Global Maritime Distress and Safety System

The course GMDSS GOC covers the training recommended in Annex 3 of IMO Assembly Resolution A. 703 (17) - Recommendation on Training of Radio Operators related to the General Operator's Certificate (GOC)

Global Maritime Distress and Safety System

GLOSSARY / ABBREVIATIONS

Abbreviation	Explanation
AIS	Automatic Identification System
ARPA	Automatic Radar Plotting Aid
IMO	International Maritime Organization
SOLAS	International Convention on the Safety of Life at Sea
A1, A2, A3, A4	Sea Areas (see definitions below)
VHF	Very high frequency (also VHF radio station)
MF	Medium frequency
HF	High frequency
Hz	The **Hertz** is the unit of frequency in the International System of Units (SI) and is defined as one cycle per second. (Ghz, khz etc)
SART	Search and Rescue Radio Transponder
EPIRB	Emergency Position-Indicating Radio Beacon

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GLOSSARY / ABBREVIATIONS

Abbreviation	Explanation
DSC	Digital Selective Calling
R/T	Radiotelephony
NBDP	Narrow Band Direct Printing (TELEX)
MMSI	Maritime Mobile Service Identities
MID	Maritime Identification Digits
ARQ	Automatic Request Query
FEC	Forward Error Correction
ISS	Information Sending Station
IRS	Information Receiving Station
ITU	International Telecommunication Union
MES	Mobile Earth Station

Global Maritime Distress and Safety System

GLOSSARY / ABBREVIATIONS

Abbreviation	Explanation
AOR-E	Atlantic Ocean Region East
AOR-W	Atlantic Ocean Region West
POR	Pacific Ocean Region
IOR	Indian Ocean Region
LES	Land Earth Station
EGC	Enhanced Group Call
NAVAREA	Navigation Area
RCC	Rescue Coordination Centre
MRSC	Maritime Rescue Sub-Centre
JRCC	Joint Rescue Coordination Centre

Global Maritime Distress and Safety System

GLOSSARY / ABBREVIATIONS

Abbreviation	Explanation
IAMSAR	International Aeronautical and Maritime Search and Rescue
NAVTEX	NAVIGATIONAL TELEX
TLF	Telephony
TLX	Telex
SES CES NCS	Ship Earth Station Coast Earth Station Network Coordination Station
GMDSS BGAN	Global Maritime Distress and Safety System Broadband Global Area Network

Global Maritime Distress and Safety System

DEFINITION OF SEA AREAS

Sea Area A1: An area within the radiotelephone coverage of at least one VHF coast station in which continuous Digital Selective Calling is available, as may be defined by a Contracting Government to the 1974 SOLAS Convention. This area extends from the coast to about 30 miles offshore.

Sea Area A2: An area, excluding sea area A1, within the radiotelephone coverage of at least one MF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government. The general area is from the A1 limit out to about 130-150 miles offshore.

Sea Area A3: An area, excluding sea areas A1 and A2, within the coverage of an Inmarsat geostationary satellite in which continuous alerting is available. This area is from about 70 (76)°N to 70 (76)°S.

Sea Area A4: All areas outside of sea areas A1, A2 and A3. This area includes the polar regions, where geostationary satellite coverage is not available.

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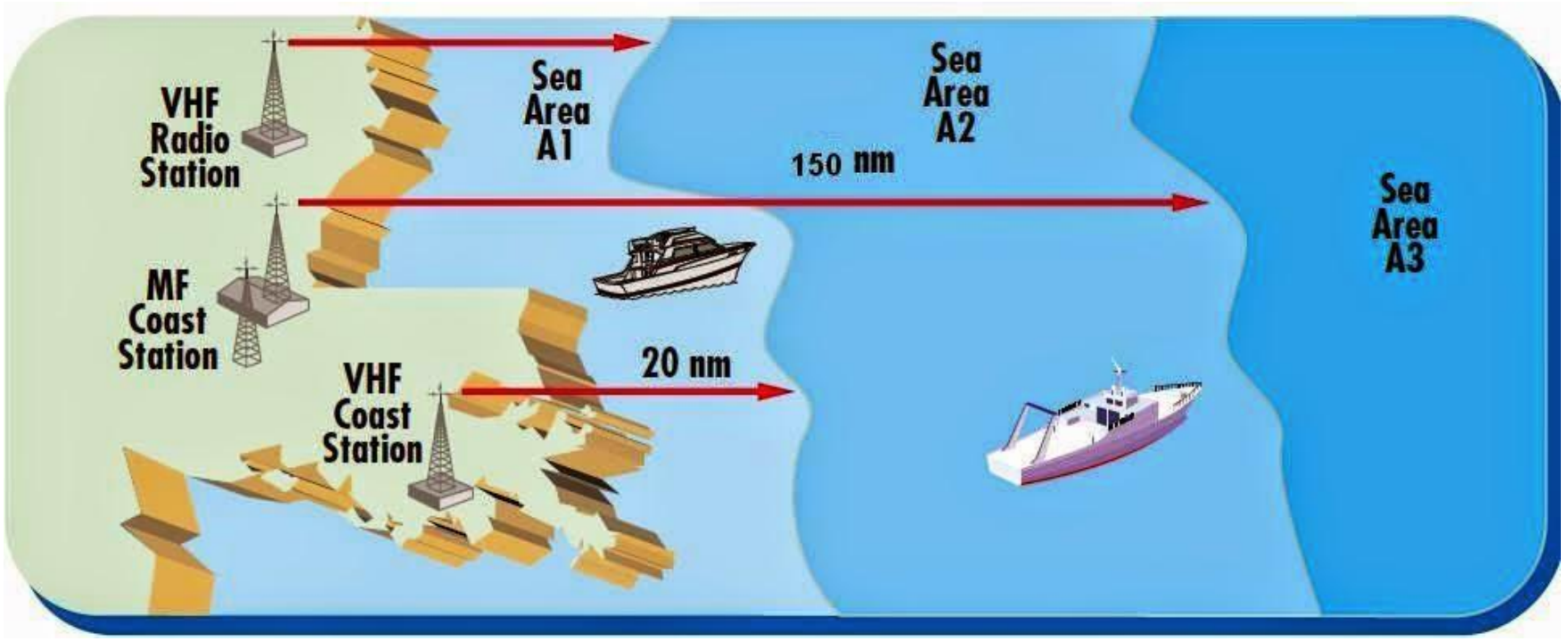
DEFINITION OF SEA AREAS



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REQUIREMENTS FOR RADIO INSTALLATIONS IN THE GMDSS

By the terms of the SOLAS Convention, the GMDSS provisions apply to cargo ships of 300 gross tons and over and ships carrying more than 12 passengers on international unlike previous shipboard carriage regulations that specified equipment according to size of vessel, the GMDSS carriage requirements stipulate equipment according to the area in which the vessel operates.

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Ships at sea must be capable of the following functional GMDSS requirements:

1. Ship-to-shore distress alerting.
2. Shore-to-ship distress alerting.
3. Ship-to-ship distress alerting.
4. SAR coordination.
5. On-scene communications.
6. Transmission and receipt of emergency locating signals.
7. Transmission and receipt of MSI.
8. General radio communications.
9. Bridge-to-bridge communications.

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To meet the requirements of the functional areas above the following is a list of the minimum communications equipment needed for all ships:

1. VHF radio capable of transmitting and receiving DSC on channel 70, and radio telephony on channels 6, 13 and 16.
2. Radio receiver capable of maintaining a continuous Digital Selective Calling (DSC) watch on channel 70 VHF.
3. Search and rescue transponders (SART), a minimum of two, operating in the 9 GHz band.
4. Receiver capable of receiving NAVTEX broadcasts anywhere within NAVTEX range.
5. Receiver capable of receiving SafetyNET anywhere NAVTEX is not available.
6. Satellite emergency position indicating radiobeacon (EPIRB), manually activated and float-free self-activated.
7. Two-way handheld VHF radios (two sets minimum on 300-500 gross tons cargo vessels and three sets minimum on cargo vessels of 500 gross tons and upward and on all passenger ships)

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Additionally, each sea area has its own requirements under GMDSS which are as follows:

Sea Area A1

General VHF radio telephone capability.
Free-floating satellite EPIRB.
Capability of initiating a distress alert from a navigational position using DSC on either VHF, HF or MF; manually activated EPIRB; or Ship Earth Station (SES).

Sea Areas A1 and A2

Radio telephone MF radiotelephony or direct printing 2182 kHz, and DSC on 2187.5 kHz.
Equipment capable of maintaining a continuous DSC watch on 2187.5 kHz.
General working radio communications in the MF band (1605-4000 kHz), or Inmarsat SES.
Capability of initiating a distress alert by HF (using DSC), manual activation of an EPIRB, or Inmarsat SES.

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Sea Areas A1, A2 and A3

Radio telephone MF 2182 kHz and DSC 2187.5 kHz.
Equipment capable of maintaining a continuous DSC watch on 2187.5 kHz
Inmarsat-A, -B or -C (class 2) or Fleet 77 SES Enhanced Group Call (EGC), or
HF as required for sea area A4
Capability of initiating a distress alert by two of the no following:
Inmarsat-A, -B or -C (class 2)or Fleet 77 SES
Manually activated EPIRB
HF/DSC radio communication

Sea Area A4

HF/MF receiving and transmitting equipment for band 1605-27500 kHz using DSC, radiotelephone and direct printing
Equipment capable of selecting any safety and distress DSC frequency for band 4000-27500 kHz, maintaining DSC watch on 2187.5, 8414.5 kHz and at least one additional safety and distress DSC frequency in the band
Capability of initiating a distress alert from a navigational position via the Polar Orbiting System on 406 MHz (manual activation of 406 MHz satellite EPIRB).

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CERTIFICATION REQUIREMENTS IN THE GMDSS

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

(1) The First and (2) 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.

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

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

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PRINCIPLES OF MARITIME RADIO-COMMUNICATIONS

THE GENERAL PRINCIPLES AND BASIC FEATURES OF THE MARITIME MOBILE SERVICE.

Maritime mobile service (short: **MMS** | also: maritime mobile radiocommunication service) is – according to Article 1.28 of the International Telecommunication Union´s (ITU) Radio Regulations (RR)[1] – defined as:

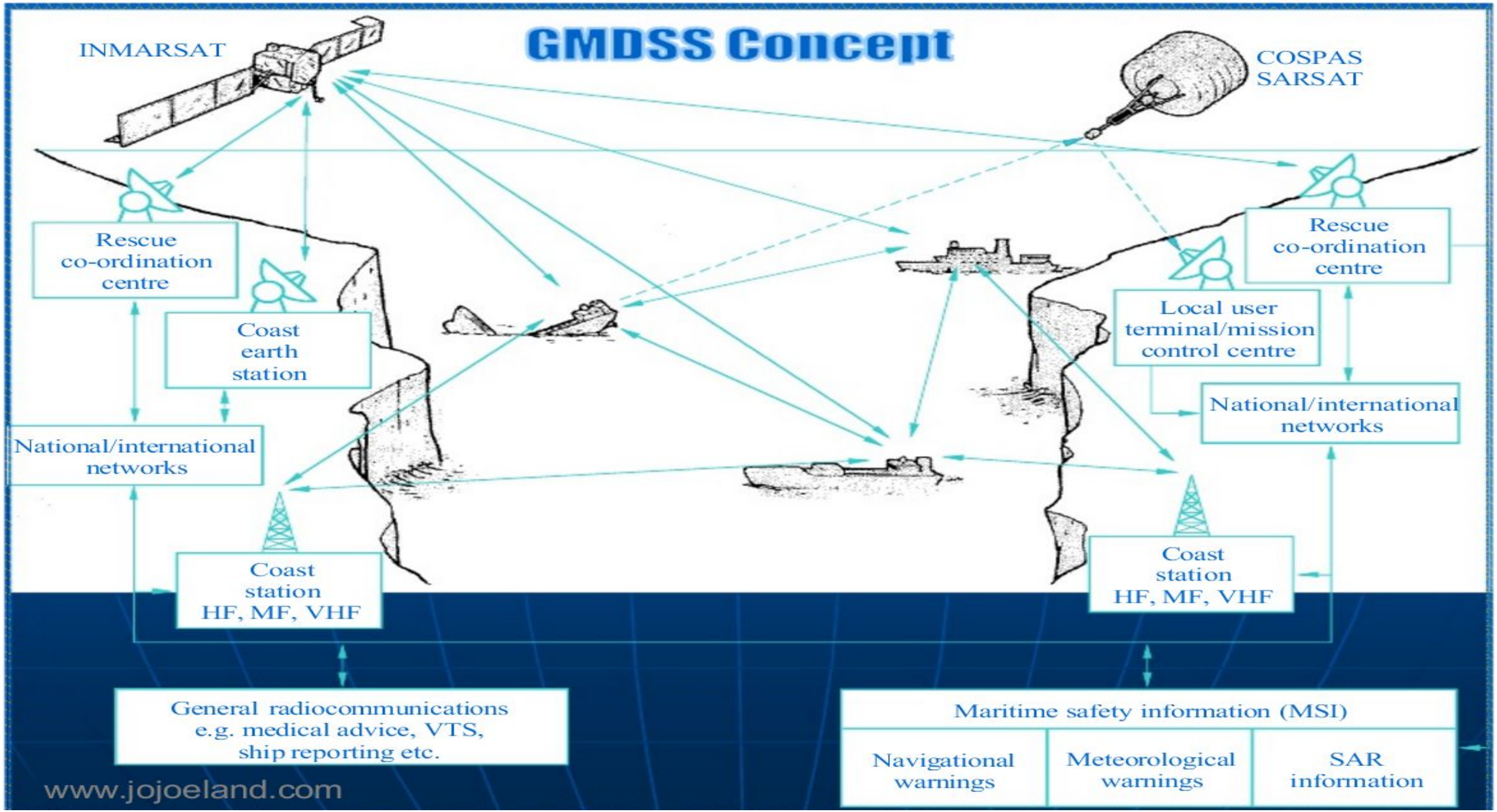
"A mobile service between coast stations and ship stations, or between ship stations, or between associated on-board communication stations; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service".

Global Maritime Distress and Safety System

GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS).

The Global Maritime Distress and Safety System (GMDSS) is an internationally agreed-upon set of safety procedures, types of equipment, and communication protocols used to increase safety and make it easier to rescue distressed ships, boats and aircraft.

GMDSS consists of several systems, some of which are new, but many of which have been in operation for many years. The system is intended to perform the following functions: alerting (including position determination of the unit in distress), search and rescue coordination, locating (homing), maritime safety information broadcasts, general communications, and bridge-to-bridge communications. Specific radio carriage requirements depend upon the ship's area of operation, rather than its tonnage. The system also provides redundant means of distress alerting, and emergency sources of power.


GMDSS Concept
INMARSAT
COSPAS
SARSAT
Rescue co-ordination centre
Coast earth station
National/international networks
Coast station HF, MF, VHF
Rescue co-ordination centre
Local user terminal/mission control centre
National/international networks
Coast station HF, MF, VHF
General radiocommunications e.g. medical advice, VTS, ship reporting etc.
Maritime safety information (MSI)
Navigational warnings
Meteorological warnings
SAR information
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GMDSS COMMUNICATION SYSTEMS
PURPOSE AND USE OF DIGITAL SELECTIVE CALLING (DSC) FACILITIES

DSC is, basically, a paging system that is used to automate distress alerts sent over terrestrial (i.e.: non-satellite) VHF, MF and HF marine radio systems.

The DSC system's digital processing techniques, combined with the relatively narrow receiver bandwidths used, provide a DSC signal with resistance to noise and fading over the radio path.

This results in increased range compared with radiotelephone transmissions.

Unfortunately, DSC remains one of the GMDSS' least understood sub-systems. This lack of understanding is reflected in the very high DSC false alert rate.

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DSC equipment

GMDSS DSC equipment is normally comprised of a stand alone control unit, with an alpha-numeric display screen and a keyboard on which to compose messages.

Typical VHF DSC controller - note display screen and keyboard.

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The control unit controls the actions of the DSC modem (modulator demodulator). The modem is interfaced to a DSC watch keeping receiver - this receiver is fixed tuned to either the VHF DSC channel (Ch. 70), the 2 MHz DSC channel, or the HF DSC channels.

HF DSC watch keeping receivers are designed to scan the 6 MF/HF DSC channels in rapid sequence (2 seconds or less).

DSC watch keeping receivers are fitted with their own dedicated antennas.

The DSC modem decodes all calls on the frequency to which the watch keeping receiver is tuned. If calls are received addressed to all ships, or to the particular ship on which the DSC system is fitted, the DSC controller sounds an alarm, and displays the decoded information on the alpha-numeric display.

MF/HF DSC operator control unit

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DSC is used to establish initial contact between stations.

Following an alert by DSC, communications are normally carried out by radiotelephone or Narrow Band Direct Printing (NBDP - radio telex).

DSC can be considered as a replacement for the radiotelephone and radiotelegraph (Morse) alarm signals.

Rather than just indicate that the sending station is in distress, the DSC system allows a great deal more information to be transmitted, including:

the priority of the call - DISTRESS, URGENCY, SAFETY or ROUTINE;
the address - ie: all ships or a single ship/station;
the identification of the ship in distress;
the position of the ship in distress; and
the nature of the distress.

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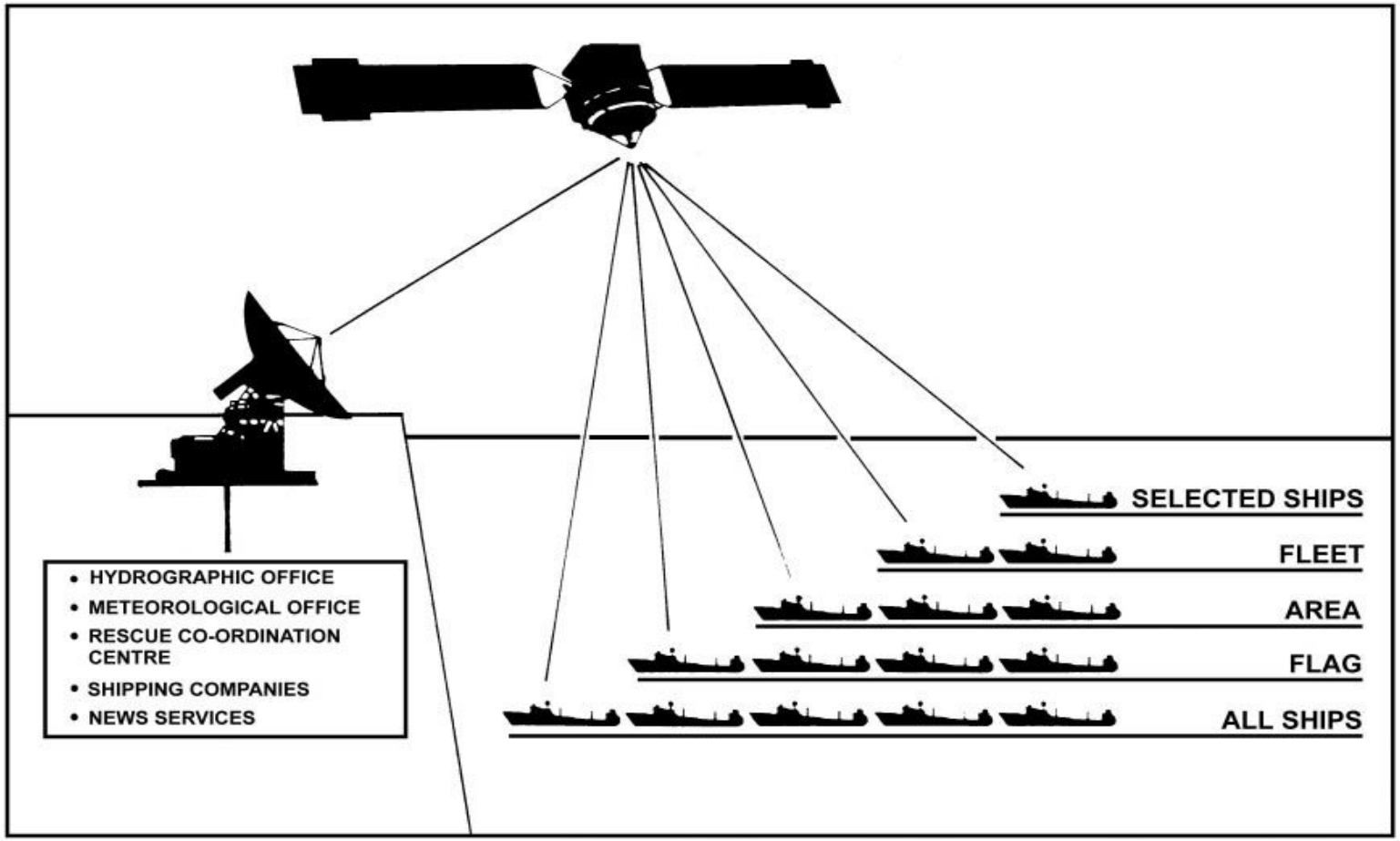

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CALL FORMAT SPECIFIER AND TYPES OF CALL

A *distress call consists of a Format Specifier--Distress*; the MMSI code; the nature of the distress (selected from a list: fire/explosion, flooding, collision, grounding, listing, sinking, disabled/adrift, or abandoning ship; defaults to Undesignated); the time of the call, and the format for subsequent communications (radiotelephone or NDBP). Once activated, a distress signal is repeated automatically every few minutes until an acknowledgment is received or the function is switched off. As soon as an acknowledgment is received by the vessel in distress, itmust commence communications with appropriate an message by radiotelephone or NDBP according to the format:

"MAYDAY"
MMSI CODE NUMBER AND CALL SIGN
NAME OF VESSEL
POSITION
NATURE OF DISTRESS
TYPE OF ASSISTANCE NEEDED
OTHER INFORMATION

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Routine calls should be made on a channel reserved for non-distress traffic. Once made, a call should not be repeated, since the receiving station either received the call and stored it, or did not receive it because it was not in service. At least 5minutes should elapse between calls by vessels on the first attempt, then at 15 minute minimum intervals.
To initiate a routine ship to shore or ship to ship call to a specific station, the no following procedures are typical:
- Select the appropriate frequency.
- Select or enter the MMSI number of the station to be called.
- Select the category of the call.
- Select subsequent communications method (R/T, NDBP).
- Select proposed working channel (coast stations will indicate vacant channel in acknowledgment).
- Select end-of-message signal (RQ for acknowledgment required).
Press.

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The digital code is broadcast. The receiving station may acknowledge receipt either manually or automatically, at which point the working channel can be agreed on and communications begin.

Watchkeeping using DSC consists of keeping the unit ON while in the appropriate Sea Area. DSC watch frequencies are

VHF Channel 70, 2187.5 kHz, 8414.5 kHz,

and one *HF* frequency selected according to the time of day and season.

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CALL CATEGORIZATION

URGENCY

Message concerning the safety of a ship, aircraft or other vehicle or person

SAFETY

Message concerning the safety of navigation or an important weather message is to follow

ROUTINE

Used for automatic and semi-automatic radiotelephone calls, ship business, etc..

Urgency, safety and routine calls can be addressed to all stations, an individual station, or a group of stations.

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CALL TELECOMMAND AND TRAFFIC INFORMATION

Function of the Controller provides for selection of the type of call we wish to initiate.

Distress alerts may be transmitted quickly by pressing one keypad marked typically for ***5 sec.***

Distress alert *will be broadcast to* ***all stations***

Call contains:

- Identity of calling vessel
- Position and time
- Nature “unspecified”

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If Controller NOT interfaced with ship's navigation system, position must be updated at least every ***12 hours.***

When programming ***Distress call,*** options which appear:

- On ***MF, H3E or J3E.***
- On ***VHF, F3E/G3E, Simplex.***
- On ***MF/VHF,*** distress relay, distress acknowledgment
- On ***MF/VHF*** it may be possible to select the type of distress eg. *Collision, cargo shift, etc…* Otherwise the indicator **UNDESIGNATED DISTRESS** will appear.

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Mayday Relay (MF)

This is only broadcast when a station learns that:
- Another person/vehicle is in Distress and is unable to transmit the Distress Alert itself, for example red flares sighted at night or *Distress Alert* was NOT acknowledge by CRS, there is no subsequent communication on associated RT or telex frequencies and the DSC distress call is not continuing.

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MAYDAY RELAY, MAYDAY RELAY, MAYDAY RELAY
THIS IS Ferryboat Cathrine, Cathrine, Cathrine,
Sierra November Golf Charlie, 261431000
RECEIVED THE FOLLOWING MAYDAY FROM 278054321:
MAYDAY
Spinaker Call sign Sierra 5 Lima 1 2, 278054321,
POSITION 045 36' North 0130 32' East AT 0545 UTC
The mast has broken and the engine is not strong enough to prevent us from grounding on a rocky shore
IMMEDIATE ASSISTANCE REQUIRED
5 persons on board and due to strong winds we can only remain on board for approximately two zero minutes
OVER

Global Maritime Distress and Safety System

This is only broadcast when a station learns that:
Another person/vehicle is in Distress and is unable to transmit the Distress Alert itself, for example red flares sighted at night or
Distress Alert was not acknowledge by CRS and there is no subsequent communication on associated RT or telex frequencies.
Note: Distress Relay Call must be addressed to CRS or RCC.

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After receiving a *Distress Alert on 2187.5 kHz*, you must listen out for a Distress Message on an associated RT or telex frequency. *Then wait for a CRS to acknowledge the call and for subsequent voice communication on an associated RT or telex frequency*. If your own vessel is able to assist, *acknowledge the call by using RT on 2182 kHz*.
If a Distress Alert is not followed by an RT broadcast on 2182 kHz or acknowledged by any other station, acknowledge the call by RT on 2182 kHz and proceed with voice communication on 2182 kHz and try to notify the shore authorities by any means.

MAYDAY
(MMSI of the vessel in distress), (Name of the vessel in distress spoken 3 times), (Call sign of the vessel in distress)
THIS IS (MMSI of the vessel), (Name of the vessel spoken 3 times), (Call sign of the vessel)
RECEIVED MAYDAY
Pattern of acknowledgment of a Distress Call on RT

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All other **MF/HF** ship-shore call should **NOT be** on the DSC Distress Alerting frequencies, but on the national frequencies allocated to the coast station. The ship DSC transmit frequency of **2189,5 kHz** coupled with the shore transmit frequency of **2177 kHz** have been allocated internationally for **Routine** calls.

Medical transport calls should be given the category **URGENCY** and be addressed to ***ALL STATIONS.***

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For an incident of lesser gravity but where your vessel is still in a difficult situation, such as mechanical breakdown, broken masts, or a non life-threatening medical problem affecting a crew member, etc., use the pan-pan (pronounced "pon-pon") call instead of the Mayday call

Say **"Pan Pan, Pan Pan, Pan Pan."**
Provide your vessel's **name** and **call sign**.
State your **position**. Give the **nature of the problem** (for example, "Engines have ceased to work", "mast has snapped, storm coming", "barrels/debris floating just below the water", etc.)
State intended action.
Over.

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DSC	*Radiotelephone*	*Telex*
2187.5 kHz	2182 kHz	2174.5 kHz
4207.5 kHz	4125 kHz*	4177.5 kHz
6312 kHz	6215 kHz	6268 kHz
8414.5 kHz	8291 kHz	8376.5 kHz
12577 kHz	12290 kHz	12520 kHz
16804.5 kHz	16420 kHz	16695 kHz
Ch 70 VHF	Ch 16 VHF	-

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TEST CALLS

Daily

(a) The proper functioning of the DSC facilities shall be tested at least once each day, without radiation of signals, by use of the means provided on the equipment.

(b) Batteries providing a source of energy for any part of the radio Installations shall be tested daily, and where necessary, brought up to the fully charged condition.

(c) Printer(s) shall be checked daily to ensure there is an adequate supply of paper.

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Weekly

(a) The proper operation of the DSC facilities shall be tested at least once a week by means of a test call when within communication range of a coast station fitted with DSC equipment. Where a ship has been out of communication range of a coast station fitted with DSC equipment for a period of longer than one week, a test call shall be made on the first opportunity that the ship is within communication range such as a coast station, or with nearby ships.

(b) Where the reserve source of energy is not a battery (for example, a motor generator), the reserve source of energy shall be tested weekly.

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Monthly

(a) Each EPIRB and satellite EPIRB shall be tested at least once a month to determine its capability to operate properly using the means provided on the device and without using the satellite system. Version 5 – February 2015

(b) Each search and rescue radar transponder shall be checked at least once a month using the in-built test facility and checked for security and signs of damage.

(c) A check shall be made at least once a month on the security and condition of all batteries providing a source of energy for any part of a radio installation. The battery connections and compartment shall also be checked.

(d) A check shall be made at least once a month on the conditions of all aerials and insulators.

(e) Each survival craft two-way VHF equipment shall be tested at least once a month on a frequency other than 156.8 MHz (VHF Channel 16).

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DSC FACILITIES AND USAGE

VHF DSC controller

Broadcasting and receiving DSC Alerts is one of the major facilities on a VHF radio that is possible by VHF DSC controller. DSC alerts are used to “switch people on” to follow on with voice communication.

DSC is used for a number of reasons and these are:

Automatic rather than manual radio watch keeping is available.

Alerts using DSC are very quick (about 0.5 seconds on the dedicated frequency on marine VHF band) and do not occupy as much time as a manual voice call. This is very important particularly in areas where VHF channels are often occupied.

Distress alerting can be enabled quickly with one press of the “Distress” push button.

Various categories of alert are available with the following order of priority: Distress, Urgency, Safety and Routine.

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VHF/HF and MF DSC controllers

The following VHF DSC alerts are available (Whom are we calling?):

ALL SHIPS – an alert to all ships received within VHF range of the station sending the alert

INDIVIDUAL – an alert addressed and received by only one radio station within VHF range

GROUP – an alert addressed and received by all those vessels having the group MMSI within VHF range

GEO – an alert to a specified geographical area received by all stations within that area

The types of DSC alerts are related to a particular category or priority:

- **DISTRESS**
- **URGENCY**
- **SAFETY**
- **ROUTINE**

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VHF / HF and MF frequencies

The ITU has allocated a DSC distress and safety channel in the MF, each of the HF and the VHF marine radio bands.

These are:
MF/HF DSC

DISTRESS AND SAFETY CHANNELS

2187.5 4207.5 6312.0 8414.5 12577.0 16804.5 (kHz)

VHF DSC

DISTRESS AND SAFETY CHANNEL

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VHF marine channel 70
Note: that voice transmissions are PROHIBITED on the DSC channels.

The MF/HF channels are restricted to distress, urgency and safety traffic only because of the relatively low speeds of transmission of 100 baud. If too many calls were permitted on the MF/HF channels, the channels would quickly become overloaded to the point where a distress call may be blocked.

VHF DSC operates at 12 times the speed of MF/HF - accordingly, **all priorities of call are allowed on the VHF channels.**

The ITU has also allocated a suite of HF channels dedicated to DSC commercial operations.

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NARROW BAND DIRECT PRINTING (NBDP)

Narrow Band Direct Printing (NBDP) is a term we use to describe a method of sending information over the radio and having it printed. In some publications it is called ***TELEX***

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Automatic Systems:

- In the ship to shore working, the ship station calls the coast station on predetermined coast station receive frequency, using the direct-printing equipment and the identification signal of the coast station assigned in accordance with App. 38, or the coast station identity in accordance with app. 43
- The coast station's direct-printing equipment detect the call and the coast station responds directly on the corresponding coast station transmit frequency, either automatically or under manual control.

Semi-Automatic Systems

Telex operator of the international exchange of the land station country selects the called subscriber directly if automatic procedures or single=operator procedures cannot be applied i.e.. after typing message into memory, a coast station operator is call (on telex), who will then forward the message for delivery via International/National telex networks.

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Manual Systems

The land station operator applies manual procedures if automatic, single-operator or semi-automatic procedures are not possible, i.e. the coast station operator is called and the message typed direct, not having been saved in memory.

For radio telex communication there are two modes:

ARQ – automatic request query.

Automatic Request for Repetition, telex mode used to send mainly routine message from one transmitter to one receiver.

FEC – forward error correction.

Telex mode used to send mainly priority message (distress, urgency or safety) from one transmitter to many receivers

SELFEC, SELECTIVE FORWARD ERROR CORRECTION :

Operation is similar to FEC operation except that the transmission is designed to send messages to one station only. The operator simply uses the **selcall** number of the receiving station, and this activates the modem and prepares it to receive a SELFEC message

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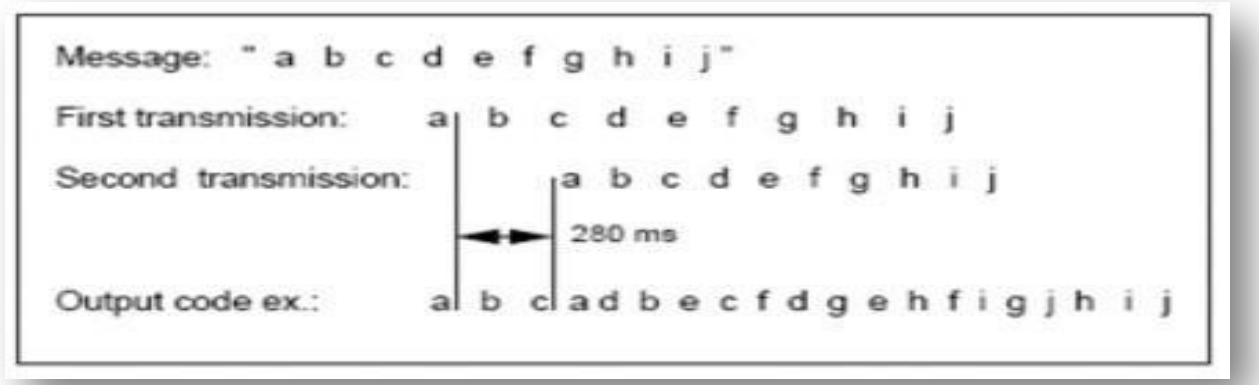
FORWARD ERROR CORRECTION

The FEC Mode is a one-way communication (one-way), which is used for streaming messages to any particular station, for example, weather, emergency bulletins, etc. The station that sends the information is known as BSS (B-mode Sending Station) and the receiving station and the BRS (B-Mode Receiving Station).

This mode uses a simple technique for error correction (FEC) by sending each character twice in an interval of 280 Ms. The first transmission is called DX (direct transmission), and the second RX (repeat transmission).



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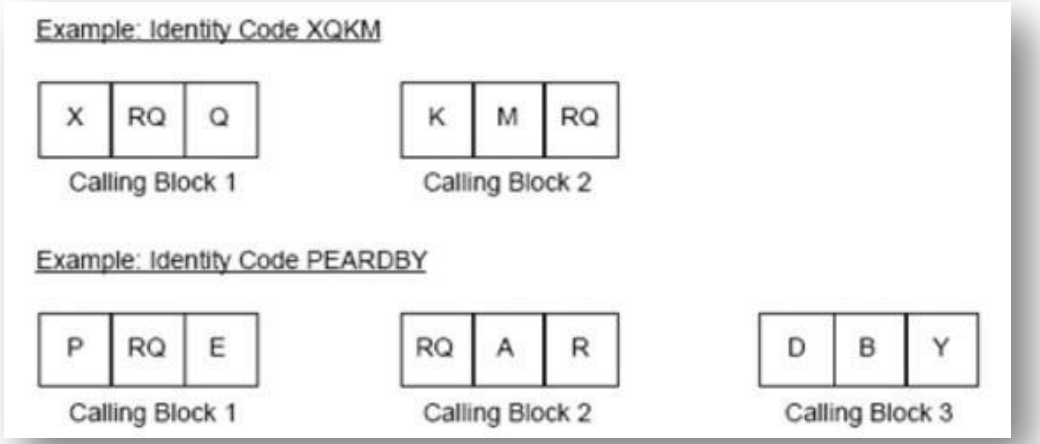
AUTOMATIC REQUEST QUERY

In ARQ mode two stations communicate directly with them. A station sends information and receives control signals, while the other station receives information and sends control signals confirming the receipt. The first station is the ISS (Information Sending Station) and the second is the IRS (Information Receiving Station).
These functions are exchanged between the stations through a special control signal. The station that initiates the call is the MS station (Master Station). The MS initiates the call by sending a separate identity code to call the station, which consists of a signal RQ and two signal of traffic information. The MS stays listening between the sending of each block.



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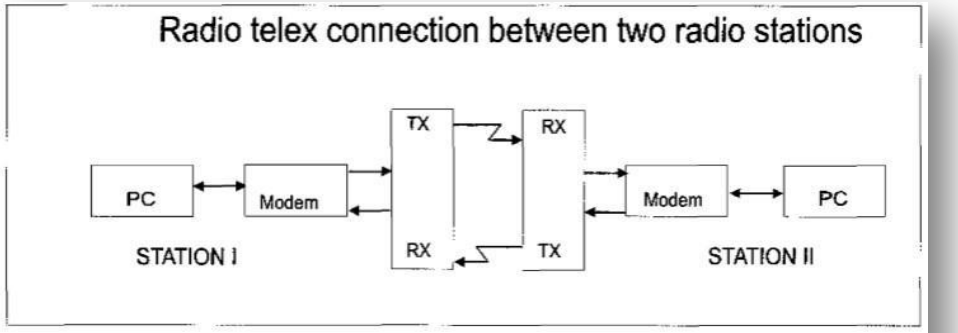
ISS – *Information Sending Station. The station transmitting characters.*
IRS – *Information Receiving Station. The station receiving characters.*

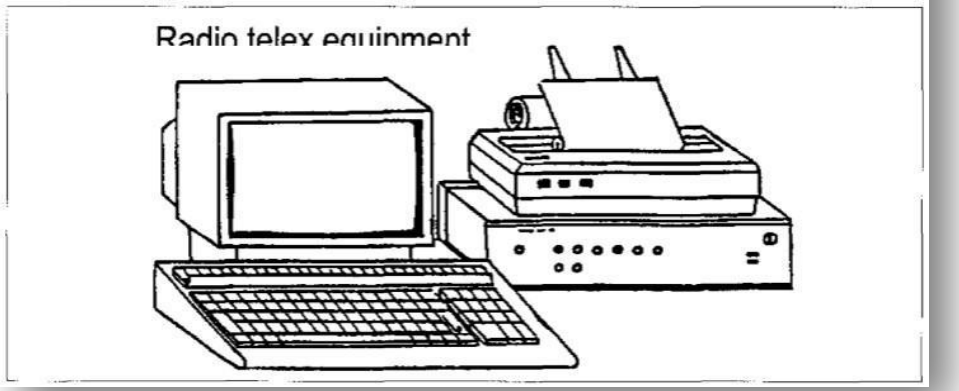
The station SS (Slave Station) recognizes as its own identity the received code and answers if ready by sending a control signal. Then the station MS starts normal traffic.

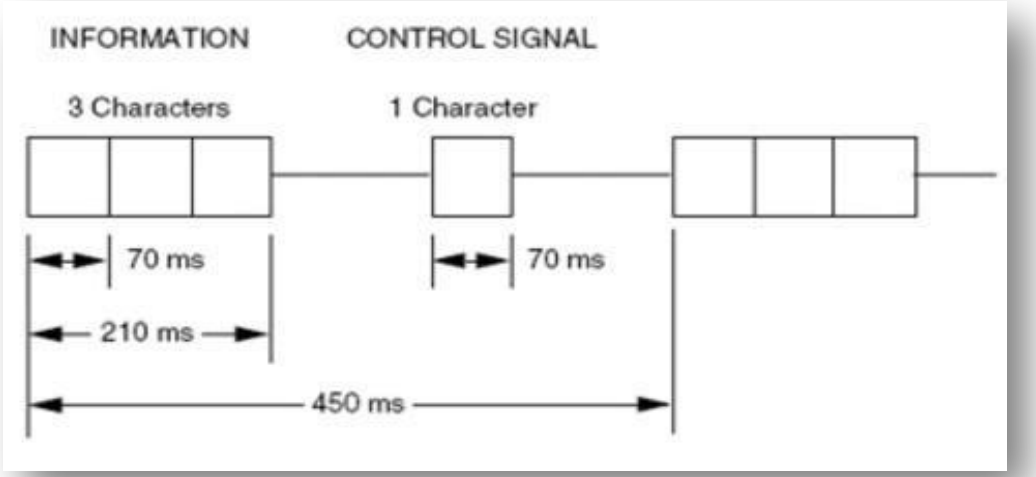
The ISS sends data in blocks of three characters. Each character is sent at a rate of 100 baud, which means 70 MS per character or 210 MS per block of characters. The block is repeated in a cycle of 450 MS, so for 240 MS the ISS does not send information. This time is taken up by the spread of the ISS to the IRS, 70 MS for the IRS to send their service signal information, and the return trip to the ISS.

The IRS listens between blocks and sends a control signal (CS1 or CS2) to request the next block, or retransmission of the last block on error (the character does not maintain the proportion received 4B/3Y). The request for retransmission may be repeated up to 32 times, until the entire received block is free of errors. After 32 times, the ISS automatically starts a new call.

Global Maritime Distress and Safety System







Global Maritime Distress and Safety System

Traffic Information Signals				
	Letters	Figures	International (1) code no. 2	Emitted signals (2)
1	A	-	ZZAAA	BBBYYYB
2	B	?	ZAAZZ	YBYYBBB
3	C	:	AZZZA	BYBBBYY
4	D	WRU	ZAAZA	BBYYBYB
5	E	3	ZAAAA	YBBYBYB
6	F		ZAZZA	BBYBBYY
7	G		AZAZZ	BYBYBBY
8	H		AAZAZ	BYYBYBB
9	I	8	AZZAA	BYBBYYB
10	J	BELL	ZZAZA	BBBYBYY
11	K	(	ZZZZA	YBBBBYY
12	L	)	AZAAZ	BYBYYBB
13	M	.	AAZZZ	BYYBBBY
14	N	,	AAZZA	BYYBBYB
15	O	9	AAAZZ	BYYYBBB
16	P	0	AZZAZ	BYBBYBY
17	Q	1	ZZZAZ	YBBBYBY
18	R	4	AZAZA	BYBYBYB
19	S	'	ZAZAA	BBYBYYB
20	T	5	AAAAZ	YYBYBBB
21	U	7	ZZZAA	YBBBYYB
22	V	=	AZZZZ	YYBBBBY
23	W	2	ZZAAZ	BBBYYBY
24	X	/	ZAZZZ	YBYBBBY
25	Y	6	ZAZAZ	BBYBYBY
26	Z	+	ZAAAZ	BBYYYBB
27	Carriage Return		AAAZA	YYYBBBB
28	Line Feed		AZAAA	YYBBYBB
29	Letter Shift		ZZZZZ	YBYBBYB
30	Figure Shift		ZZAZZ	YBBYBBY
31	Space		AAZAA	YYBBBYB
32	Unperforated Tape		AAAAA	YBYBYBB

Global Maritime Distress and Safety System

Service Information Signals

Mode A (ARQ)	emitted signal	Mode B (broadcast)
Control signal 1	BYBYYBB	
Control signal 2	YBYBYBB	
Control signal 3	BYYBBYB	
Idle time b	BBYYBBY	Idle signal (sel.)
Idle time a	BBBBYYY	Phasing signal 1 (a)
Signal repetition (RQ)	YBBYYBB	Phasing signal 2 (I)

Global Maritime Distress and Safety System

According to the Radio Regulations as defined by the International Telecommunication Union (ITU), a station has to identify itself either by call sign, selcall or selective call number. Maritime call signs and identification numbers are listed in the "List of Call Signs and Numerical Identities" and is published by the ITU. Ship stations are listed alphabetically in the "List of Ship Stations"
also published by the ITU.

COASTAL STATIONS

The ITU assigned blocks of station identification numbers to many countries in the world. The coastal stations use 4 digit numbers. They can be translated as follows:

0 = V 1 = X 2 = Q 3 = K 4 = M 5 = P 6 = C 7 = Y 8 = F 9 = S

Example: Lyngby Radio has identification number ***0832*** = selcall ***VFKQ***

Global Maritime Distress and Safety System

SHIP STATIONS

Ship stations use 5 digit identification numbers. The table on the right should be used as follows:
1st digit: defines the column that you have to check.
2nd digit: defines the row in block 1.
3rd digit: defines the row in block 2.
4th digit: defines the row in block 3.
5th digit: defines the row in block 4.
Example:
mv Alemania Express has identification number **62913**=call sign **USXE**.
1st digit = 6 (column 6)
2nd digit = 2 (column 6, block 1, row 2) = U
3rd digit = 9 (column 6, block 2, row 9) = S
4th digit = 1 (column 6, block 3, row 1) = X
5th digit = 3 (column 6, block 4, row 3) = E

Global Maritime Distress and Safety System

digit 1:

digit 2:	0	1	2	3	4	5	6	7	8	9
0	T	V	V	V	T	T	T	V	V	V
1	B	X	X	X	B	B	B	X	X	X
2	U	Q	Q	Q	U	U	U	Q	Q	Q
3	E	K	K	K	E	E	E	K	K	K
4	O	M	M	M	O	O	O	M	M	M
5	I	P	P	P	I	I	I	P	P	P
6	R	C	C	C	R	R	R	C	C	C
7	Z	Y	Y	Y	Z	Z	Z	Y	Y	Y
8	D	F	F	F	D	D	D	F	F	F
9	A	S	S	S	A	A	A	S	S	S

digit 3:

	0	1	2	3	4	5	6	7	8	9
0	V	T	V	V	T	V	V	T	T	V
1	X	B	X	X	B	X	X	B	B	X
2	Q	U	Q	Q	U	Q	Q	U	U	Q
3	K	E	K	K	E	K	K	E	E	K
4	M	O	M	M	O	M	M	O	O	M
5	P	I	P	P	I	P	P	I	I	P
6	C	R	C	C	R	C	C	R	R	C
7	Y	Z	Y	Y	Z	Y	Y	Z	Z	Y
8	F	D	F	F	D	F	F	D	D	F
9	S	A	S	S	A	S	S	A	A	S

digit 4:

	0	1	2	3	4	5	6	7	8	9
0	V	V	T	V	V	T	V	T	V	T
1	X	X	B	X	X	B	X	B	X	B
2	Q	Q	U	Q	Q	U	Q	U	Q	U
3	K	K	E	K	K	E	K	E	K	E
4	M	M	O	M	M	O	M	O	M	O
5	P	P	I	P	P	I	P	I	P	I
6	C	C	R	C	C	R	C	R	C	R
7	Y	Y	Z	Y	Y	Z	Y	Z	Y	Z
8	F	F	D	F	F	D	F	D	F	D
9	S	S	A	S	S	A	S	A	S	A

digit 5:

	0	1	2	3	4	5	6	7	8	9
0	V	V	V	T	V	V	T	V	T	T
1	X	X	X	B	X	X	B	X	B	B
2	Q	Q	Q	U	Q	Q	U	Q	U	U
3	K	K	K	E	K	K	E	K	E	E
4	M	M	M	O	M	M	O	M	O	O
5	P	P	P	I	P	P	I	P	I	I
6	C	C	C	R	C	C	R	C	R	R
7	Y	Y	Y	Z	Y	Y	Z	Y	Z	Z
8	F	F	F	D	F	F	D	F	D	D
9	S	S	S	A	S	S	A	S	A	A

Global Maritime Distress and Safety System

Example of some country codes

ITU Radio Regulations

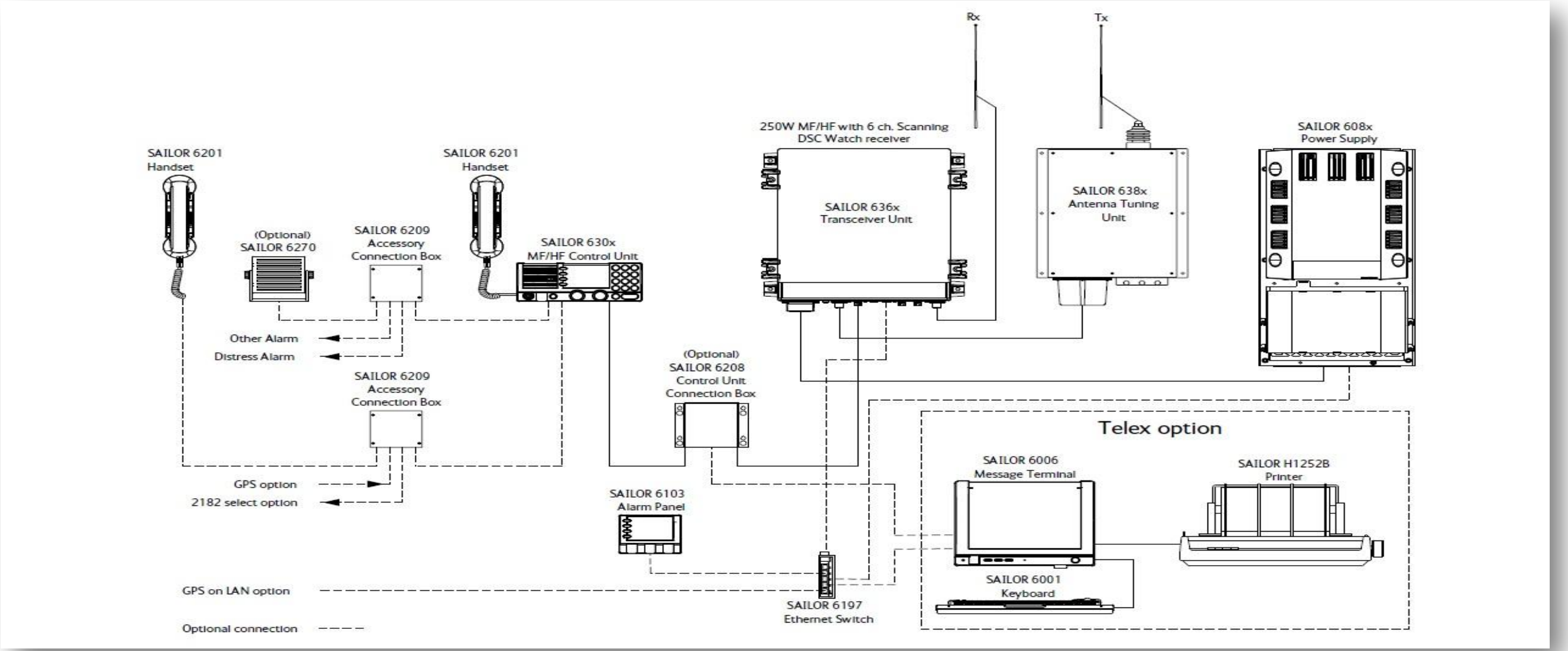
Table of Blocks of Selective Call Numbers for Ship Stations

00000-00499	Argentina
00500-00699	Cyprus
00700-00799	Fiji
00800-00899	Hungary
00900-00999	Saudi Arabia
01000-01199	Australia
01200-01399	Peru
01400-01499	Bolivia
01500-01599	Tanzania
01600-01699	Myanmar
01700-01799	Cyprus
01800-01899	Singapore
01900-01999	Seychelles
02000-02099	Slovenia
02020	Argentina (gc)
02100-02199	Bangladesh
02200-02299	Cape Verde
02300-02499	St Vincent & Grenadines
02500-02599	Malaysia
02600-02699	Western Samoa
02700-02799	Mauritius
02800-02999	Antigua and Barbuda
03000-03199	China
03200-03299	Canada
03300-05199	Denmark
04040	Canada (gc)
05050	China (gc)
05200-05399	Cyprus
05400-05899	Denmark
05900-05999	Bulgaria
06000-08399	Denmark
06060	China (gc)
08400-09499	Spain
52500-52599	Venezuela
52525	UK Great Britain and NI (gc)
52600-56099	Russia
54545	Spain (gc)
55555	Estonia (gc)
56100-56199	Cyprus
56200-56299	Malaysia
56300-56399	Cyprus
56400-56599	Turkey
56600-56699	Thailand
56700-56799	Estonia
56800-57099	Yugoslavia
57100-57499	Norway
57500-57574	Ecuador
57575	Yugoslavia (gc)
57576-57599	Ecuador
57600-57699	Uruguay
57700-57799	Mozambique
57800-57899	Venezuela
57900-58099	Romania
58100-58199	Algeria
58200-58299	Austria
58300-58399	Costa Rica
58400-58899	Brazil
58900-58999	Sri Lanka
59000-59099	Ecuador
59100-59199	Brazil
59200-59399	Iran
59400-59499	Libya
59500-59699	Brazil
59700-59799	New Zealand
59800-59899	Germany
59900-59999	Monaco
60000-60099	Brazil
60100-60599	Germany
60600-60699	Latvia
60700-60999	Pakistan
61000-61099	Netherlands Antilles

Global Maritime Distress and Safety System

RADIOTELEX EQUIPMENT

Global Maritime Distress and Safety System

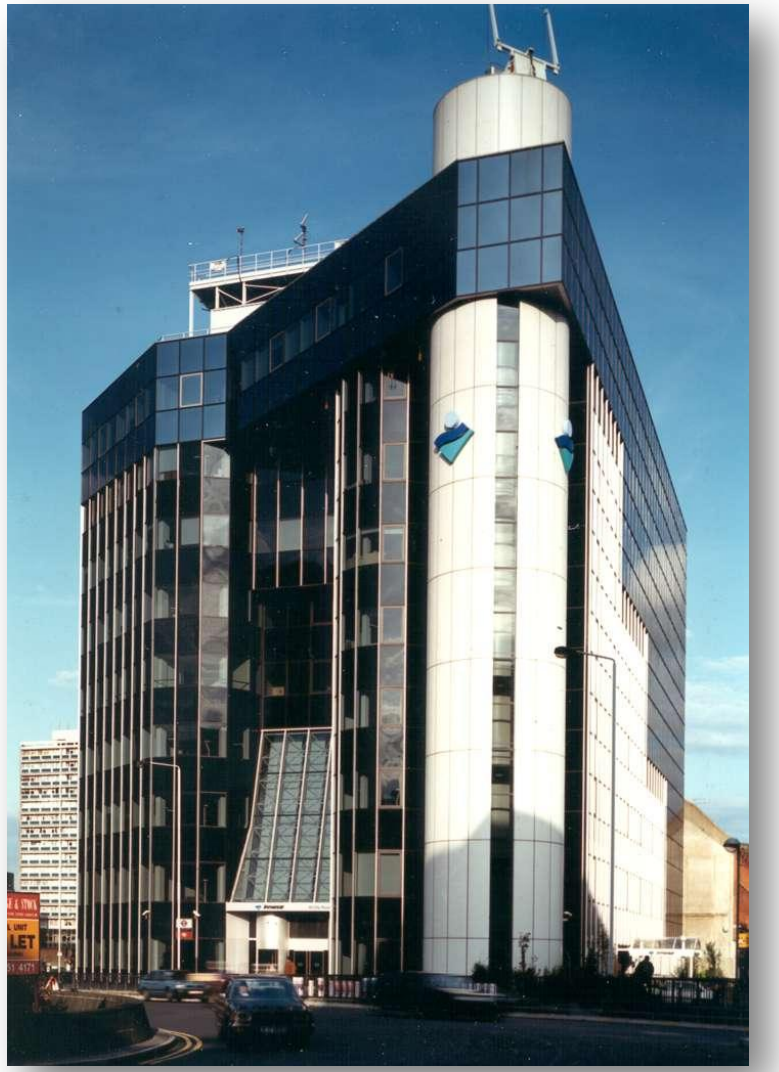


Global Maritime Distress and Safety System

Global Maritime Distress and Safety System

INMARSAT SYSTEMS

- Established in 1979
- Previously an inter-government organization
- A privatized UK company since 15 April 1999



Global Maritime Distress and Safety System

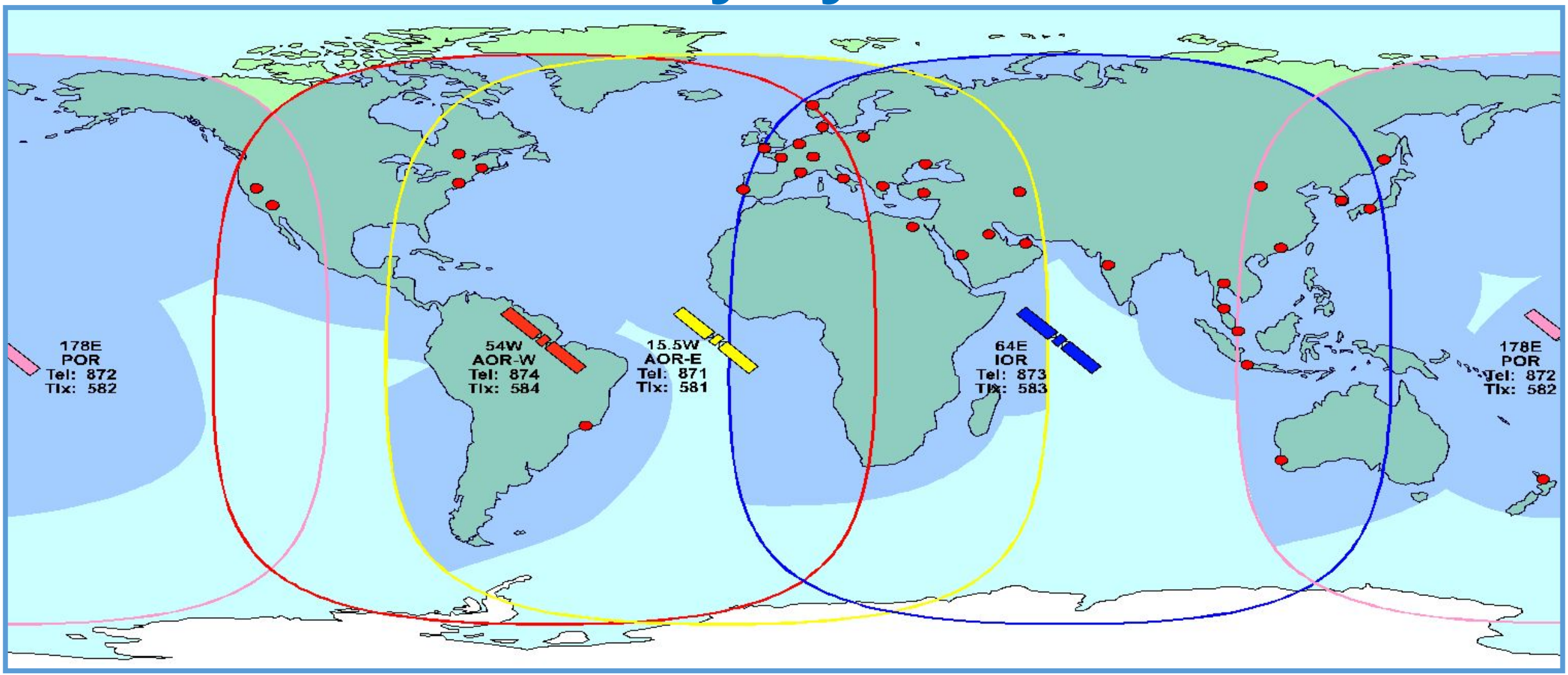
INMARSAT SYSTEMS

98% of the world's landmass and all ocean regions

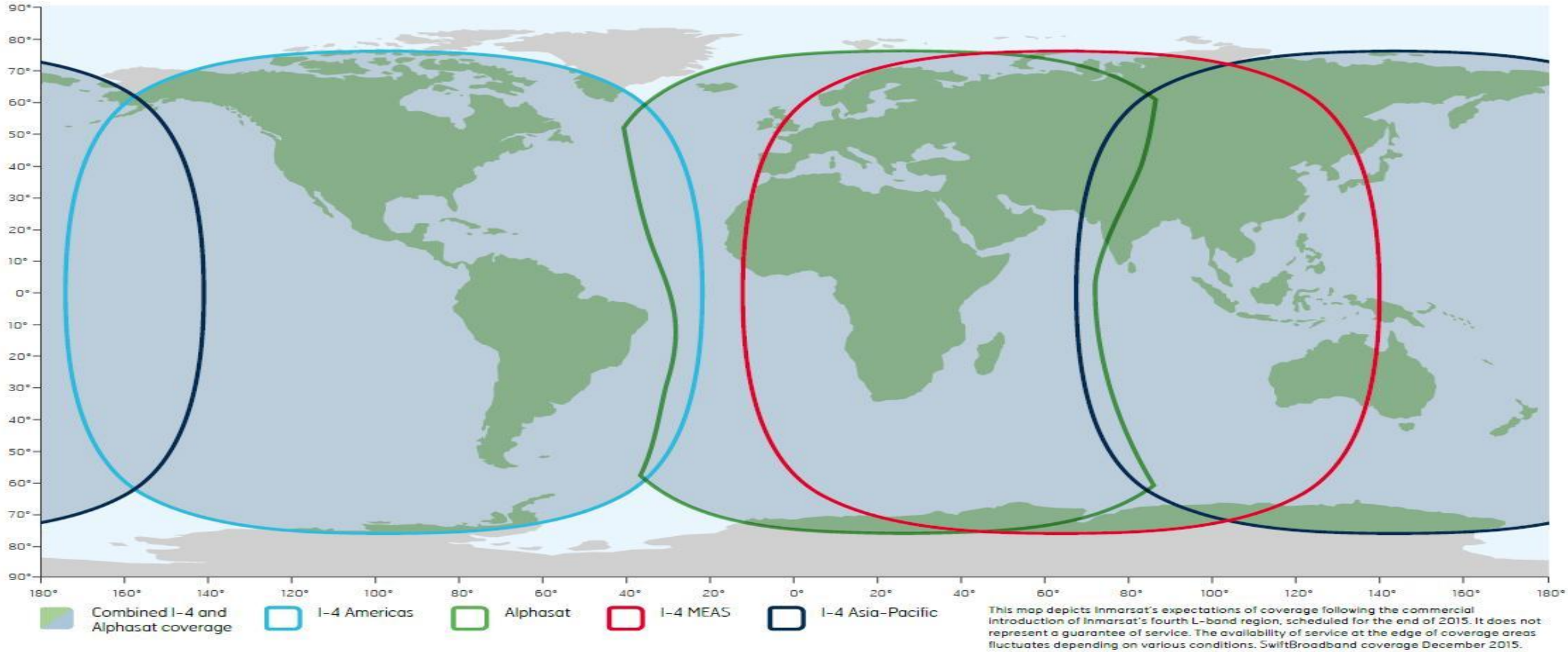
10% of the world's landmass

Atlantic Ocean Region East ***(AOR-E)***
Pacific Ocean Region ***(POR)***
Indian Ocean Region ***(IOR)***
Atlantic Ocean Region West ***(AOR-W)***

Global Maritime Distress and Safety System

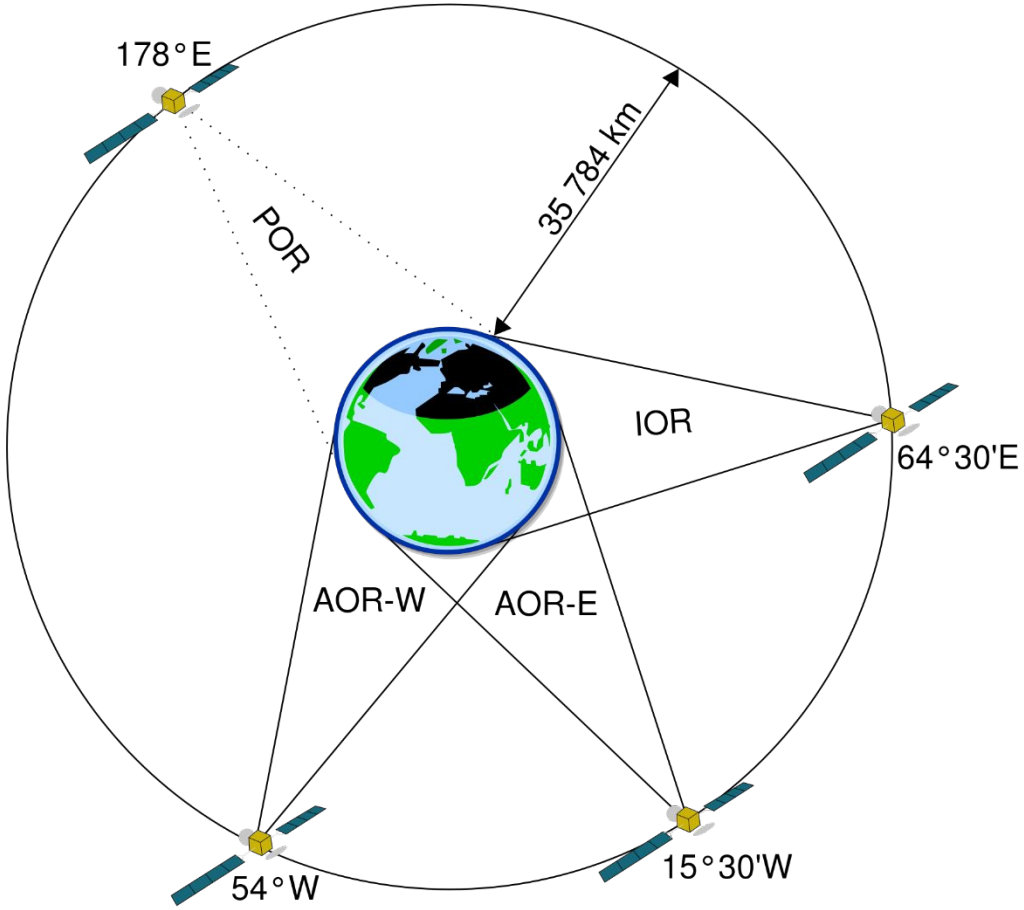


Global Maritime Distress and Safety System



This map depicts Inmarsat's expectations of coverage following the commercial introduction of Inmarsat's fourth L-band region, scheduled for the end of 2015. It does not represent a guarantee of service. The availability of service at the edge of coverage areas fluctuates depending on various conditions. SwiftBroadband coverage December 2015.

Global Maritime Distress and Safety System



Global Maritime Distress and Safety System

INMARSAT SYSTEMS

Inmarsat-A

The Inmarsat-A mobile Satellite communications (satcoms) system provides two-way direct-dial phone (high quality voice), fax, telex, electronic mail and data communications to and from anywhere in the world with the exception of the poles. It also provides distress communication capabilities. It is based upon analogue technology. It supports data rates of between 9,600 bps through up to 64,000 bps depending upon different elements of your end-to-end connection.

Every SES has own identification number which consist of 7 digits:
1st digit – system identification
3 digits – MID number
3 last digits – the number of the station.

Global Maritime Distress and Safety System

THE SYSTEM – Service Description:

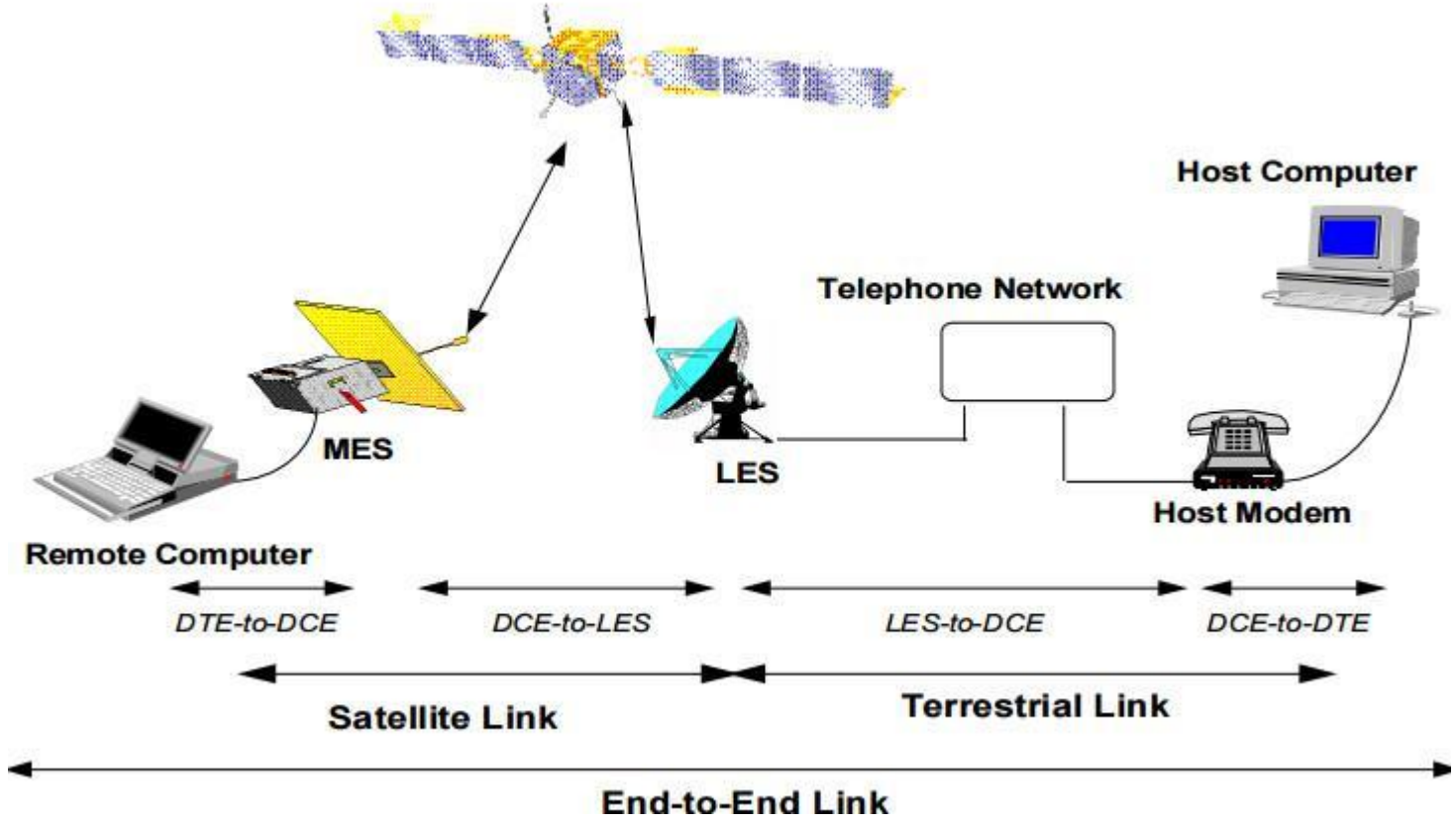
The Inmarsat-A service comprises 3 components:

• The mobile-earth station (MES): An Inmarsat-A terminal is a small, self-contained
satellite earth station comprising a lightweight parabolic antenna, electronic units, power supply interface, and direct-dial telephone, fax and telex connections.

• The satellites: The transmission and reception of signals are coordinated by four network co-ordination stations (NCS), one for each satellite coverage region - Atlantic Ocean East and West, Indian Ocean and Pacific Ocean.

• The Land-Earth station (LES): A call from a mobile or transportable Inmarsat-A terminal is routed via the Inmarsat satellite system to a land earth station (LES) for connection to the national and international phone and data networks.

Global Maritime Distress and Safety System



Global Maritime Distress and Safety System

Inmarsat-A has antenna, based on stabilized platform, which provides constant satellite monitoring.

How to switch satellites:

- *Define longitude difference between ship and satellite up to 5 deg.*
- *Define ship's latitude up to 5 deg.*
- *Find in which rhumb line (square) vessel in.*
- *Put antenna's azimuth and angle of elevation to Inmarsat terminal.*

Global Maritime Distress and Safety System

Inmarsat-B

Inmarsat B is a digital mobile satellite communication system providing two-way direct-dial voice, telex, fax and data communications at rates up to 9.6kbps, anywhere in the world outside of the Polar Regions.

A distress call from an Inmarsat B terminal is routed via the Inmarsat network to a Land Earth Station (LES) and then to a Maritime Rescue Co-ordination Centre (MRCC).

All Inmarsat maritime systems make use of two-digit safety service codes to facilitate transmission and reception of information. These codes are:

32 – Medical advice
38 – Medical assistance
39 – Maritime assistance
41 – Meteorological report
42 – Navigational hazard and warnings
43 – Ship position report

Global Maritime Distress and Safety System

Inmarsat-C

Inmarsat C is a cornerstone of the GMDSS supporting 5 out of 9 communication functions defined in the *IMO SOLAS Convention, Chapter IV*. It is a packet data communication system providing store and forward messaging including e-mailing, distress alerting and distress priority messaging to associated Rescue Coordination Centers, reception of maritime safety information via the International Safety NET service, data reporting and polling service. It is also very important that Inmarsat C is used to send messages to a short code or two-digit address, e.g. sending meteorological reports, navigational hazards and warnings, request for medical advice and medical assistance, requests for search and rescue assistance and sending ship position reports to shore authorities.

EGC Safety NET provides an efficient and low-cost means of transmitting maritime safety information to vessels at sea and is used by meteorological, hydrographic, search and rescue and coastguard co-ordination authorities. Messages are addressed to ships at sea using IMO defined NAVAREAs/METAREAs, coastal areas or sea areas defined by a circular, e.g. area around vessel in distress or rectangular area.

Global Maritime Distress and Safety System

Mobile Earth Stations

PARAMETER	Inmarsat-A	Inmarsat-B	Inmarsat-C	Inmarsat-M	Aeronautical
Steering	Steerable	Steerable		Steerable AZ only	Electronic
Type	Parabolic	Parabolic	Omni	Linear array	Phased array
EIRP	36 dBW	25-33 dBW	12 dBW min at 5°	22-28 dBW	14 dBW l-g 26 dBW h-g
Receive G/T	-4 dB/K min	-4 dB/K	-23 dB/K at 5°	-12 dB/K	-26 dBK l-g -13 dBK h-g
Telex & Data Rates	50 baud telex	50 baud telex 9.6 kbps	600 bps	2.4 kbps	600, 1200, 2400, 10,500 bps
Telephony	FM	Digital coded	Data only	Digital coded	Digital coded
Voice Coding Rates	12 kHz deviation	16 kbps		4.2 kbps	9.6 kbps
Channel Spacing	50 kHz	20 kHz	5 kHz	10 kHz	5 kHz, 17.5 kHz

Global Maritime Distress and Safety System

DESCRIPTION OF INMARSAT-A

TERMINALS – Product Description:
The maritime terminals typically consist of the above-deck equipment comprising the stabilized antenna (enabling it to stay locked onto the satellite even in heavy sea conditions) and the below-deck equipment comprising the telephone, telex, fax and data interfaces. A number of models also feature a High Speed Data (HSD) option, capable of supporting data rates of up to 64kbit/sec.

Range of Options & Value Added Services:

1. The MES interfaces can be connected to onboard data modems, PABX's that route voice, fax or data calls to / from crew cabins, radio room and bridge.
2. Local Area Network (LAN) facilities can be setup via a server that interfaces to the medium or high-speed data ports of the terminal for sophisticated remote or mobile office operations.
3. Variety of cordless, DECT, encryption and other middleware can be deployed for specific benefits

Global Maritime Distress and Safety System

Connection between station using telephony:

1. *Select telephony mode (pick up handset)*
2. *Select one of the priority:*
   - *0 – normal (default) priority*
   - *1 – safety priority*
   - *2 – urgency*
   - *3 – distress (press EMERGENCY button)*

3. Select CES to establish connection

4. When "ready signal" received dial 2 digits:

***00 –** automatic service*

***13 –** manual connection using operator of CES*

***32 –** medical advice*

5. In case of automatic connection type, select:

- *country code*
- *area code*
- *telephone number*

And press button #

OCEAN REGIONS:

871 – AOR-E
872 – POR
873 – IOR
874 – AOR-W

Global Maritime Distress and Safety System

Connection between station using telex:

1. *Select telex mode*
2. *Select one of the priority:*
   - *0 – normal (default) priority*
   - *1 – safety priority*
   - *2 – urgency*
   - *3 – distress (press EMERGENCY button)*

3. Dial CES identification number (after 10sec CES number start blinking on monitor)

GA+ - ready signal (*go ahead****)***

4. Dial 2 digits of telex code:

00 – *automatic dial*

11 – *call international subscriber with manual switching*

13 - *call national subscriber with manual switching*

33 – *technical assistance*

4. In automatic mode dial: country telex code – number and press ***+ button***

TELEX CODE OF OCEAN REGIONS:

581 – AOR-E

582 – POR

583 – IOR

584 – AOR-W

Global Maritime Distress and Safety System

DESCRIPTION OF INMARSAT-B

Inmarsat – B system is a digital analogue to Inmarsat – A, it has similar services with more services added.

COMPONENTS:

- Antenna
- Main electric block
- Handset with display
- PC
- Printer
- DISTRESS block
- Power supply

Global Maritime Distress and Safety System

INMARSAT – B has 9 digits identification code and consist: **3 MID XXXXX**

Satellite terminal provides:

- *Telephony (Kbit/s)*
- *Fax (9,6 Kbit/s)*
- *Telex*
- *Data transfer (9,6 Kbit/s)*
- *High speed data transfer (64/56 Kbit/s)*

Global Maritime Distress and Safety System

DESCRIPTION OF INMARSAT-C

Inmarsat – C is improved version of Inmarsat – B and it has some advantages and disadvantages comparing to old Inmarsat versions

Disadvantages: - does not support real-time connection with subscriber

- no telephony mode.

Advantages: - less terminal sizes

- no need gyro stabilized antenna

- less cost

- satisfies the GMDSS requirements

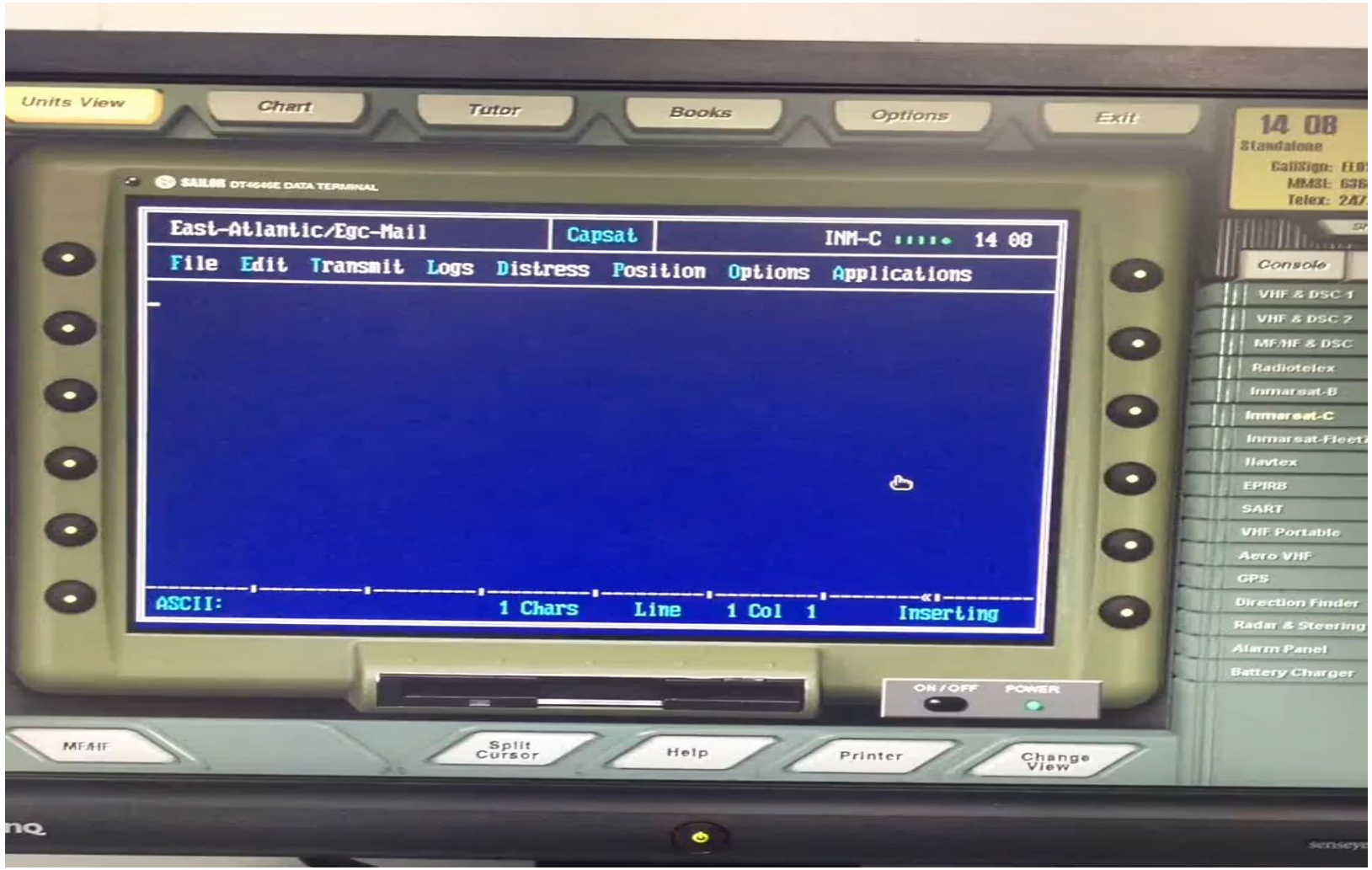
INMARSAT – C has 9 digits identification code and consist: **4 MID XXXXX**

Global Maritime Distress and Safety System

DISTRESS MESSAGE USING INMARSAT – C

- Type message in terminal like normal message using editor
- Set priority as “Distress”
- Select CES at same ocean region (closer to the ship’s position)
- Initiate transfer of the message using “Manufacture’s manual”
- Wait for acknowledge from CES or RCC

Global Maritime Distress and Safety System



Global Maritime Distress and Safety System

Depends on type of Inmarsat – C MES you may receive different types of information from navigation, weather and other safety services

EGC - message broadcast service within the Inmarsat-

It allows terrestrial information providers to pass messages or data to JUE-85 Inmarsat-C MES.
EGC messages are sent to Land Earth Station by shore based Information Providers using terrestrial facilities such as Telex, and are processed at the LES, and forwarded to an NCS then are broadcasted to the INMARSA-C MES via NCS common channel transmitted by NCS.
There are three basic services offered by EGC; the Safety NET service, the Fleet NET service and System service. Safety NET is a service provided primarily for the dissemination of maritime safety
information, such as shore to ship distress alerts, weather forecasts and coastal navigational warning.

Global Maritime Distress and Safety System

Fleet NET is a commercial communication service allowing terrestrial information providers to send messages to pre-defined groups of subscribers. System service is a service provided for operational information.

Both the **Safety NET and Fleet NET** services make use of flexible addressing techniques to allow the reception of messages from a variety of service providers depending on the particular requirements of the user. The Safety NET service utilizes a geographic area addressing technique to direct messages to ships within defined boundary. The Fleet NET service employs closed user group and unique receiver addressing to provide secure transmission of messages from the terrestrial information provider
to the desired service recipients(s).

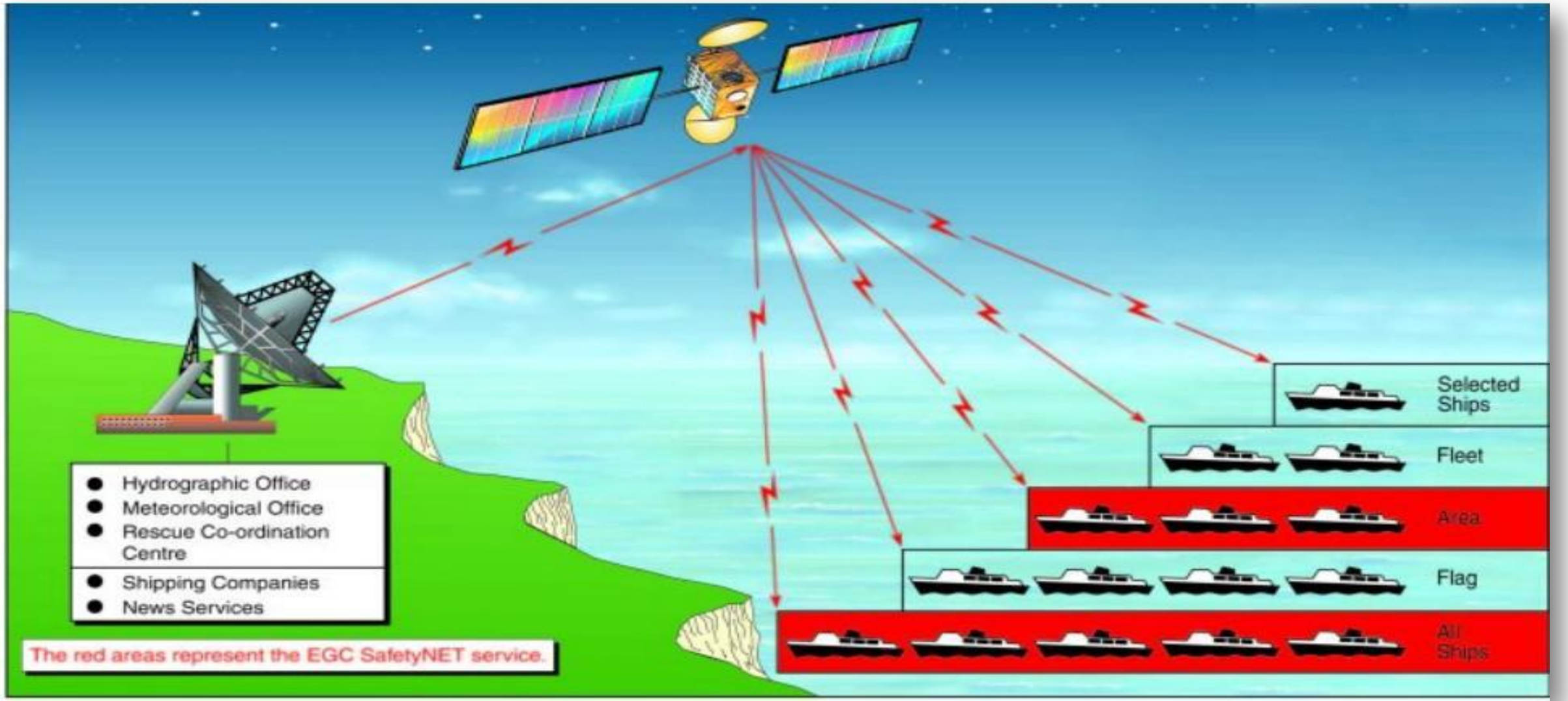
Global Maritime Distress and Safety System

INMARSAT EGC (ENHANCED GROUP CALLING)

The Inmarsat C satellite communications system has a capability known as Enhanced Group Call (EGC), which enables MSI providers to send messages for selective reception
by EGC receivers located anywhere in the four Ocean Regions

The EGC Safety NET service, which allows the ship's operator to program EGC receiver with main (on some models) and/or additional NAVAREAs/METAREAs, geographical areas or coastal warning areas for which MSI will be received and the categories of coastal warnings required

Global Maritime Distress and Safety System



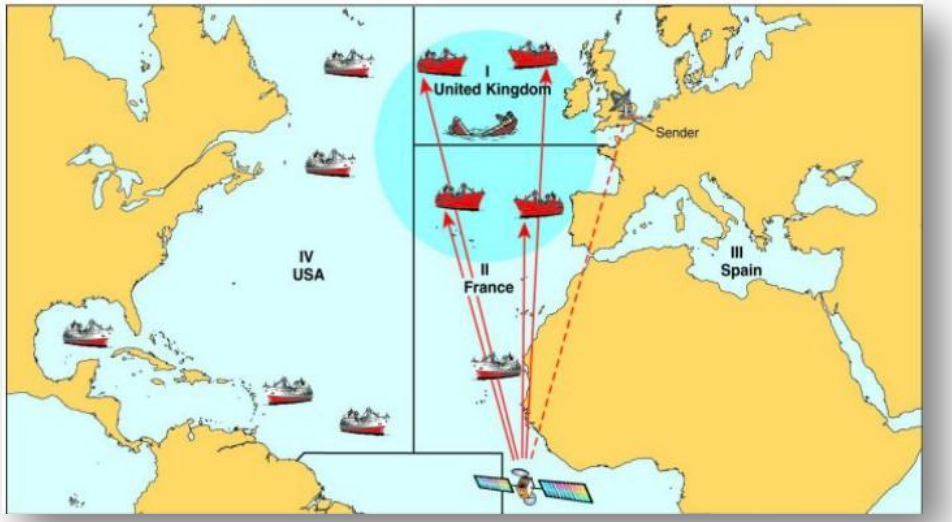
Global Maritime Distress and Safety System

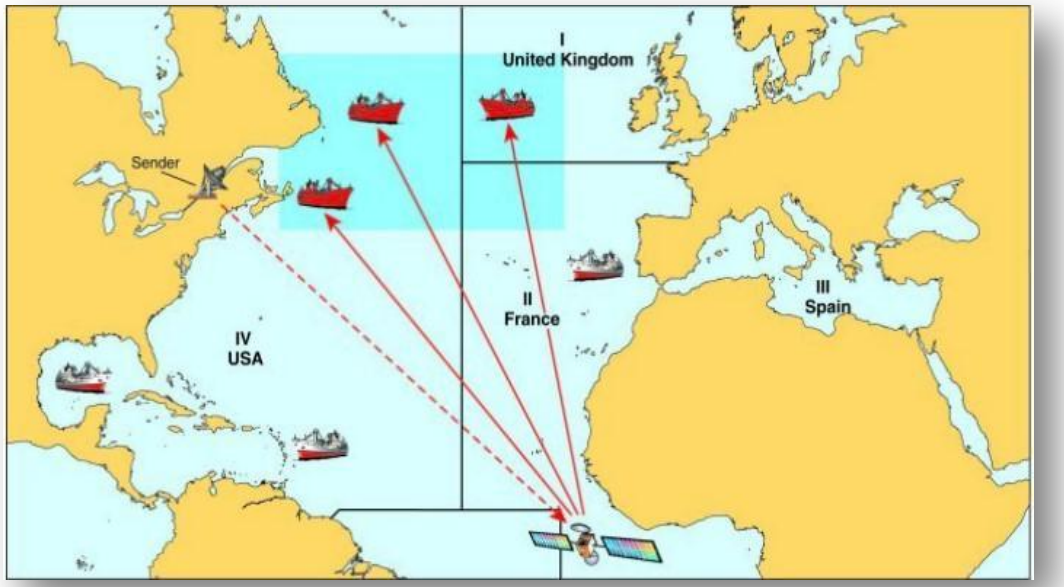
The coordinator checks the message with any other information received, and edits it accordingly, then submits the finalized text to a selected Inmarsat C LES. Included with the message are the following codes (known as the "C" codes), to instruct the LES and MES on how to process the message automatically:

- C0 - Ocean Area Code, to identify which Inmarsat satellite MSI is addressed to (generally the code is used by LESs supporting service in two or three ocean regions);
- C1 - Priority Code, to identify the message priority – Distress - P3, Urgency – P2 and Safety – P1;
- C2 - Service Code, to identify the message type, for example a shore-to-ship distress alert, or meteorological forecast;
- C3 - Address Code, to identify the geographical area for which the MSI is applicable – this may be a fixed geographical area, such as one of the 21 NAVAREAs/METAREAs shown in Figure 2, a temporary area determined by the MSI provider, such as a circular or rectangular area, as shown in Figure 5 and Figure 6 or coastal warning area;

Global Maritime Distress and Safety System

- C4 - Repetition Code, to indicate the number of times the message should be broadcast unless cancelled;
- C5 - Presentation Code, to indicate the character set in which the message will be transmitted. The character set used is always International Alphabet Number 5, which is also known as 7-bit ASCII.





Global Maritime Distress and Safety System

LES 102 - MSG 7698 - MetWarn/Fore Safety Call to Area: 1 - NoPos

STRATOS CSAT 81.148.5.74 1-OCT-2012 05:44:00 606085
NAVAREA ONE 044
ENGLAND, EAST COAST
Thames Estuary.
Chart BA 1975.
Black Deep light-buoy moved to 51-47.79N 001-36.31E.
NNNN

LES 112 - MSG 9644 - MetWarn/Fore Safety Call to Area: 3 - PosOK

NL BURUM LES 204999123456789 28-SEP-2012 12:21:01 618223
NAVAREA III 068/12
EASTERN MEDITERRANEAN SEA
Offshore rig "OCEAN ENDEAVOR" moved from 32-05.1N 030-36.5E to 32-04.1N 030-29.4E.

LES 112 - MSG 11400 - MetWarn/Fore Urgent Call to Area: 5 - PosOK

NL BURUM LES 28-SEP-2012 15:36:29 831346
WARNING NR 074/2011
ROUGH SEA WARNING
ISSUED AT 1500 GMT - MON - 28/SEP/2012
SOUTH OCEANIC AREA S OF 30S AND E OF 035W STARTING AT 010000 GMT.
WAVES FM NE/NW BECOMING SW/SE 3.0/4.0 METERS.
VALID UNTIL 020600 GMT.

Global Maritime Distress and Safety System

INMARSAT - M

Inmarsat M provides receiving/transferring information in real-time using communication network X.25, X.400, Internet, E-mail.

Satellite terminal modes:

- Telephone (4,8kBit/s)
- Fax (2,4 Kbit/s)
- Data transfer (2,4 Kbit/s)

Global Maritime Distress and Safety System

General working arrangement scheme
Inmarsat – C and M

Global Maritime Distress and Safety System

THE PURPOSE AND USAGE OF WATCHKEEPING RECEIVERS

The radio frequency ***2182 kHz*** is one of the international calling and distress frequency for maritime radio communication on a frequency band allocated to the MOBILE SERVICE on primary basis, exclusively for distress and calling operations.
2182 kHz is analogous to channel ***16 on the marine VHF band***, but unlike VHF which is limited to ranges of about 20 to 50 nautical miles (40 to 90 km) depending on antenna height,[2] communications on 2182 kHz and nearby frequencies have a reliable range of around 50 to 150 nautical miles (90 to 280 km) during the day and 150 to 300 nautical miles (280 to 560 km) or sometimes more at night. The reception range of even a well-equipped station can be severely limited in summer because of static caused by lightning.

Global Maritime Distress and Safety System

The ITU has allocated a DSC distress and safety channel in the MF, each of the HF and the VHF marine radio bands.
These are:
MF/HF DSC
DISTRESS AND SAFETY CHANNELS
2187.5 4207.5 6312.0 8414.5 12577.0 16804.5 (kHz)
VHF DSC
DISTRESS AND SAFETY CHANNEL
VHF marine channel 70
Note that voice transmissions are PROHIBITED on the DSC channels.
The MF/HF channels are restricted to distress, urgency and safety traffic only because of the relatively low speeds of transmission of 100 baud. If too many calls were permitted on the MF/HF channels, the channels would quickly become overloaded to the point where a distress call may be blocked.
VHF DSC operates at 12 times the speed of MF/HF - accordingly, all priorities of call are allowed on the VHF channels.

Global Maritime Distress and Safety System

3.4.2 THE USAGE AND FUNCTIONS OF THE VHF RADIO STATIONS

Marine **VHF** radio refers to the radio frequency range between ***156.0 and 162.025 MHz***, inclusive. In the official language of the International Telecommunication Union the band is called the VHF maritime mobile band.

Global Maritime Distress and Safety System

Marine radio equipment is installed on all large ships and most seagoing small craft. It is also used, with slightly different regulation, on rivers and lakes. It is used for a wide variety of purposes, including summoning rescue services and communicating with harbors, locks, bridges and marinas, and operates in the very high frequency (VHF) range, ***between 156 and 162.025 MHz*** Although it is widely used for collision avoidance, its use for that purpose is contentious and is strongly discouraged by some countries, including the UK

Global Maritime Distress and Safety System

Simplex channels here are listed with the A and B frequencies the same. The frequencies, channels, and some of their purposes are governed by the ITU. For an authoritative. The original allocation of channels consisted of only channels 1 to 28 with 50 kHz spacing between channels, and the second frequency for duplex operation 4.6 MHz higher. Improvements in radio technology later meant that the channel spacing could be reduced to 25 kHz with channels 60 to 88 interspersed between the original channels. Channels 75 and 76 are omitted as they are either side of the calling and distress channel 16, acting as guard channels. The frequencies which would have been the second frequencies for simplex channels are not used for marine purposes and can be used for other purposes that vary by country. For example 161.000 to 161.450 MHz are part of the allocation to the Association of American Railroads channels used by railways in the USA and Canada.

Global Maritime Distress and Safety System

THE USAGE AND FUNCTIONS OF THE HF/MF RADIO STATIONS

MF/HF RT radio is often known as SSB radio. It is a transmitting-receiving system often referred to as a Transceiver (TX/RX), which allows the operator to either transmit or receive information by voice. MF/HF radios use SSB modulation for voice communication.

Global Maritime Distress and Safety System

THE USAGE AND FUNCTIONS OF THE HF/MF RADIO STATIONS

MF/HF RT radio is often known as SSB radio. It is a transmitting-receiving system often referred to as a Transceiver (TX/RX), which allows the operator to either transmit or receive information by voice. MF/HF radios use SSB modulation for voice communication.

Global Maritime Distress and Safety System

One of the greater disadvantages of an MF/HF RT radio is that it is not able to "address" a particular radio. A voice broadcasted over MF/HF RT radio can be heard by all other MF/HF radios within range.

Because of that, MF/HF radios integrate an MF/HF DSC Controller. Its function can be regarded as a cross between a normal telephone and a radio. The DSC functions via the DSC Controller or Modem, which simply sends a burst of digital code on the MF/HF DSC frequencies, will automatically “ring” another MF/HF radio. This is feasible because each MF/HF DSC Controller has been allocated a unique MMSI number that acts like a telephone number.

Global Maritime Distress and Safety System

SURVIVAL CRAFT RADIO EQUIPMENT

Search And Rescue (Radar) Transponders (SARTs)

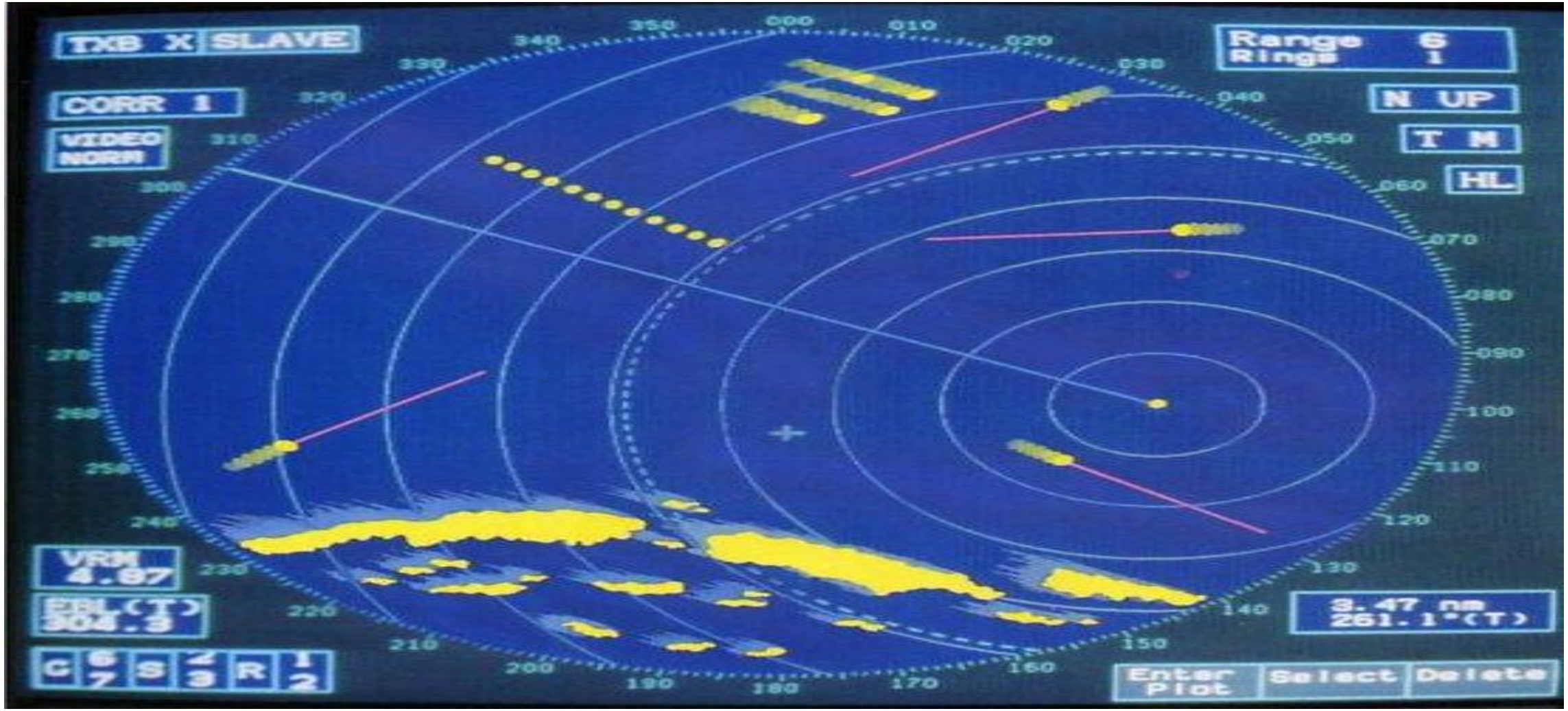
SART is a self contained, portable and buoyant Radar Transponder (receiver and transmitter).

SARTs operate in the 9 GHz marine radar band, and when interrogated by a searching ship's radar, respond with a signal which is displayed as a series of dots on a radar screen.

Although SARTs are primarily designed to be used in lifeboats or life rafts, they can be deployed on board a ship, or even in the water.

SARTs are powered by integral batteries which are designed to provide up to 96 hours of operation.

Global Maritime Distress and Safety System



Global Maritime Distress and Safety System

Portable VHF transceivers

These units are designed to allow communications between searching vessels and survivors in life rafts. They operate on the VHF marine band in voice mode. DSC capability is not fitted. Performance standards

The IMO performance standard requires that the equipment:

- provide operation on VHF channel 16 (the radiotelephone distress and calling channel) and one other channel
- be capable of operation by unskilled personnel
- be capable of operation by personnel wearing gloves
- be capable of single handed operation, except for channel changing
- withstand drops on to a hard surface from a height of 1 meter
- be watertight to a depth of 1 meter for at least 5 minutes, and maintain water tightness when subjected to a thermal shock of 45 degrees Celsius.

Global Maritime Distress and Safety System

- not be unduly effected by seawater or oil
- have no sharp projections which could damage survival craft
- be of small size and weight
- be capable of operating in the ambient noise level likely to be encountered on board survival craft
- have provisions for attachment to the clothing of the user
- be either a highly visible yellow/orange color or marked with a surrounding yellow/orange marking strip
- be resistant to deterioration by prolonged exposure to sunlight

Special note: FOR PASSENGER VESSELS YOU REQUIRE RADIO TELEPHONY ON THE AIRBAND FREQUENCIES 121.5 MHZ AM AND A SECOND EPIRB IN THE BRIDGE

Global Maritime Distress and Safety System

EPIRB are tracking transmitters which aid in the detection and location of boats, aircraft, and people in distress. A PLB (Personal Locator Beacon) is particular type of EPIRB that is typically smaller, has a shorter battery life and unlike a proper EPIRB is registered to a person rather than a vessel. The terminology ELB (Emergency Locator Beacon) is used interchangeably with EPIRB only when used on aircraft. Strictly, they are radio beacons that interface with worldwide offered service of Cospas-Sarsat, the international satellite system for search and rescue (SAR). When manually activated, or automatically activated upon immersion or impact, such beacons send out a distress signal. The signals are monitored worldwide and the location of the distress is detected by non-geostationary satellites Doppler trilateration and in more recent EPIRBs also by GPS

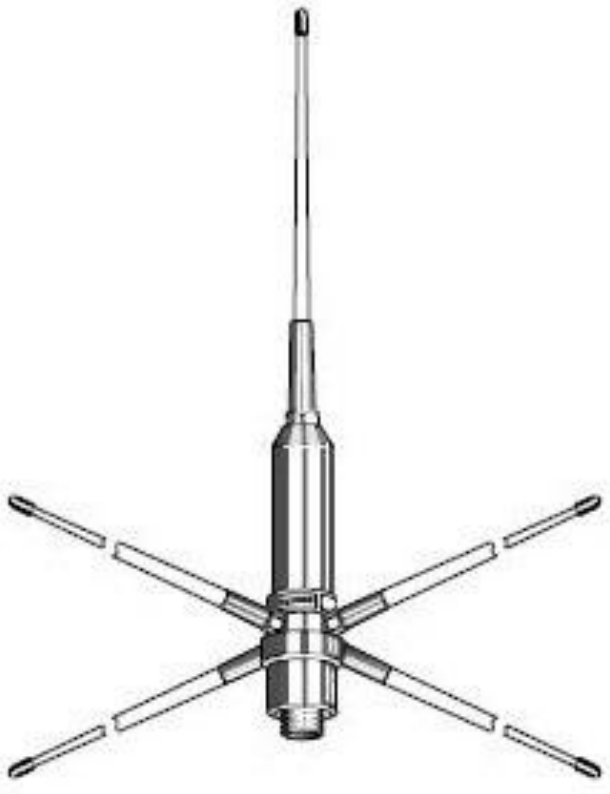
Global Maritime Distress and Safety System

BASIC ANTENNA SYSTEMS

VHF ANTENNAS

As the wavelength in the maritime VHF band (154-162 MHz) is around 2 meters, it is possible to use 1 and 1 wavelength antennas. The most basic design is the dipole, which consists of a split 1-wavelength element connected at the center to a balanced feeder cable. Figure below shows some simple examples of VHF antennas, including the artificial ground-plane antenna and the VHF rod antenna - typically a 1.5 m fiberglass pole contains a dipole antenna. As noted in section 3, it is important that VHF antennas are mounted as high as possible and in a position free from obstruction by the ship's superstructure

Global Maritime Distress and Safety System



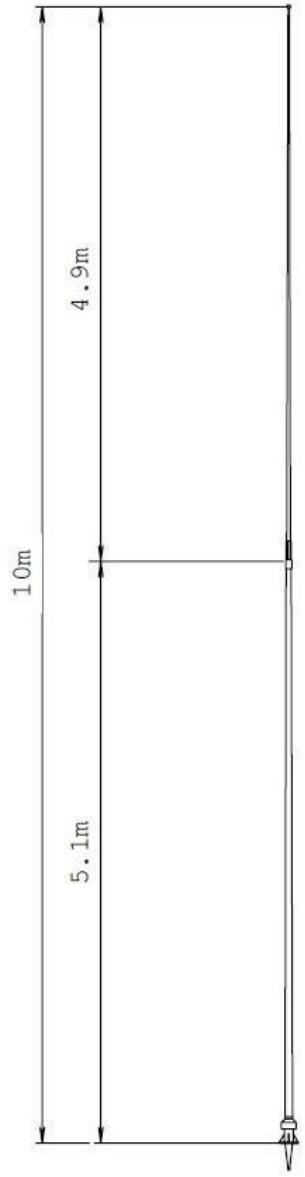
VHF antenna with artificial ground plane

CX 3 - typical VHF rod antenna

Global Maritime Distress and Safety System

MF/HF ANTENNAS

In the MF/HF bands, however, wavelengths vary from 180 meters (1650 kHz) to about 12 meters (25 MHz). Resonant 1- or 1-wavelength antennas covering this entire frequency range are therefore not possible. The problem can be eased by using a number of separate antennas, each covering a single band or several harmonically-related bands.
An antenna tuning unit (ATU) is usually used to "match" the transmitter output to the antenna over a wide range of frequencies. In effect, the ATU uses electrical components, i.e. coils (inductors) and capacitors, to achieve a resonant electrical length in combination with the actual physical length of the antenna. Nevertheless, it must be noted that the efficiency will vary over the frequency range used because the radiating efficiency is still determined by the physical length of the antenna.



Global Maritime Distress and Safety System

The Inmarsat C system uses an omnidirectional antenna. As this antenna transmits and receives in all directions, there is no need to point it in the direction of the satellite. This antenna system is quite simple, isn't heavy and is easy to mount. This makes it much cheaper compared to the complex antenna righting system of the Inmarsat B and F77 terminals. The signal strength of this Inmarsat C system is weaker than the other mentioned systems. Because of this 'weak signal strength', you cannot work 'on line' with the Inmarsat C system. This system will always work 'store and forward' - this will be explained later in this chapter. Inmarsat C can be used e.g. for sending faxes, sending/receiving e-mails and TELEX, but not for making phone calls. The cost of sending a message will be calculated based on the total number of bytes that have been transferred

Global Maritime Distress and Safety System

BATTERIES STORAGE SYSTEM

The SOLAS convention requirements

A reserve source(s) of energy to supply radio installations must be provided on every SOLAS vessel for the purposes of conducting distress and safety radio communications in the event of failure of the vessel's main emergency sources of power. The reserve source of energy must be capable of simultaneously operating the VHF radio installations, and either the MF/HF radio installation or the INMARSAT ship's earth station (as appropriate for ship's sea area operation).

The capacity of the reserve source of energy should be sufficient to operate the particular installation with the highest power consumption for the appropriate period specified:

Ships with emergency generators: 1 Hour

Ships without emergency generators: 6 Hours

The batteries must be recharged to required minimums within a 10-hour period. The capacity of batteries must be checked, using an appropriate method, at intervals not to exceed 12 months.

Global Maritime Distress and Safety System

Lead/acid batteries

This is the most common type of large rechargeable battery. This is the same as the ubiquitous car battery. Each battery is made from a number of individual cells, each having a nominal voltage of 2 V. Most batteries are made from 3 or 6 cells giving a battery voltage of 6 or 12 V. These batteries are then grouped together to make a bank of the required voltage and capacity. Most vessels use 12 or 24 V for their battery bank.
Lead/acid cells consist of a series of lead plates immersed in a liquid called the electrolyte. The electrolyte in these batteries is sulphuric acid.
Lead/acid batteries are popular because they are cheap and can supply high current when needed, for example for starting an engine.
Lead/acid batteries may be found in two versions: *unsealed and sealed*.
Unsealed lead/acid batteries offer the access to each of their cells through batteries caps that enables accurately determining the state of charge of each cell.

Global Maritime Distress and Safety System

Gel batteries

These are the modern version of the lead/acid battery. As the name suggests, the electrolyte is in the form of a gel rather than a liquid. This has the great advantage that the electrolyte cannot be spilled. Another advantage is that they do not give off hydrogen when being charged, so the possibility of an explosion is reduced and water does not need to be added. Gel batteries can tolerate being completely discharged which lead/acid batteries cannot, and they can usually accept a charge at a higher rate than a lead/acid battery without suffering any harm. Against all these benefits there are a couple of negatives. The first is the cost. They are at least twice the price of the equivalent lead/acid battery but generally they have a longer service life.

Global Maritime Distress and Safety System

Nickel cadmium / Nickel metal hydride batteries

NiCad batteries face the same environmental problems of disposal, as the mercury batteries. It is the cadmium which poses the problem, and they are being largely replaced by nickel metal hydride batteries. These have similar properties, but are much safer to dispose off. Both of the nickel batteries perform best if they are almost fully discharged and then fully recharged. If they are just partially discharged and then recharged on a regular basis they can lose some of their capacity. Any of the nickel batteries will benefit from a periodic discharge to about 1 V per cell. They should not be allowed to go below this voltage because if the battery is flattened completely, some of the cells may suffer a reversal of polarity which effectively ends the useful life of the battery.

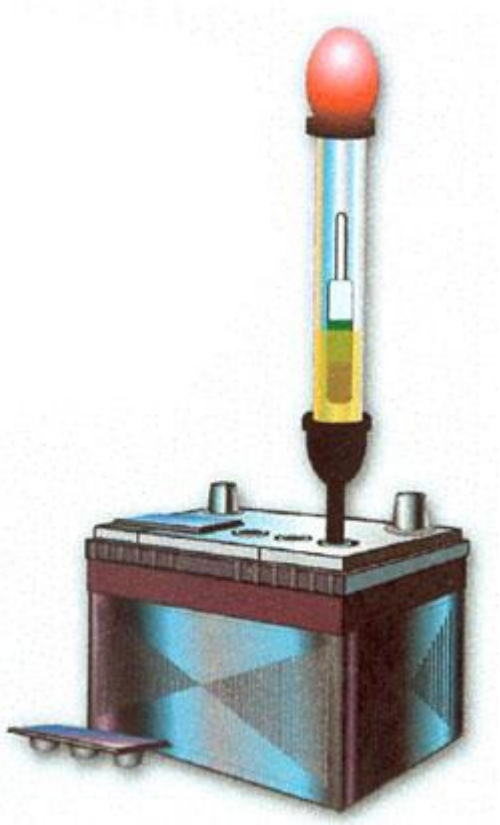
Lithium ion batteries

These are state-of-the-art rechargeable batteries. They offer at least twice the capacity of nickel metal hydride batteries and have little tendency to form a memory. The snag is that they are about three times the price of nickel metal hydride batteries. They are found in applications where a lot of power is needed but where weight or bulk must be kept to a minimum.

Global Maritime Distress and Safety System

Monitoring and maintenance

This can be done by measuring the specific gravity of the electrolyte with a hydrometer, because the more charge that there is in the battery, the denser the electrolyte becomes.



Global Maritime Distress and Safety System

A hydrometer consists of a glass tube containing a float. At one end of the tube there is a rubber bulb which is used to draw a sample of the electrolyte into the tube. The float inside the tube indicates the specific gravity of the electrolyte according to how deeply or otherwise it floats in the liquid. The less dense the liquid, the deeper immersed is the float. The readings for the specific gravity of the electrolyte can be read directly off the stem of the float. The electrolyte of a fully charged lead/acid battery will have a specific gravity of about **1.27**, and a fully discharged cell will give a reading about **1.16**, depending on the temperature of the electrolyte. Usually, the float is also color coded to help the user determine the state of charge of the cell.

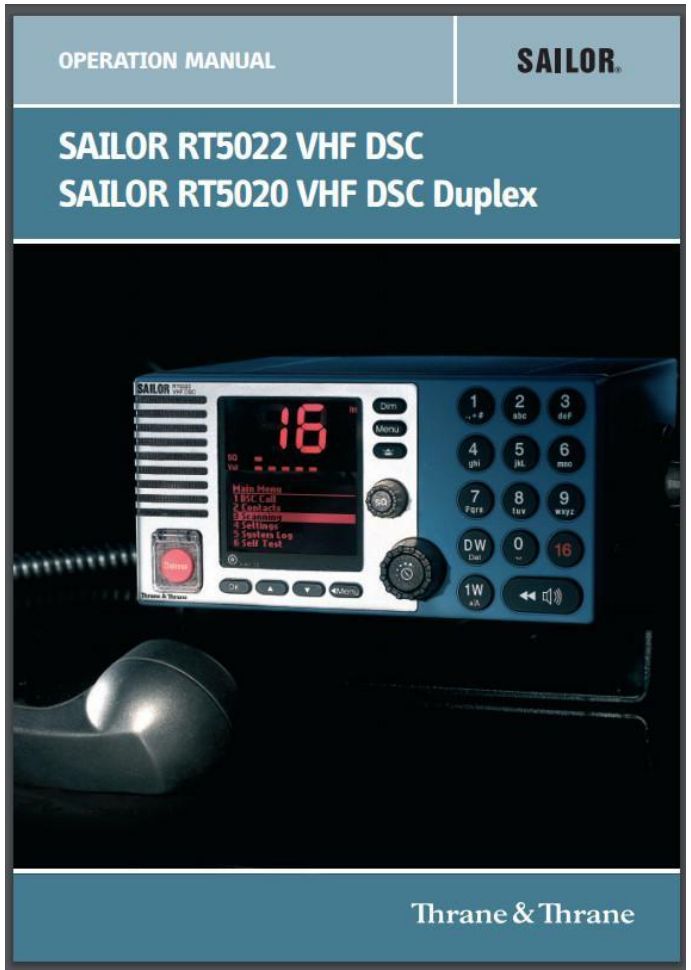
Global Maritime Distress and Safety System

FAULT LOCATION AND RECTIFICATION ON GMDSS EQUIPMENT

Daily/weekly/monthly function tests should be carried out regularly of all GMDSS equipment according to manufacture's instruction.

Internal display and sound test, various indicator's test and proper functional tests to determine faults.

All manufacture's operational manual have section which describes errors which could indicate specific faults and troubleshooting methods



Global Maritime Distress and Safety System

OTHER GMDSS EQUIPMENT

EMERGENCY POSITIONING-INDICATING RADIO BEACONS (EPIRBS)

Emergency position-indicating radio beacon station (short: **EPIRS**) is – according to Article 1.93 of the International Telecommunication Union's (ITU) Radio Regulations (RR)[1] – defined as «A station in the mobile service the emissions of which are intended to facilitate search and rescue operations.» In marine use the terminology Emergency Position Indicating Radio Beacon (EPIRB) is used.

EPIRB is used to alert search and rescue services in the event of an emergency. It does this by transmitting a coded message on the **406 MHz** distress frequency via satellite and earth stations to the nearest rescue co-ordination centre. Some EPIRBs also have built-in GPS which enables the rescue services to accurately locate you to +/- 50 meters.

Global Maritime Distress and Safety System

SEARCH AND RESCUE RADAR TRANSPONDER (SART)

A **search and rescue transponder (SART)** is a self-contained, waterproof transponder intended for emergency use at sea. These devices may be either a **radar-SART**, or a GPS-based **AIS-SART** (automatic identification system SART).

The radar-SART is used to locate a survival craft or distressed vessel by creating a series of dots on a rescuing ship's radar display. A SART will only respond to a **9Hz X-band (3 cm wavelength)** radar. It will not be seen on S-band (10 cm) or other radar. The radar-SART may be triggered by any X-band radar within a range of approximately 8 nautical miles (15 kilometers). Each radar pulse received causes the SART to transmit a response which is swept repetitively across the complete radar frequency band. Shipboard Global Maritime Distress Safety System (GMDSS) include one or more search and rescue locating devices.

Global Maritime Distress and Safety System

RECEPTION OF MARITIME SAFETY INFORMATION (MSI)

The Maritime Safety Information (MSI) service is an internationally coordinated network of broadcasts of Maritime Safety Information. This information contains:

- Navigational warnings;
- Meteorological information (forecasts and warnings);
- Distress alerts.

MSI is part of the Global Maritime Distress and Safety System (GMDSS). Every ship, while at sea, has to be capable of transmitting and receiving maritime safety information. Reception of MSI is free of charge to all ships.

MSI is transmitted by a variety of means, using terrestrial and satellite radio communications. The GMDSS supports two independent systems to broadcast Maritime Safety Information (MSI):

NAVTEX, MF terrestrial radio to cover many coastal areas.

Safety NET, using the **Inmarsat-C Enhanced Group Call (EGC)**, covering the entire Inmarsat ocean regions including costal areas. All navigational warnings and meteorological forecasts are scheduled broadcasts with a safety priority, which does not produce an alarm at the receiver. Meteorological warnings and shore-to-ship distress alerts are unscheduled broadcasts with urgency or distress (broadcast on receipt), which does produce an alarm at the receiver.

Global Maritime Distress and Safety System

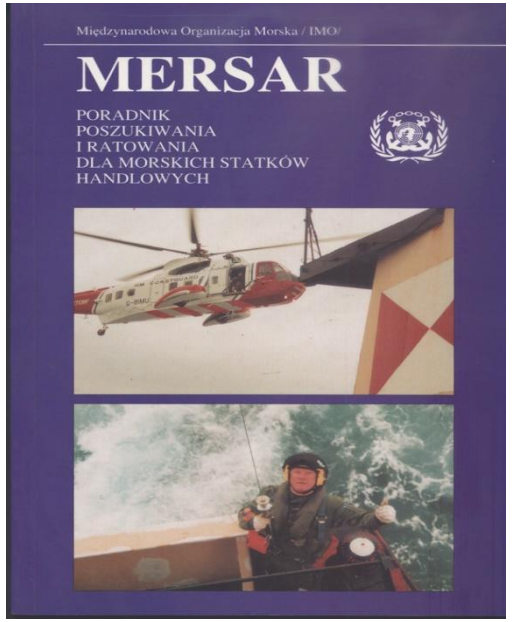
SAR OPERATIONS
ROLE OF RCC

A ***rescue coordination center or RCC*** is a primary search and rescue facility in a country that is staffed by supervisory personnel and equipped for coordinating and controlling search and rescue operations.
RCC's are responsible for a geographic area, known as a *"search and rescue region of responsibility" (SRR)*. SRR's are designated by the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO). RCC's are operated unilaterally by personnel of a single military service (e.g. an Air Force, or a Navy) or a single civilian service (e.g. a national Police force, or a Coast Guard)
A **Joint Rescue Coordination Centre** or **JRCC** is a special type of RCC that is operated by personnel from multiple military services, civilian services, or a combination of military and/or civilian services.
A **Maritime Rescue Sub-Centre** or **MRSC** is a special type of RCC dedicated exclusively to organizing search and rescue in a maritime environment. A MRSC usually is subservient to a RCC and is used to take the workload for a particular geographic area within the SRR.

Global Maritime Distress and Safety System

MERSAR

In 1969 IMO considered search and rescue matters, and as a first step prepared the Merchant Ship Search and Rescue Manual (MERSAR). This manual was adopted by the seventh IMO Assembly in 1971. The purpose of this Manual is to provide guidance to those who, during emergencies at sea, may require assistance or may be able to render assistance. In particular, it was designed to help the master of any ship who might be called upon to participate in search and rescue operations.



This Manual was revised and replaced by the
IAMSAR Manual

Global Maritime Distress and Safety System

The ***IAMSAR*** manual is divided into three volumes:

Volume I, Organization and Management, discusses the global SAR system concept, establishment and improvement of national and regional SAR systems and co-operation with neighboring States to provide effective and economical SAR services.

Volume II, Mission Co-ordination, assists personnel who plan and co- ordinate SAR operations and exercises.

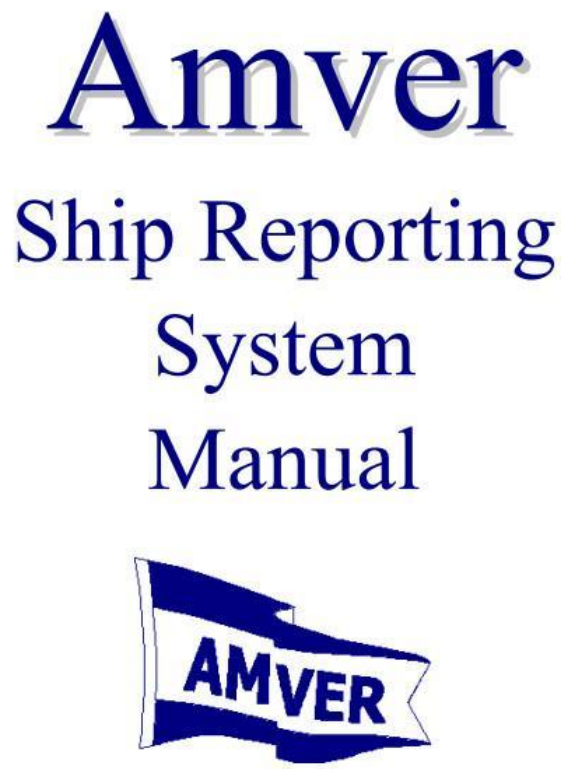
Volume III, Mobile Facilities, is intended to be carried aboard rescue units, aircraft and vessels to help with performance of a search, rescue or on-scene coordinator function, and with aspects of SAR that pertain to their own emergencies.

Global Maritime Distress and Safety System

ROLE AND METHODS OF USE OF SHIP'S REPORTING SYSTEM

Amver is a worldwide voluntary ship reporting system operated by the United States Coast Guard (USCG) to promote safety of life and property at sea. Amver's mission is to quickly provide SAR authorities, on demand, accurate information on the positions and characteristics of vessels near a reported distress. Any merchant vessel anywhere on the globe, on a voyage of greater than 24 hours duration, is welcome in the Amver system and family.

JASREP, AUSREP, and CHILREP: Presently, Amver and the Japanese, Australian, and Chilean Regional Reporting Systems (JASREP, AUSREP, and CHILREP) cooperate with each other by accepting and complying with relay requests



Global Maritime Distress and Safety System

DISTRESS, URGENCY AND SAFETY COMMUNICATION SYSTEM

DISTRESS ALERT DISTRESS COMMUNICATIONS

A distress alert should be transmitted if, in the opinion of the Master, the ship or a person is in distress and requires immediate assistance.

A DSC distress alert should as far as possible include the ship's last known position and the time (in UTC) when it was valid. The position and the time may be included automatically by the ship's navigational equipment or may be inserted manually.

Global Maritime Distress and Safety System

The DSC distress alert is transmitted as follows:

-tune the transmitter to the DSC distress channel (2187.5 kHz on MF, channel 70 on VHF)
-if time permits, key in or select on the DSC equipment keyboard
the nature of distress,
-the ship's last known position (latitude and longitude),
-the time (in UTC) the position was valid,
-type of subsequent distress communication (telephony),
-in accordance with the DSC equipment manufacturer's instructions;

-transmit the DSC distress alert
-prepare for the subsequent distress traffic by tuning the transmitter and the radiotelephony receiver to the distress traffic channel in the same band, i.e. *2182 kHz on MF, channel 16 on VHF,* while waiting for the DSC distress acknowledgement.

Global Maritime Distress and Safety System

Actions on receipt of a distress alert

Ships receiving a DSC distress alert from another ship should normally not acknowledge the alert by DSC since acknowledgement of a DSC distress alert by use of DSC is normally made by coast stations only.

Only if no other station seems to have received the DSC distress alert, and the transmission of the DSC distress alert continues, the ship should acknowledge the DSC distress alert by use of DSC to terminate the call. The ship should then, in addition, inform a coast station or a coast earth station by any practicable means.

Global Maritime Distress and Safety System

Ships receiving a DSC distress alert from another ship shall:

watch for the reception of a distress acknowledgement on the distress channel (2187.5 kHz on MF and channel 70 on VHF);
prepare for receiving the subsequent distress communication by tuning the radiotelephony receiver to the distress traffic frequency in the same band in which the DSC distress alert was received, i.e. 2182 kHz on MF, channel 16 on VHF;
acknowledge the receipt of the distress alert by transmitting the following by radiotelephony on the distress traffic frequency in the same band in which the DSC distress alert was received, i.e. 2182 kHz on MF, channel 16 on VHF:

"MAYDAY",
the 9-digit identity of the ship in distress, repeated 3 times,
"this is",
the 9-digit identity or the call sign or other identification of own ship, repeated 3 times,

"RECEIVED MAYDAY".

Global Maritime Distress and Safety System

Ships receiving a DSC distress alert from another ship shall:

watch for the reception of a distress acknowledgement on the distress channel (2187.5 kHz on MF and channel 70 on VHF);
prepare for receiving the subsequent distress communication by tuning the radiotelephony receiver to the distress traffic frequency in the same band in which the DSC distress alert was received, i.e. 2182 kHz on MF, channel 16 on VHF;
acknowledge the receipt of the distress alert by transmitting the following by radiotelephony on the distress traffic frequency in the same band in which the DSC distress alert was received, i.e. 2182 kHz on MF, channel 16 on VHF:

"MAYDAY",
the 9-digit identity of the ship in distress, repeated 3 times,
"this is",
the 9-digit identity or the call sign or other identification of own ship, repeated 3 times,

"RECEIVED MAYDAY".

Global Maritime Distress and Safety System

Transmission of a DSC distress relay alert

A ship knowing that another ship is in distress shall transmit a DSC distress relay alert if the ship in distress is not itself able to transmit the distress alert,
the Master of the ship considers that further help is necessary.
The DSC distress relay alert is transmitted as follows:
-tune the transmitter to the DSC distress channel (2187.5 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 or the 9-digit identity of the appropriate coast station,
the nature of distress,
the latest position of the ship in distress, if known,
the time (in UTC) the position was valid, if known,
type of subsequent distress communication (telephony);
transmit the DSC distress relay call,
prepare for the subsequent distress traffic by tuning the transmitter and the radiotelephony receiver to the distress traffic channel in the same band, i.e. 2182 kHz on MF and channel16 on VHF, while waiting for the DSC distress acknowledgement.

Global Maritime Distress and Safety System

Acknowledgement of a DSC distress relay alert received from a coast station

Coast stations, after having received and acknowledged a DSC distress alert, may if necessary, retransmit the information received as a DSC distress relay call, addressed to all ships, all ships in a specific geographical area, a group of ships or a specific ship.

Ships receiving a distress relay call transmitted by a coast station shall not use DSC to acknowledge the call, but 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. 2182 kHz on MF, channel 16 on VHF.

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 relay alert was received:

"MAYDAY",
the 9-digit identity or the call sign or other identification of the calling coast station,
"this is",
the 9-digit identity or call sign or other identification of own ship,
"RECEIVED MAYDAY".

Global Maritime Distress and Safety System

A station transmitting an inadvertent distress alert shall cancel the distress alert using the following procedure:

Immediately transmit a DSC "distress acknowledgement" in accordance with Recommendation ITU-R M.493, 8.3.1 e.g. with own ship's MMSI inserted as identification of ship in distress. (NOTE: This feature is not yet generally available on DSC-equipped radios)
Cancel the distress alert aurally over the telephony distress traffic channel associated with each DSC channel on which the "distress call" was transmitted.
Monitor the telephony distress traffic channel associated with the DSC channel on which the distress was transmitted, and respond to any communications concerning that distress alert as appropriate.

Global Maritime Distress and Safety System

URGENCY AND SAFETY COMMUNICATIONS

Transmission of urgency messages

Transmission of urgency messages shall be carried out in two steps:

-announcement of the urgency message,

-transmission of the urgency message.

-The announcement is carried out by transmission of a DSC urgency call on the DSC distress calling channel (2187.5 kHz on MF, channel 70 on VHF).

The urgency message is transmitted on the distress traffic channel (2182 kHz on MF, channel 16 on VHF).

The DSC urgency call 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 call.

Global Maritime Distress and Safety System

1. tune the transmitter to the DSC distress calling channel (2187.5 kHz on MF, channel 70 on VHF);
2. key in or select on the DSC equipment keyboard:
   - All Ships Call or the 9-digit identity of the specific station,
   - the category of the call (urgency),
   - the frequency or channel on which the urgency message will be transmitted,
   - the type of communication in which the urgency message will be given (e.g. radiotelephony), in accordance with the DSC equipment manufacturer's instructions;
3. transmit the DSC urgency call.

"PAN PAN", repeated 3 times,
"ALL STATIONS" or called station, repeated 3 times,
"this is",
the 9-digit identity and the call sign or other identification of own ship,
the text of the urgency message

Global Maritime Distress and Safety System

Transmission of the safety message:

-tune the transmitter to the frequency or channel indicated in the DSC safety call;
-transmit the safety message as follows:

"SECURITE", repeated 3 times,
"ALL STATIONS" or called station, repeated 3 times,
"this is",
the 9-digit identity and the call sign or other identification of own ship,
the text of the safety message.

Global Maritime Distress and Safety System

Testing the equipment used for distress and safety

Testing on the exclusive DSC distress and safety calling frequency 2187.5 kHz should be avoided as far as possible by using other methods.
No test transmission should be made on VHF DSC calling channel 70.
Test calls should be transmitted by the ship station and acknowledged by the called coast station. Normally there would be no further communication between the two stations involved.
A test call to a coast station is transmitted as follows:

- tune the transmitter to the DSC distress and safety calling frequency 2187.5 kHz,
- key in or select the format for the test call on the DSC equipment in accordance with the DSC equipment manufacturer's instructions,
- key in the 9-digit identity of the coast station to be called,
- transmit the DSC call after checking as far as possible that no calls are in progress on the frequency,
- wait for acknowledgement.

Global Maritime Distress and Safety System

DESCRIPTION OF RADIOTELEPHONY PROCEDURES FOR DISTRESS, URGENCY AND SAFETY COMMUNICATION WITH NON-SOLAS SHIPS WHICH ONLY USE RADIOTELEPHONY

Non SOLAS vessels do not need to comply with GMDSS radio equipment carriage requirements, but will increasingly use it, because that causes an important increase of the safety at sea. Some countries have incorporated GMDSS radio equipment carriage requirements into their domestic marine legislation that is valid for non SOLAS vessels under their flag.

HF DSC for yachts

HF radios with built in DSC suitable for yachts and small craft are readily available.

The Icom IC-M801E is a popular choice for cruising sailors.

The well known marine radio station Brunei Bay Radio has produced an excellent series of articles on use of HF DSC by yachts:

HF/SSB radio with DSC - For cruising, racing and rallies

HF/SSB radio with DSC - A comms strategy for race, rally or cruising

Global Maritime Distress and Safety System

RECEPTION OF MARITIME SAFETY INFORMATION

Frequency of operation

The NAVTEX system uses three broadcast frequencies:

518 kHz - the main NAVTEX channel

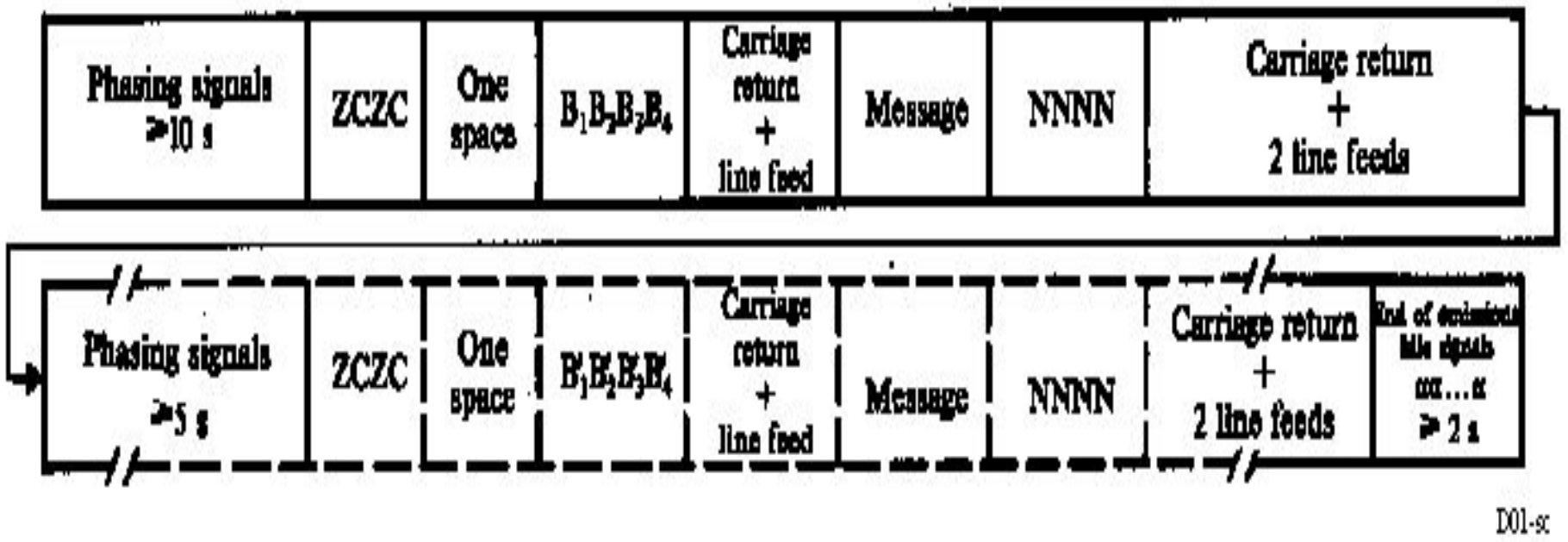
490 kHz - used for broadcasts in local languages (i.e.: non-English)

4209.5 kHz - allocated for NAVTEX broadcasts in tropical areas - not widely used at the moment.

All broadcasts from stations within the same NAVAREA must be coordinated on a time sharing basis to eliminate interference.

Global Maritime Distress and Safety System

NAVTEX message format



Global Maritime Distress and Safety System

Subject indicator characters assigned to the NAVTEX system are as follows:

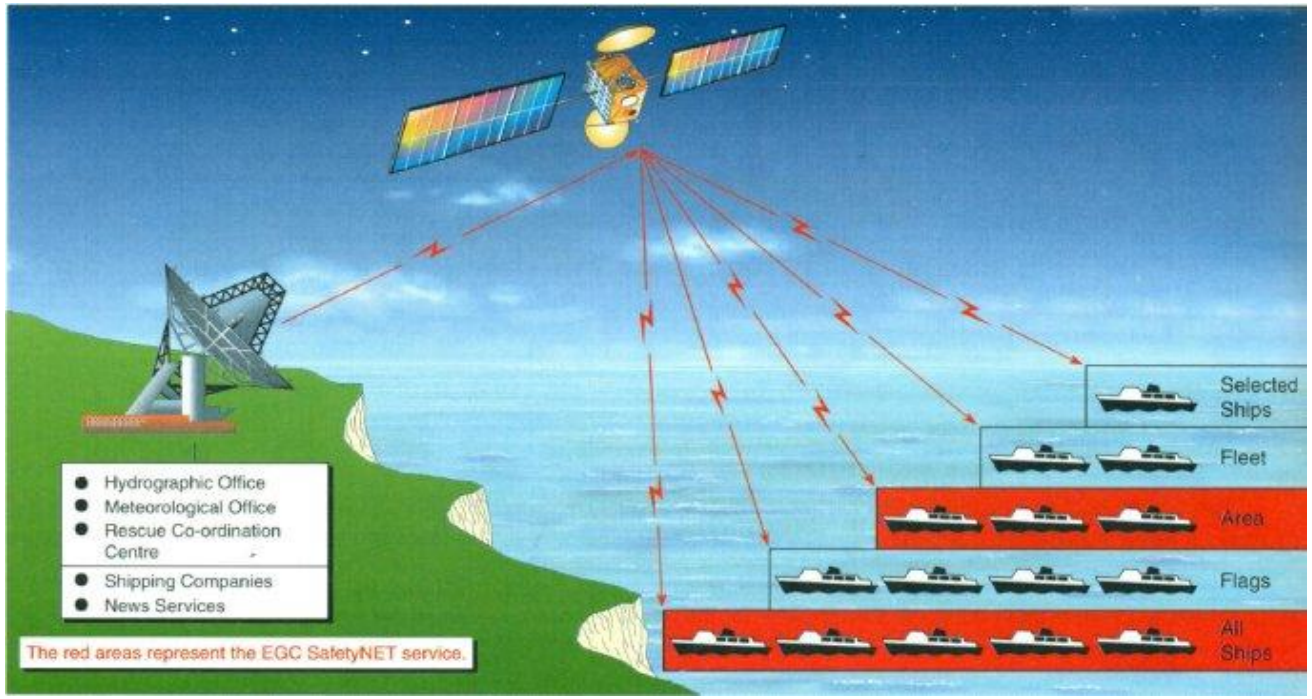
A - Navigational warnings
B - Meteorological warnings
C - Ice reports
D - Search and rescue information
E - Meteorological forecasts
F - Pilot service messages
G - Decca messages
H - Loran messages
I - Omega messages
J - Satnav messages
K - Other electronic navaid messages
L - Additional navigational messages
V - Special services
W - Special services (possible other languages use)
X - Special services
Y- Special services
Z - No message on hand (QRU)

Global Maritime Distress and Safety System

Enhanced Group Call (EGC) service is a part of the GMDSS system for the transmission of maritime safety information (MSI) in areas where the NAVTEX service is not available. These messages could be e.g. Navigational warnings, Meteorological warnings, Meteorological forecasts and Search And Rescue messages. The EGC service uses the Inmarsat C system for broadcasting these messages. The Enhanced Group Call (EGC) service is used for the transmission of messages to a group of ships or to ships in a specified area via the Inmarsat satellites.

The EGC messages can be divided into two categories known as:

- *Safety NET and*
- *Fleet NET.*



Global Maritime Distress and Safety System

GMDSS SATELLITE DISTRESS, URGENCY AND SAFETY COMMUNICATION PROCEDURES THE INMARSAT A/B SES ALERTING FUNCTION

INMARSAT B TLF

1. Select **telephone mode** of operation.
2. Select **Distress Priority** (level 3, emergency).
3. Select the required **LES access code**.
4. Lift the handset and listen for the dial tone, (or switch the handset to the TALK, as appropriate), then initiate the Call Request according to your equipment manufacturers instructions, your call will then be directed directly to the **RCC** associated with the LES though
which you requested the call.
5. If you do not receive any response within 15 seconds, **repeat the distress call**.
6. When contact has been established, send your message in the following format:

Global Maritime Distress and Safety System

MAYDAY MAYDAY MAYDAY
THIS IS [ship's name/call sign] CALLING VIA INMARSAT-B FROM POSITION [latitude and longitude, or relative to a named point of land].
MY INMARSAT MOBILE NUMBER IS [IMN for this channel of your MES] USING THE [Ocean Region] SATELLITE.
MY COURSE AND SPEED ARE [course and speed].
The NATURE OF YOUR DISTRESS, for example: Fire/explosion, Flooding, Collision, Grounding, Listing, Sinking, Disabled and adrift, Abandoning Ship, Attack by Pirates
ANY ASSISTANCE REQUIRED
ANY OTHER INFORMATION to help rescue units

Global Maritime Distress and Safety System

INMARSAT A/B TLX

1. Press and hold down the **Distress "Push-button"** for at least 6 seconds.
2. Wait for automatic connection to the RCC.

Then either:

A. Type your distress message using the following format

MAYDAY MAYDAY MAYDAY
THIS IS [ship's name/call sign] CALLING VIA INMARSAT-B FROM POSITION [latitude and longitude, or relative to a named point of land].
MY INMARSAT MOBILE NUMBER IS [IMN for this channel of your MES] USING THE [Ocean Region] SATELLITE.
MY COURSE AND SPEED ARE [course and speed].
The NATURE OF YOUR DISTRESS, for example: Fire/explosion, Flooding, Collision, Grounding, Listing, Sinking, Disabled and adrift, Abandoning Ship, Attack by Pirates
ANY ASSISTANCE REQUIRED ANY OTHER INFORMATION to help rescue units
DO NOT CLEAR THE CALL UNTIL INSTRUCTED BY THE RCC TO DO SO

Global Maritime Distress and Safety System

INMARSAT A/B TLX

1. Press and hold down the **Distress "Push-button"** for at least 6 seconds.
2. Wait for automatic connection to the RCC.

Then either:

A. Type your distress message using the following format

MAYDAY MAYDAY MAYDAY

THIS IS [ship's name/call sign] CALLING VIA INMARSAT-B FROM POSITION [latitude and longitude, or relative to a named point of land].

MY INMARSAT MOBILE NUMBER IS [IMN for this channel of your MES] USING THE [Ocean Region] SATELLITE.

MY COURSE AND SPEED ARE [course and speed].

The NATURE OF YOUR DISTRESS, for example: Fire/explosion, Flooding, Collision, Grounding, Listing, Sinking, Disabled and adrift, Abandoning Ship, Attack by Pirates

ANY ASSISTANCE REQUIRED ANY OTHER INFORMATION to help rescue units

DO NOT CLEAR THE CALL UNTIL INSTRUCTED BY THE RCC TO DO SO

Global Maritime Distress and Safety System

THE INMARSAT C SES ALERTING FUNCTION

Using the distress menu on your GMDSS, follow these steps:

- Enter your vessel's position, course, speed, and any other vital information onto the form displayed on the screen.
- Choose "Nature of Distress" from the toolbar list on top of the screen.
- Choose the closest LES to your ship's coordinates near your Ocean Region. You may select any LES within your particular Ocean Region.
- Using the distress button, send the alert by keeping it pressed for the required time (5 seconds).You should receive an acknowledgment from the LES within 5 minutes.
- If no acknowledgment from the LES, send another distress alert.
- After acknowledgment, further detailed information regarding the distress may be sent using the same method as above. This should be sent through the same LES as the original distress alert, this information will be sent to the same Rescue Co-ordination Center.

Global Maritime Distress and Safety System

There is usually little time to send a distress alert using the method above, therefore there is a quicker and simpler method:

Press and hold the distress button for the required time (5 seconds).

Global Maritime Distress and Safety System

BRIDGE ALARM PANEL FOR PASSENGER SHIPS

SOLAS Ch. IV

In passenger ships, a distress alarm panel shall be installed at the conning position. The distress alarm panel shall provide visual and aural indication of any distress alert or alerts received on board and shall also indicate through which radio communication service the distress alerts have been received.

In passenger ships, a distress panel shall be installed at the conning position. This panel shall contain either one single button which, when pressed, initiates a distress alert using all radio communication installations required on board for tha purpose or one button for each individual installation. The panel shall clearly and visually indicate whenever any button or buttons have been pressed. Means shall be provided to prevent inadvertent activation of the button or buttons.

Global Maritime Distress and Safety System

PROTECTION OF DISTRESS FREQUENCIES AND AVOIDANCE OF FALSE DISTRESS ALERTS

1. Ensure that all GMDSS certificated personnel responsible for sending a distress alert have been instructed about , and are competent to operate, the particular radio equipment on the ships;
2. Ensure that the person or persons responsible for communications curing distress incidents give the necessary instructions and information to all crew members on how to use GMDSS equipment to send a distress alert;
3. Ensure that as part of each "abandon ship" drill, instruction is given on how emergency equipment should be used to provide GMDSS functions;
4. Ensure that GMDSS equipment testing is only undertaken under the supervision of the person responsible for communication during distress incidents;
5. Ensure that GMDSS equipment testing or drills are never allowed to cause false distress alerts;

Global Maritime Distress and Safety System

6. Ensure that encoded identity of satellite, EPIRBs which are used by SAR personnel responding to emergencies, are properly registered in a database accessible 24 hrs. a day or automatically provided to SAR authorities (Master should confirm that their EPIRBs have been registered with such a database to help SAR service identify the ship in the event of distress and rapidly obtain other information which will enable them to respond appropriately);
7. Ensure that EPIRB, Inmarsat and DSC registration data is immediately updated if there is any change in information relating to the ship such as owner name of flag, and that the necessary action is taken to reprogrammed the ship's new data in the GMDSS equipment concerned;
8. Ensure that, for new ships, positions for installing EPIRBs are considered at the earliest stage of ship design and construction.

Global Maritime Distress and Safety System

9. Ensure that satellite EPIRBs are carefully installed installed in accordance with manufacturers instructions and using qualified personnel (sometimes satellite EPIRBs are damaged or broken due to improper handling or installation. They must be installed in a location that will enable them to float free and automatically activate if the ship sinks. Care must be taken to ensure that they are not tampered with or accidentally activated. If the coding has to be changed or the batteries serviced, manufacturers requirements must be strictly followed. There have been cases where EPIRB lanyards were attached to the ship so that the EPIRB could not float free; lanyards are only to be used by survivors for securing the EPIRB to a survival craft or person in water);
10. Ensure that EPIRBs are not activated if assistance is already immediately available (EPIRBs are intended to call for assistance if the unable to obtain help by other means and to provide position information and homing signals for SAR units).
11. Ensure that, if a distress alert has been accidentally transmitted, the ship makes every reasonable attempt to communicated with the RCC by any means to cancel the false distress alert using the procedures given in the appendix:

Global Maritime Distress and Safety System

12. Ensure that when an EPIRB is damaged and needs to be disposed of, if a ship is sold for scrap or if for any other reason a satellite EPIRB will no longer be used, the satellite EPIRBs is made inoperable, either by removing its battery and, if possible, returning it to the manufacturer, or by demolishing it.
13. Ensure that, if possible, after emergency use, the EPIRB is retrieved and deactivated and

Global Maritime Distress and Safety System

MISCELLANEOUS SKILLS AND OPERATIONAL PROCEDURES FOR GENERAL COMMUNICATIONS

ABILITY TO USE THE ENGLISH LANGUAGE, WRITTEN AND SPOKEN, FOR THE SATISFACTORY EXCHANGE OF COMMUNICATION RELEVANT TO THE SAFETY OF LIFE AT SEA.

- Use of obligatory documents and publications including the use of the **International Code of Signals** and the **IMO Standard Marine Communication Phrases**
- Standard abbreviations and commonly used service codes
- **International Phonetic Alphabet**

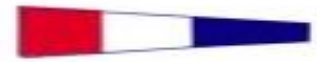
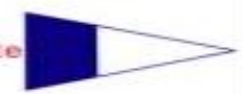
Global Maritime Distress and Safety System

EXPLANATION OF THE USE OF OBLIGATORY DOCUMENTS AND PUBLICATIONS INCLUDING THE USE OF THE INTERNATIONAL CODE OF SIGNALS AND THE IMO STANDARD MARINE COMMUNICATION PHRASES

The **International Code of Signals (ICS)** is an international system of signals and codes for use by vessels to communicate important messages regarding safety of navigation and related matters. Signals can be sent by flaghoist, signal lamp ("blinker"), flag semaphore, radiotelegraphy, and radiotelephony. The International Code is the most recent evolution of a wide variety of maritime flag signaling systems.

The International Code of Signals is currently maintained by the International Maritime Organization, which published a new print edition in 2005.

INTERNATIONAL FLAGS AND PENNANTS

ALPHABET FLAGS						NUMERAL PENNANTS	
Alfa		Kilo		Uniform		1	
Bravo		Lima		Victor		2	
Charlie		Mike		Whis-key		3	
Delta		Novem-ber		Xray		4	
Echo		Oscar		Yankee		5	
Foxtrot		Papa		Zulu		6	
Golf		Quebec		SUBSTITUTES 1st Substitute		7	
Hotel		Romeo		2nd Substitute		8	
India		Sierra		3rd Substitute		9	
Juliett		Tango		 CODE (Answering Pennant or Decimal Point)		0	

Global Maritime Distress and Safety System

The purpose of the **International Code of Signals** is to provide ways and means of communication in situations related essentially to safety of navigation and persons, especially when language difficulties arise. It has done this by first establishing a standardized alphabet (the letters A to Z, and the ten digits), along with a spoken form of each letter (to avoiding confusing similar sounding letters, such as 'b', 'p', and 'v'), and associating this alphabet with standardized flags. Combinations of these alphanumeric characters are assigned as codes for various standardized messages.

For instance, ship may to communicate with another ship, where his own radio may not be working, or the other ship's call sign is not known, or the other ship may not be maintaining a radio watch. One simply raises the Kilo flag, or sends the Morse Code equivalent (dash-dot-dash) by flashing light; this has the assigned message of "I wish to communicate with you.“ One of the elegant aspects of the ICS is that all of the standardized messages come in nine languages (English, French, Italian, German, Japanese, Spanish, Norwegian, and, since 1969, Russian and Greek). That the sender and receiver(s) are using different languages is immaterial; each language has a book with equivalent messages keyed to the same code. This is also useful in radiotelephony, or even when ships are within hailing distance, if there is no common language: a crewman on a burning ship yells "Juliet Alfa Vour", and a vessel coming to their aid knows exactly what they need: "material for foam fire extinguishers" (that is, the foaming agent).

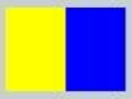
The code also covers procedural aspects (how to initiate a call, the format of a message, how to format date and time, etc.), how naval ships (which usually use their own codes) indicate they are using the ICS (by flying the code pennant), use in radiotelephony (use of the spoken word "Interco"), and various other matters (such as how an aircraft directs a vessel to another vessel in distress, and how to order unidentified submarines to surface).

Global Maritime Distress and Safety System

Prior to 1969, the code was much more extensive, covering a wider range of messages and included a list of five-letter codes for every prominent maritime location in the world. Since 1969, it has been reduced to focus on navigation and safety, including a medical section. Signals can be sorted into three groups:

- **Single-letter** signals which are very urgent, important, or common.
- **Two-letter** signals for other messages, sometimes followed with a numeric "complement" that supplements or modifies the message.
- **Three-letter** signals beginning with "M" – these are the **Medical Signal Codes**.

In some cases, additional characters are added to indicate quantities, bearing, course, distance, date, time, latitude, or longitude. There is also provision for spelling words and for indicating use of other codes. Two-letter signals cover a broad gamut of situations. Repeated characters can be a problem in flaghoist. To avoid having to carry multiple sets of signal flags, the Code uses three "substitute" (or "repeater") flags. These repeat the flag at the indicated position. For instance, to signal MAA ("I request urgent medical advice") the Mike, Alfa, and 2nd substitute flags would be flown, the substitute indicating a repeat of the second character.

Letter/ Phonetic Name	Flag	ICS Meaning as Single Flag	Meaning when used with Numeric Complements
A **Alfa**		"I have a diver down; keep well clear at slow speed."	Azimuth or bearing
B **Bravo**		"I am taking in or discharging or carrying dangerous goods." (Originally used by the Royal Navy specifically for military explosives.)	
C **Charlie**		"Affirmative."[a][b]	Course in degrees magnetic
D **Delta**		"Keep clear of me; I am maneuvering with difficulty."	Date
E **Echo**		"I am altering my course to starboard."[b]	
F **Foxtrot**		"I am disabled; communicate with me."	
G **Golf**		"I require a pilot." *By fishing vessels near fishing grounds:* "I am hauling nets."	Longitude (The first 2 or 3 digits denote minutes; the last 2 denote degrees.)
H **Hotel**		"I have a pilot on board."	
I **India**		"I am altering my course to port."[b]	
J **Juliet**		"I am on fire and have dangerous cargo on board: keep well clear of me." or "I am leaking dangerous cargo."	
K **Kilo**		"I wish to communicate with you."	"I wish to communicate with you by...": 1) Morse signaling by hand-flags or arms; 2) Loud hailer (megaphone); 3) Morse signaling lamp; 4) Sound signals.
L **Lima**		*In harbour:* "The ship is quarantined." *At sea:* "You should stop your vessel instantly."	Latitude (The first 2 digits denote minutes; the last 2 denote degrees.)
M **Mike**		"My vessel is stopped and making no way through the water."[b]	

N **November**		"Negative."[a]	
O **Oscar**		"Man overboard."[b] (often attached to the *man overboard pole* on boats). With a sinister hoist, the semaphore flag.	
P **Papa**		The *Blue Peter*. *In harbour:* All persons should report on board as the vessel is about to proceed to sea. *At sea:* It may be used by fishing vessels to mean: "My nets have come fast upon an obstruction."	
Q **Quebec**		"My vessel is 'healthy' and I request free pratique."	
R **Romeo**		(No ICS meaning as a single flag)	Distance (range) in nautical miles.
S **Sierra**		"I am operating astern propulsion."[b]	Speed (velocity) in knots
T **Tango**		"Keep clear of me; I am engaged in pair trawling."	Local time. (The first 2 digits denote hours; the last 2 denote minutes.)
U **Uniform**		"You are running into danger."	
V **Victor**		"I require assistance."	Speed in kilometres per hour.
W **Whiskey**		"I require medical assistance."	
X **Xray**		"Stop carrying out your intentions and watch for my signals."	
Y **Yankee**		"I am dragging my anchor."	
Z **Zulu**		"I require a tug." *By fishing vessels near fishing grounds:* "I am shooting nets."[c]	Time (UTC). (The first 2 digits denote hours; the last 2 denote minutes.)

Flag Hoist	Code	Meaning
	AC	I am abandoning my vessel.
	AN 1	I need a doctor; I have severe burns.
	EL 1	What is the position of vessel in distress?
	GN 1	I wish some persons taken off. Skeleton crew will remain on board.
	IT	I am on fire.
	MAC	I request you to arrange hospital admission.
	VG	The coverage of low clouds is... (number of octants or eighths of sky covered).
	NC	Distress signal

Flag Hoist	Code	Meaning
	AD	I am abandoning my vessel which has suffered a nuclear accident and is a possible source of radiation danger.
	AN 2	I need a doctor; I have radiation casualties.
	GM	I cannot save my vessel.
	GN 2	I will take off persons.
	MAA	I request urgent medical advice.
	MAD	I am . . . (indicate number) hours from the nearest port.
	US 4	Nothing can be done until weather moderates.

Flag Hoist	Code	Meaning
	AN	I need a doctor.
	EL	Repeat the distress position.
	GN	You should take off persons.
	GN 3	Can you take off persons?
	MAB	I request you to make rendezvous in position indicated.
	MS 1	My vessel is a dangerous source of radiation; you may approach from my starboard side.

Global Maritime Distress and Safety System

The **Medical Signal Code** (incorporated in the International Code of Signals since 1930) is a means of providing assistance when medical personnel are not present. While plain language is preferred in such cases (presumably via radiotelephone), where there are language or communication difficulties the various codes provide a succinct method of communicating to a doctor the nature of the problem, and in return the recommended treatment. Even where there are no language problems the Medical Signal Code is useful in providing a standard method of case description and treatment. There is also a standard list of medicaments (medicines), keyed to a standard ships medicine chest carried by all merchant ships. The Medical signals all begin with the letter "M" (Mike) followed by two more letters, and sometimes with additional numerals or letters:

	MAA	I request urgent medical advice.
The pennant at the bottom indicates a repeat of the second letter.		

Global Maritime Distress and Safety System

RECOGNITION OF STANDARD ABBREVIATIONS AND COMMONLY USED SERVICE CODES

- Standard abbreviations
- Morse Code
- Q-Code
- International Telex Service Codes and Abbreviations

Global Maritime Distress and Safety System

MAYDAY (repeated three times) is to be used to announce a distress message

PAN PAN (repeated three times) is to be used to announce an urgency message

SECURITE (repeated three times) is to be used to announce a safety message

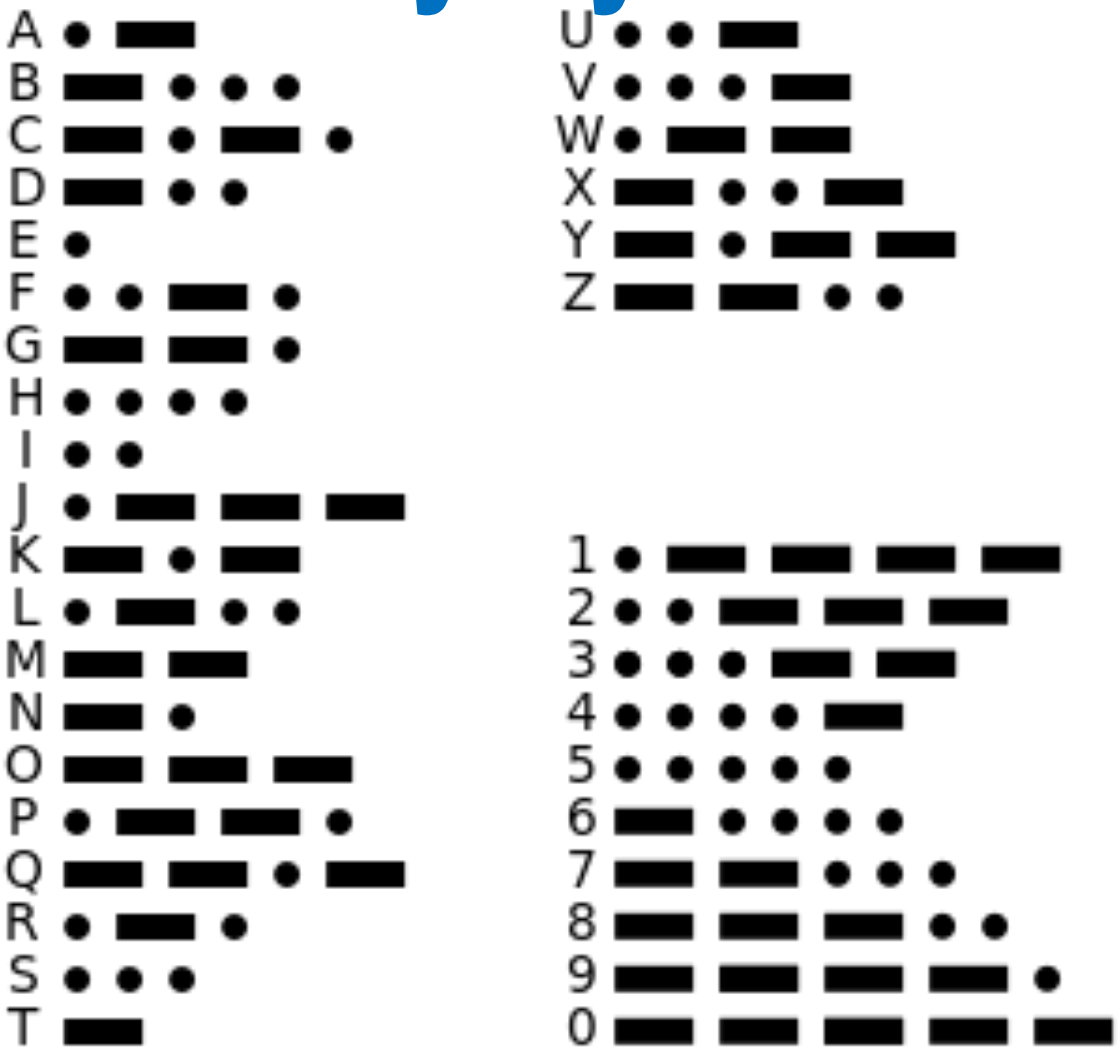
Global Maritime Distress and Safety System

Morse code is a way to encode text through the generation of a carrier wave (CW). It is used to communicate over long distances or with low power (QRP).

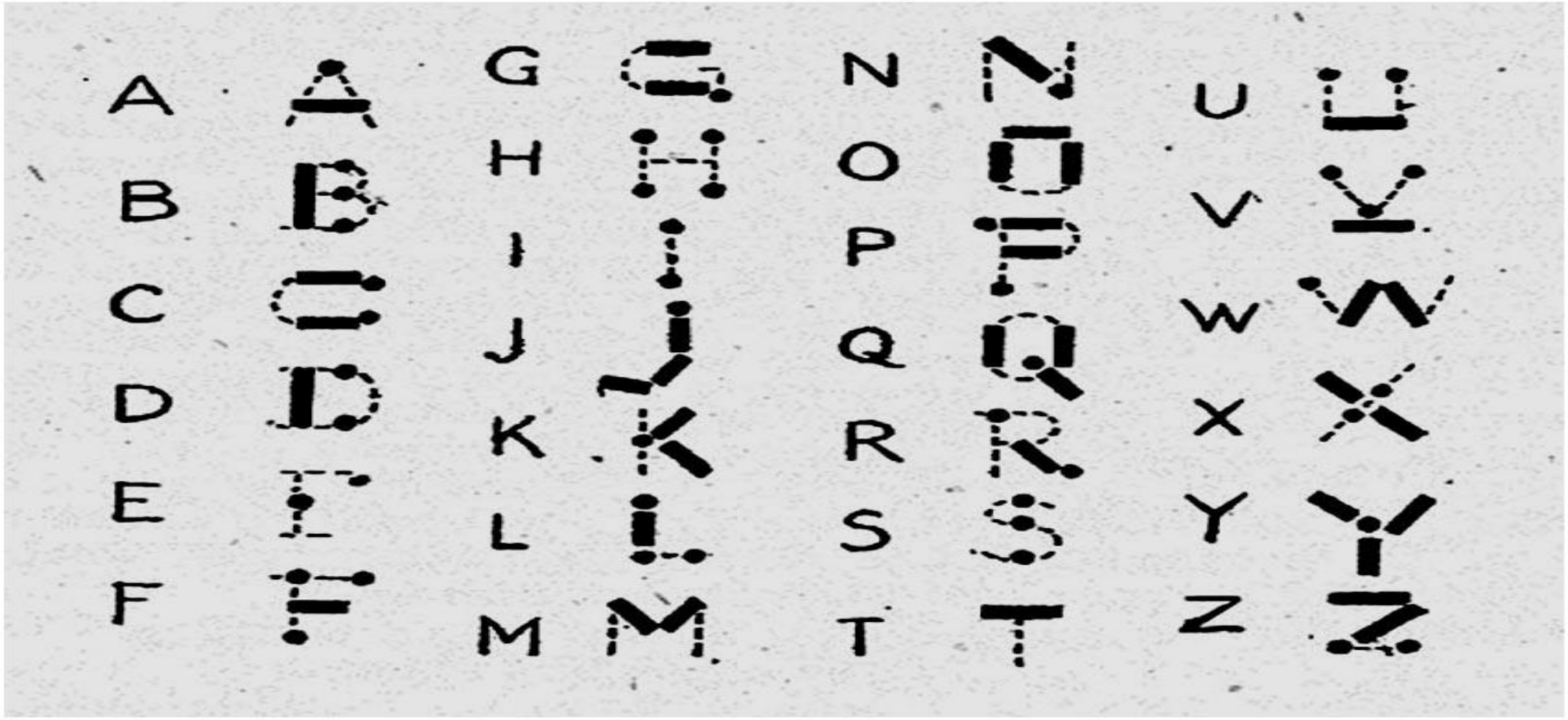
The code is composed of 5 elements:

short mark, dot or 'dit' (·) — one unit long
longer mark, dash or 'dah' (–) — three units long
intra-character gap (between the dots and dashes within a character) — one unit long
short gap (between letters) — three units long
medium gap (between words) — seven units long

Global Maritime Distress and Safety System



Global Maritime Distress and Safety System



Global Maritime Distress and Safety System

Q-Code were originally developed to shorten transmission times when using CW, but are frequently used in voice transmissions (e.g. I am going to go QRT, thanks for the QSO.)
The QRA...QUZ code range includes phrases applicable to all services and is allocated to the International Telecommunications Union. NATO's ACP 131(E), COMMUNICATIONS INSTRUCTIONS - OPERATING SIGNALS, March 1997, chapter 2 contains a full list of 'Q' codes. Other 'Q' code ranges are allocated specifically to aviation or maritime services (specified in RECOMMENDATION ITU-R M.1172); many of those codes have fallen into disuse as voice displaces CW in commercial operation. Q Codes still work when HF voice circuits are not possible due to atmospherics and the nearest vessel is one ionosphere hop away.
The Q-code was originally instituted at the Radiotelegraph Convention held in London, 1912 and was intended for marine radiotelegraph use. The codes were based on an earlier list published by the British postmaster general's office in 1908.

From ITU Radio Regulations 1990, Appendix 14: Miscellaneous Abbreviations and Signals to Be Used for Radiocommunications in the Maritime Mobile Service.

QOA	Can you communicate by radiotelegraphy (500 kHz)?	I can communicate by radiotelegraphy (500 kHz).
QOB	Can you communicate by radiotelephony (2182 kHz)?	I can communicate by radiotelephony (2182 kHz).
QOC	Can you communicate by radiotelephony (channel 16 - frequency 156.80 MHz)?	I can communicate by radiotelephony (channel 16 - frequency 156.80 MHz).
QOD	Can you communicate with me in ... 0. Dutch 5. Italian 1. English 6. Japanese 2. French 7. Norwegian 3. German 8. Russian 4. Greek 9. Spanish?	I can communicate with you in ... 0. Dutch 5. Italian 1. English 6. Japanese 2. French 7. Norwegian 3. German 8. Russian 4. Greek 9. Spanish.
QOE	Have you received the safety signal sent by ... (*name and/or call sign*)?	I have received the safety signal sent by ... (*name and/or call sign*).
QOF	What is the commercial quality of my signals?	The quality of your signals is ... 1. not commercial 2. marginally commercial 3. commercial.
QOG	How many tapes have you to send?	I have ... tapes to send.
QOH	Shall I send a phasing signal for ... seconds?	Send a phasing signal for ... seconds.
QOI	Shall I send my tape?	Send your tape.
QOJ	Will you listen on ... kHz (*or* MHz) for signals of emergency position-indicating radiobeacons?	I am listening on ... kHz (*or* MHz) for signals of emergency position-indicating radiobeacons.
QOK	Have you received the signals of an emergency position-indicating radiobeacon on ... kHz (*or* MHz)?	I have received the signals of an emergency position-indicating radiobeacon on ... kHz (*or* MHz).
QOL	Is your vessel fitted for reception of selective calls? If so, what is your selective call number or signal?	My vessel is fitted for the reception of selective calls. My selective call number or signal is ...
QOM	On what frequencies can your vessel be reached by a selective call?	My vessel can be reached by a selective call on the following frequency/ies ... (periods of time to be added if necessary).
QOO	Can you send on any working frequency?	I can send on any working frequency.
QOT	Do you hear my call; what is the approximate delay in minutes before we may exchange traffic?	I hear your call; the approximate delay is ... minutes.

Global Maritime Distress and Safety System

DESCRIBTION OF THE USE OF INTERNATIONAL PHONETIC ALPHABET

The **International Phonetic Alphabet** (unofficially—though commonly—abbreviated **IPA**) is an alphabetic system of phonetic notation based primarily on the Latin alphabet. It was devised by the International Phonetic Association as a standardized representation of the sounds of oral language. The IPA is used by lexicographers, foreign language students and teachers, linguists, speech-language pathologists, singers, actors, constructed language creators, and translators.

The IPA is designed to represent only those qualities of speech that are part of oral language: phones, phonemes, intonation, and the separation of words and syllables. To represent additional qualities of speech, such as tooth gnashing, lisping, and sounds made with a cleft palate, an extended set of symbols called the Extensions to the International Phonetic Alphabet may be used.

IPA symbols are composed of one or more elements of two basic types, letters and diacritics. Often, slashes are used to signal broad or phonemic transcription; thus, /t/ is less specific than, and could refer to, either [t̪ʰ] or [t], depending on the context and language.

Occasionally letters or diacritics are added, removed, or modified by the International Phonetic Association. As of the most recent change in 2005, there are 107 letters, 52 diacritics, and four prosodic marks in the IPA. These are shown in the current IPA chart:

CONSONANTS (PULMONIC)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks		Voiced implosives		Ejectives	
ʘ	Bilabial	ɓ	Bilabial	’	Examples:
|	Dental	ɗ	Dental/alveolar	pʼ	Bilabial
!	(Post)alveolar	ʄ	Palatal	tʼ	Dental/alveolar
ǂ	Palatoalveolar	ɠ	Velar	kʼ	Velar
‖	Alveolar lateral	ʛ	Uvular	sʼ	Alveolar fricative

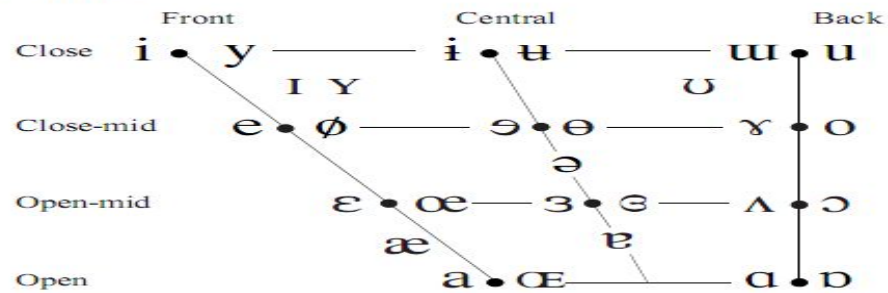
OTHER SYMBOLS

ʍ	Voiceless labial-velar fricative	ɕ ʑ	Alveolo-palatal fricatives
w	Voiced labial-velar approximant	ɺ	Voiced alveolar lateral flap
ɥ	Voiced labial-palatal approximant	ʃʒ	Simultaneous ʃ and x
ʜ	Voiceless epiglottal fricative		
ʢ	Voiced epiglottal fricative		
ʡ	Epiglottal plosive		

Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary.

k͡p t͡s

VOWELS



Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEGMENTALS

ˈ	Primary stress	ˌfoʊnəˈtɪʃən
ˌ	Secondary stress	
ː	Long	eː
ˑ	Half-long	eˑ
˘	Extra-short	e˘
|	Minor (foot) group	
‖	Major (intonation) group	
.	Syllable break	ɹi.ækt
‿	Linking (absence of a break)	

TONES AND WORD ACCENTS

LEVEL		CONTOUR	
é or ˥	Extra high	ě or ˩˥	Rising
ē ˦	High	ê ˥˩	Falling
e̋ ˧	Mid	᷄ ˧˥	High rising
è ˨	Low	᷅ ˩˧	Low rising
ȅ ˩	Extra low	᷄ ˩˥˧	Rising-falling
↓	Downstep	↗	Global rise
↑	Upstep	↘	Global fall

DIACRITICS

Diacritics may be placed above a symbol with a descender, e.g. ŋ̊

◌̥	Voiceless	n̥ d̥	◌̤	Breathy voiced	b̤ a̤	◌̪	Dental	t̪ d̪
◌̬	Voiced	s̬ t̬	◌̰	Creaky voiced	b̰ a̰	◌̺	Apical	t̺ d̺
◌ʰ	Aspirated	tʰ dʰ	◌̼	Linguolabial	t̼ d̼	◌̻	Laminal	t̻ d̻
◌̹	More rounded	ɔ̹	◌ʷ	Labialized	tʷ dʷ	◌̃	Nasalized	ẽ
◌̜	Less rounded	ɔ̜	◌ʲ	Palatalized	tʲ dʲ	◌ⁿ	Nasal release	dⁿ
◌̟	Advanced	u̟	◌ˠ	Velarized	tˠ dˠ	◌ˡ	Lateral release	dˡ
◌̠	Retracted	e̠	◌ˤ	Pharyngealized	tˤ dˤ	◌̚	No audible release	d̚
◌̈	Centralized	ë	◌̴	Velarized or pharyngealized	ɫ			
◌̽	Mid-centralized	e̽	◌̝	Raised	e̝	(ɹ̝ = voiced alveolar fricative)		
◌̩	Syllabic	n̩	◌̞	Lowered	e̞	(β̞ = voiced bilabial approximant)		
◌̯	Non-syllabic	e̯	◌̘	Advanced Tongue Root	e̘			
◌˞	Rhoticity	ə˞ a˞	◌̙	Retracted Tongue Root	e̙			

Global Maritime Distress and Safety System

OBLIGATORY PROCEDURES AND PRACTICES

- The effective use of obligatory documents and publications: methods of updating information.

- Procedures for radio record keeping: log-book requirements and mandatory entries.

- Detailed knowledge of the regulations and agreements governing the **Maritime Mobile Service** and the **Maritime Mobile-Satellite Service**

Global Maritime Distress and Safety System

PRACTICAL AND THEORETICAL KNOWLEDGE OF GENERAL COMMUNICATIONS PROCEDURES.

How to select appropriate communication methods in different situations:
- use of obligatory documentation to determine frequencies, etc.
- use of propagation tables

The use of obligatory documentation to receive traffic lists and meteorological information
Procedures for radiotelephone calls:
- method of calling coast station by a radio telephony
- requesting/ordering for a manually switched link call
- exterminating/ending a call
- special facilities of calls available
- methods of calling a coast station by DSC
- selecting an automatic radio telephone call

Details of a radio telegram:
- the preamble
- service instructions
- accounting authority identification code (AAIC)
- the address
- the text

Global Maritime Distress and Safety System

PRACTICAL AND THEORETICAL KNOWLEDGE OF GENERAL COMMUNICATIONS PROCEDURES.

Details of a radio telegram:

- the signature
- types of addressing available
- full address
- registered address
- telephonic address
- telex address (may be omitted)
- counting words
- transmission of telegram by radiotelephony

Methods of traffic charges:

- the international charging and accounting system
- Inmarsat communication charging systems
- the AAIC code and use of documentation to determine/verify it
- the meaning of landline (LL), coast station (CC) and ship station (SC) charge
- currencies used in charging and conversion
- gold francs and special drawing rights, etc.
- practical traffic routines

World geography, especially the principal shipping routes and related communication routes