, except for the polar areas (70N and 70S)
Coast Earth Station (CES)

- Establish communication between the terrestrial network and the SES.
- It is the gateway between two SES’s.
- Operates on the C-band (6/4 GHz).
iii. Ship Earth Stations (SES’s)

There are three types of ship earth stations:

- INMARSAT – A.
- INMARSAT – B.
- INMARSAT – C.

Ship Earth stations operate in the L-band (1.6/1.5 GHz)
3. COSPAS-SARSAT
Emergency Position Indicating Radio Beacons (EPIRB)

- These devices transmit a continuous signal on which rescue units can home.
- The signal can be activated manually but the EPIRB must also be able to float free and being signaling automatically in the event of a sudden accident (such as the ship capsizing before any other form of signal can be given).
4. Search And Rescue Radar Transponder (SART)
Location (1) of SART in the survival raft
Location (2) of SART in the survival raft
SURVIVAL CRAFT
IMO recommends SART mounted 1 metre above sea level.

Using compatible radar, with output power at least 1kW, on a search height of 300ft, detection ranges are up to 40 nautical miles.

With antenna height of 15 metres, detection ranges are up to at least 5 n miles.

IMO SYMBOL
FOR SART

As the search craft approaches within about 1 n mile of the SART the 12 dots will change to wide arcs, then into complete circles as the SART is closed.

Radar Display showing the SART 12 dot blip code (bearing approximately 30°)
5. NAVTEX
NAVTEX

NAVTEX is an international, automated system for instantly distributing maritime navigational warnings, weather forecasts and warnings, search and rescue notices and similar information to ships.
NAVTEX - Allocation of B₁ characters

The basic scheme for the allocation of NAVTEX transmitter identification (B₁) characters by the International Maritime Organisation within NAVAREAS of the World-Wide Navigational Warning Service.
ZCZC JB38
071930 UTC JUN
GERMAN GALE WARNING 218

RISK OF STRONG SOUTH-WEST TO WESTERLY WIND
FORCE 6 AT TIME* IN
WESTERN AND SOUTHERN
BALTIC...

NNNN
6. Enhanced Group Call (EGC)
Inmarsat Enhanced Group Calls (EGC) services
Safety NET message addressed to a circular area
Safety NET message addressed to a rectangular area
NOTE: HF NBDP system may be used to provide an additional supplementary equivalent service to EGC SafetyNET until full implementation of the GMDSS on 1 February 1999.
16 NAVAREA / METAREA Showing Inmarsat Ocean Regions
7. MF/HF Radiotelephony
8. VHF Radiotelephony
VHF radios
9. Narrow Band Direct Printing (NBDP)
DSC Coast Stations in EGYPT
<table>
<thead>
<tr>
<th>Country</th>
<th>Area</th>
<th>Main Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Frequency</th>
<th>Mode</th>
<th>Coverage</th>
<th>Time Zone</th>
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Rescue operation of “Achilli Lauro”
On the 1\textsuperscript{st} of December 1994, there was a fire on board the Italian passenger ship “Achilli Lauro”. The ship was sailing in the Arabian Sea (nearby to Somalia).

The ship had not been equipped with the GMDSS facilities (it was not mandatory at that time), hence it transmitted a distress signal using Morse code on 500 KHz.

A vessel with a call sign HSDL has received the distress message and relayed it, where it had been received by another vessel called “Coridal Express”.
The ship had re-transmitted the signal through an Inmarsat-A equipment where the MRCC in Stavanger (Norway) had received it.

The center has relayed the signal to the MRCC in Falmouth(U.K.).

The duty officer at the Falmouth MRCC had communicated with all the vessels sailing in the area, and informed them about the distress signal he received. Tanker “Lima” was one of them.

Since tanker “Lima” had been well equipped with communication facilities, it had been selected by the duty officer to take the command of the rescue operations. It had been instructed to communicate with all other vessels for this purpose.
Lima had chosen a tanker called “Hawaiian King” that was very close to Achilli Lauro, to communicate via VHF equipment to investigate the situation.

The crew of Achilli Lauro had told Lima that all passenger and crew had been safely evacuated, and moved to the life rafts.

Hawain King had selected other two nearby vessels to pick up the rescued passengers and crew (around 900).

All rescued persons were on board the three vessels within 9 hours of the transmission of the initial distress signal.
05.20 Corriedale Express relays distress call to Stavanger

05.30 Stavanger begins contacting vessels in area

07.00 Lima appointed coordinator, surface search

07.30 Hawaiian King arrives on scene

07.55 About 900 evacuated from Achille Lauro

09.00 Hawaiian King, Bardu and third vessel on scene and picking up survivors

11.20 Achille Lauro fully evacuated; 3-400 people aboard Hawaiian King

13.50 All passengers and crew from Achille Lauro safely aboard three vessels
Conclusion

• GMDSS is mainly an integrated telecommunication system that is intended to improve the search and rescue operations for ships in distress.

• Since its introduction in 1992, it helped much in achieving safety of life at sea.
Thank You for Your Kind Attention