SEAFARERS TRAINING CENTER INC

GENERAL OPERATORS CERTIFICATE FOR THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)

(Regulation IV/2, Section A-IV/2 and table A-IV/2)

SCOPE

This course covers the training recommendation in annex 3 TO IMO Assembly resolution A. 703 (179- Recommendation on Training of Radio Operators related to the General Operator's Certificate (GOC).

OBJECTIVE

A trainee successfully completing this course and passing the prescribed examination will be enable to efficiently operate the GMDSS equipment, and to have primary responsibility to radio communications during Distress incidents. Given the severe problems being experienced in the GMDSS as a result of the large number false Distress alerts that sometimes occur, training will also be provided in techniques to avoid the unintentional transmission of false Distress alerts and the procedures to use in order to mitigate the effects of false Distress alerts following unintentional transmissions.

ENTRY STANDARDS

This course framework assumes little knowledge of maritime radio communication practice, but a working knowledge English as a second. Elementary computer skills are assumed in the recommended course timetable. Additional training will be needed for those lacking basic proficiency in the use of computers.

CERTIFICATION

Every person in charge of or performing radio duties on a ship that is required to participate in the GMDSS equipment is required to hold an appropriate certificate related to the GMDSS, which satisfies the provisions of the Radio Regulations of the International Telecommunication Union (ref. ITU RR Art. 47).

In addition, every candidate for certification under the STCW Convention, as amended in 1995 (STCW95), for service on a ship which is required by the international Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, to have a radio installation shall:

- Be not less than 18 years of age, and
- Have completed approved education and training and shall meet the standard of competence specified in section A-IV/2 of the STCW Code.

The material contained in this course covers all aspects of training in GMDSS radio communications. However, where the additional requirements for certification under the STCW Convention contained in column 2 of table A-IV/2 of the STCW 1978 amended Code are not examined as part of the national qualification requirements for a

certificated issued under the Radio Regulations, the appropriate provisions for training and assessment contained in section A-IV/2 of the STCW 1978 amended Code will have to be met separately.

The examination must be supervised by an independent objective examiner (usually a qualified representative from (STCW 1978 amended, Section A-I/6, A-I/7 and A-I/8).

STAFF REQUIREMENTS

All training and instruction should be given by personnel properly qualified in the subject matter. Instructors in charge of practical training must be possession of a valid General Operator`s Certificate. In addition to having considerable experience in maritime radio communications, including GMDSS, all instructors must have a good general knowledge of ships, maritime Distress, Urgency and Safety as well as Search and Rescue matters.

COURSE INTAKE LIMITATIONS

Practical training should be undertaken in small group of not more than trainees depending on the available equipment. The recommendation for facilities and equipment for this course are based on a total number of 12 trainees and corresponding instructor capacity (most Academies, Colleges or maritime education institutions recommend 8 students per instructor).

The use of GMDSS simulators to supplement training on real equipment may allow greater numbers to be accommodated without sacrificing training standards.
However, the course co-ordinator will have to ensure that the timetable arrangements provide sufficient access to real GMDSS equipment. Note also the arrangements needed for examination and assessment listed under column 3 or table A-IV/2 of the STCW Code.

TEACHING FACILITIES AND EQUIPMENT (AS EXAMPLE)

A simulator NAUTIS vs Version 1-3.

Classroom facilities should include a blackboard, whiteboard or flipchart and an overhead projector. When audio-visual material such as videos, slides, tape recordings, etc. is used, the appropriate equipment must be available.

For practical training, adequate working space and separate working areas we have:

- ✓ One fully operational MF/HF transmitter/receiver set for radiotelephony, NBDP and DSC (an additional DSC controller is recommended since local

communications over a hardwired back-to-back connection between DSC controllers then becomes possible);

- ✓ One dedicated MF/HF watch receiver for the DSC Distress frequencies;
- ✓ At least one dummy satellite EPIRB (406 MHz or 1.6 GHz) with hydrostatic release mechanism;
- ✓ One dummy SART;
- ✓ One EGC receiver facility (An Inmarsat-C covers that requirement on board);
- ✓ A Distress alarm panel for passenger ships (1/2 dummy – to avoid unintended Distress-alarms), connected to the VHF-DSC, MF-DSC and Inmarsat-C;
- ✓ One NAVTEX receiver;
- ✓ One fully (preferably two) operational VHF transmitter/receiver for radiotelephony and DSC, incorporating a DSC watch receiver for channel 70 (should be possible to go on the air with one of them);
- ✓ One 2.182,0 KHz watch receiver (as there still is thousands of none GMDSS vessels in the world with 2182 KHz watch receivers);
- ✓ One two-way portable VHF radiotelephone with charging arrangement;
- ✓ One portable two-way on-scene communication for 121,5 and 123,1 mHz (dummy);
- ✓ One personal computer or realistic simulation equipment for every one or sometimes two students, capable of running relevant programs for simulating the operation of Inmarsat -A, -B and –C, DSC and NBDP, as appropriate;
- ✓ One battery inverter power supply, connected as the reserve source of energy (not necessarily located in the working area) or a regular reserve source of energy (radio batteries) connected to the charging arrangement (re. Comsar/C Sirc. #16, of 4 March 1998); and
- ✓ Sign and marking in accordance with the requirements of the administrations for GMDSS ship stations.

Note: GMDSS training equipment (real equipment) should be installed in such a way that it corresponds with the requirements of installations on board GMDSS vessels. The standard should be set at the Training Institutions and not on board.

Note: Throughout the course, safe working practices are to be clearly defined and emphasized with reference to current international requirements and regulations.

(*= Two sets of equipments would prove advantageous.)

TEACHING AIDS (A)

A1 GOC Model Course Compendium
A2 PC programs, including documentation, for the simulation of:

1. Inmarsat-(A*)/-B operation
2. Inmarsat-C operation
3. Narrow Band Direct Printing (NBDP)
4. Digital Selective calling (DSC)

A3 User manuals for all installed GMDSS equipment
A4 Radio log-book
A5 Demonstration equipment (SARTs, portable GMDSS VHF, portable two-way on-scene Communication VHF for 121,5 and 123,1 MHz and EPIRBs)
A6 Real equipment as VHF, VHF-DSC, MF/HF including NBDP and DSC and Inmarsat-C

IMO REFERENCES (R)

R1 GMDSS handbook
R2 MERSAR Manual
R3 Standard Marine Communication Phrases
R4 Master Plan of the shore-based facilities for the GMDSS
R5 STCW 95 Code
R6 Resolution A. 814 (19)
R7 International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended (always the latest edition)

TEXTBOOKS (T)

T1 ITU Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services.

T2
1. ITU List of Coast Stations
2. ITU List of Radio-determination and Special Service Stations
3. ITU List of Call Signs and Numerical Identifies
4. ITU List of Ship Stations
5. ITU Radio Regulations (complete edition and always the latest one)
6. ITU List of call signs and numerical identifies (volume II & III)

T3
1. Inmarsat Maritime Communications Handbook
2. Harmonization of GMDSS requirements for radio installations on board SOLAS-ships (ref. Comsar Circ. 32 per 02.01-04)
3. Inmarsat-E User Manual (EPIRB)
4. Inmarsat SafetyNET User´s Handbook
5. Admiralty List of Radio Signals, Volume 5 (always the last edition)

BIBLIOGRAPHY OF OTHER PUBLICATIONS USED IN THE COURSE (B)

B1 P.C. Smith and J.J. Seaton, GMDSS for Navigators.
(Rushden, Butterworth-Heinemann, 1994) (ISBN 0-7506-2177-X)
B2 I. Waugh, The Maritime Radio and Satellite Communications Manual. (Shrewbury, Waterline, 1994) (ISBN 1-85310-471-X)

B3 G.D. Less, Handbook for Marine Radio Communication, 2nd edn. (London, Lloyd´s of London Press, 1996) (ISBN 1-85978-041-5)

Note: It is expected that the national education institution implementing the course will insert references to national requirements and regulations as necessary.

COURSE OUTLINE

1. **Introduction**
   - **1.1** The course.

2. **Principles of maritime radio-communications**
   - **2.1** The general principles and basic features of the Maritime Mobile Service.
   - **2.2** The general principles and basic features of the Maritime Mobile-Satellite Service.
   - **2.3** Global Maritime Distress and Safety System (GMDSS)

3. **GMDSS communication systems**
   - **3.1** Purpose and use of Digital Selective Calling (DSC) facilities.
   - **3.2** Knowledge of the general principles of Narrow-Band Direct Printing (NBDP) and radio telex systems. Ability to use the maritime NBDP and radio telex equipment in practice (emergency).
   - **3.3** Knowledge and use of Inmarsat systems. Ability to use Inmarsat equipment or simulator in practice.
   - **3.4** Fault location and rectification on marine electronic equipment.
   - **3.5** Knowledge of and ability to use in practice the basic equipment of a terrestrial ship station.

4. **Other GMDSS equipment**
   - **4.1** Emergency Positioning-Indicating Radio Beacons (EPIRBs)
   - **4.2** Search and Rescue Radar Transponder (SART).
   - **4.3** Reception of Maritime Safety Information (MSI).

5. **Distress alerting**
   - **5.1** Search and Rescue (SAR) operation.
   - **5.2** Distress, Urgency and Safety communication procedures in the GMDSS.
   - **5.3** GMDSS satellite Distress, Urgency and Safety communication procedure.
   - **5.4** Protection of Distress frequencies and avoidance of false Distress alerts.

6. **Miscellaneous skills and operational procedures for general communications**
   - **6.1** Ability to use the English language, written and spoken, for the satisfactory exchange of communications relevant to the Safety of life at sea.
   - **6.2** Obligatory procedures and practices.
   - **6.3** Practical and theoretical knowledge of general communications procedures.

7. **Assessment and discussion**

COURSE TIMETABLE

UNIT	CLASS HOURS		TOTAL
1	1.0		1.0
1.1	2.5		2.5
2.1	15.0		15.0
2.2	4.0		4.0
2.3	8.0		8.0
3.1			22.5
3.2	5.0	17.5	4.0
3.3	2.0	2.0	7.0
3.4	3.0	4.0	18.0
3.5	4.0	14.0	3.0
4.1	1.5	3.0	2.0
4.2	0.5	0.5	1.0
4.3	2.0	0.5	4.0
5.1	3.0	0.5	4.0
5.2	3.0	2.0	11.0
5.3	1.0	1.0	4.0
5.4	1.0	8.0	2.0
6.1		3.0	
6.2		1.0	
6.3	4.0	7.0	11.0
7	8.0		8.0
	68.5	**63.5**	**132.0**

Note: This course timetable assumes that the student has limited knowledge of communication systems, techniques or sea experience.

Providing that the learning objectives contained in part C of this course are fully achieved, the course timetable may be adjusted to suit course entry requirements based on different standards of prior knowledge in radio-communications or seagoing experience. In addition, any adjustment should take into account the need to maintain an effective instructor to student ratio and adequate access to GMDSS equipment for practical training during course.

Some instructors consider the course program to be quite complex and some administrations have decided that 132 hours is a minimum amount of hours, in spite of the student´s background.

1.0 Introduction

1.1 The course

GMDSS refers to a system that was developed by the International Maritime Organization (II"v10) This highly regarded organization is made up of many member countries who strive for improvements in safety at sea. GMDSS took ten years to develop and as of this writing is still being improved to upgrade the system.

The 1974 Safety of Life at Sea Convention (SOLAS) has required a continuous Morse Telegraphy watch on 500 kHz for ships of 1600 gross tons and over. SOLAS also requires a radiotelephone watch on 2182 kHz and 156.8 MHz (channel16) on all ships of 1600 gross tons and above. Although the system has proven itself reliable for many years, the limitations are short range, require manual alerting, and aural watchkeeping. The advances in technology have led the International Organization (IMO) member Govemments to develop a new system based on modem technology and automation.

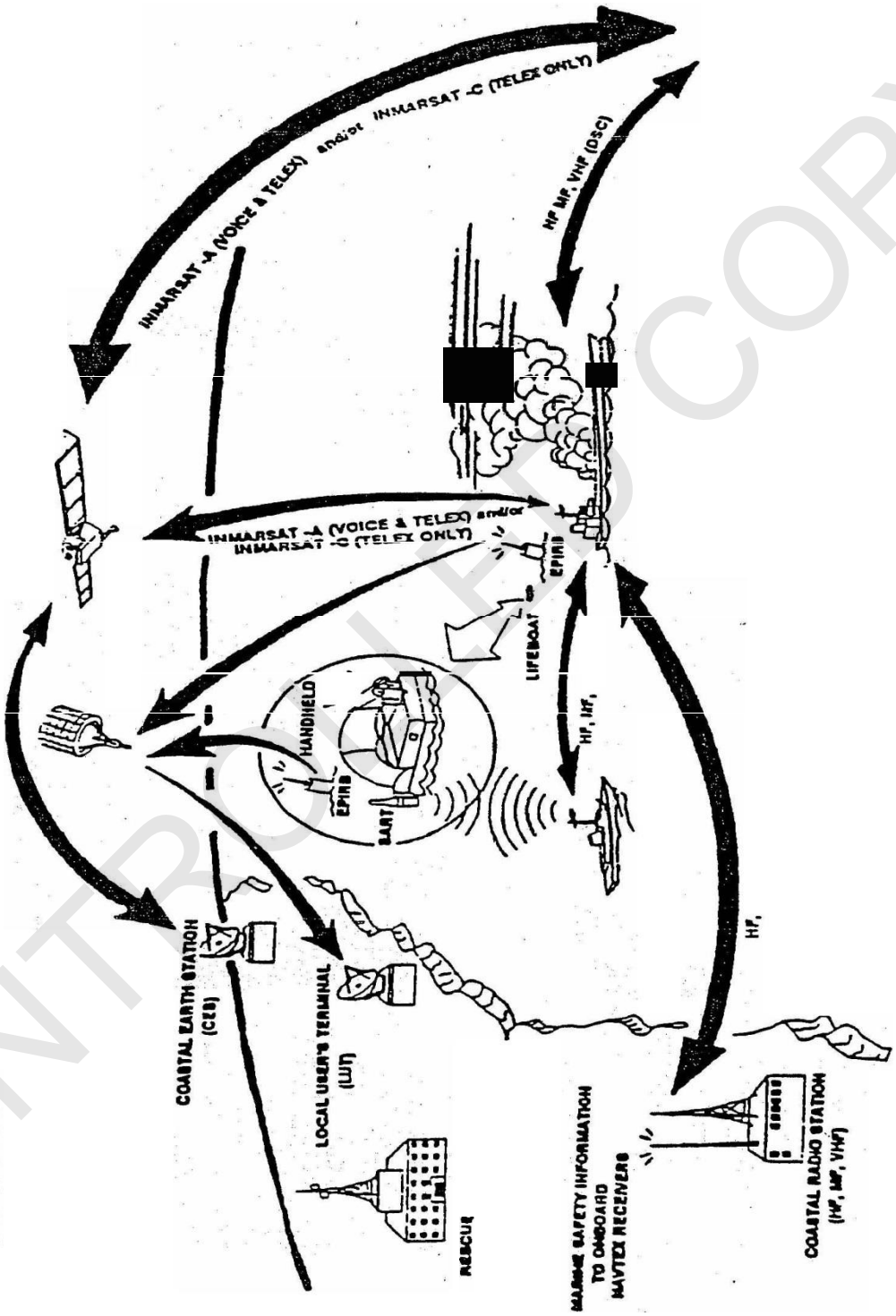
The new system is called the Global Maritime Distress and Safety System (GMDSS). This system was adopted by the IMO and replaces the old Chapter IV SOLAS 500 kHz Morse code system. The GMDSS uses a ship to shore communications path instead of the old ship-to-ship alerting communications path. The new system is automated and uses ship-to-shore alerting using MF, HF, and satellites. GMDSS will apply to all passenger ships regardless of size and cargo ships of 300 gross tons and above. There is a transition period from the old to the new system in order to allow the industry to overcome any unforeseen problems in implementation of the new system. The transition period began 1 February 1992 and continues to 1 February 1999. During this period ships operating under the new GMDSS system will have to comply with the new revisions of chapter IV of SOLAS 1974. Until 1 February 1999, both systems will require watchkeeping 2182kHz and VHF channel16.

GMDSS is a largely, but not fully, automated system that requires ships to have a range of equipment capable of the following communications:

- Distress alerting ship-to-shore, shore-to-ship, and ship-to-ship.
- Transmit distress alerts to shore by 2 different methods.
- This means having a VHF Digital Select Call (DSC) as primary system for a vessel near coastal areas backed up by a satellite Emergency Position Indicating Radio Beacon (EPIRB). A vessel operating in an offshore ocean area should have either High Frequency (HF) or Medium Frequency (MF) DSC or primary INMARSAT satellite communications as a primary system backed up by a satellite EPIRB. The type of equipment used in the primary system is determined by the area in which the ship will be navigating (Navigational Area).
- Receive distress alerts from shore by a radio telephone watch receiver, DSC watch receiver, or INMARSAT as determined by the Navigational (NAV) area (refer to chart of sea areas in front of the book).
- Search and rescue coordination on scene.
- On-scene communications.
- Signals for locating on 2182 kHz and on 9 GHz Search and Rescue Transponder (SART).

- Maritime Safety Information (MSI) via NAVTEX, INMARSAT, Enhanced Group Call (EGC), HF Narrow Band Direct Printing (NBDP).
- General radio communications via radiotelephone, INMARSAT, or Narrow Band Direct Printing (NBDP).
- Bridge to Bridge communications.

The primary difference between the earlier 500 kHz Morse code based system and 2182 kHz Single Sideband system is that the earlier systems were ship-to-ship. The GMDSS system is a Ship-to-shore, sore to ship, and ship to ship system. The GMDSS system provides a high level of coordination for rescuers and it offers rescuers the use of satellite technology. GMDSS also requires that there be at least 2 paths of communications available for declaring a distress situation. The older system did not have this requirement. The GMDSS system will allow rapid alerting of search and rescue authorities ashore, as well as ships in the vicinity of the distress so that they can assist in a coordinated search and rescue operation with minimum delay.



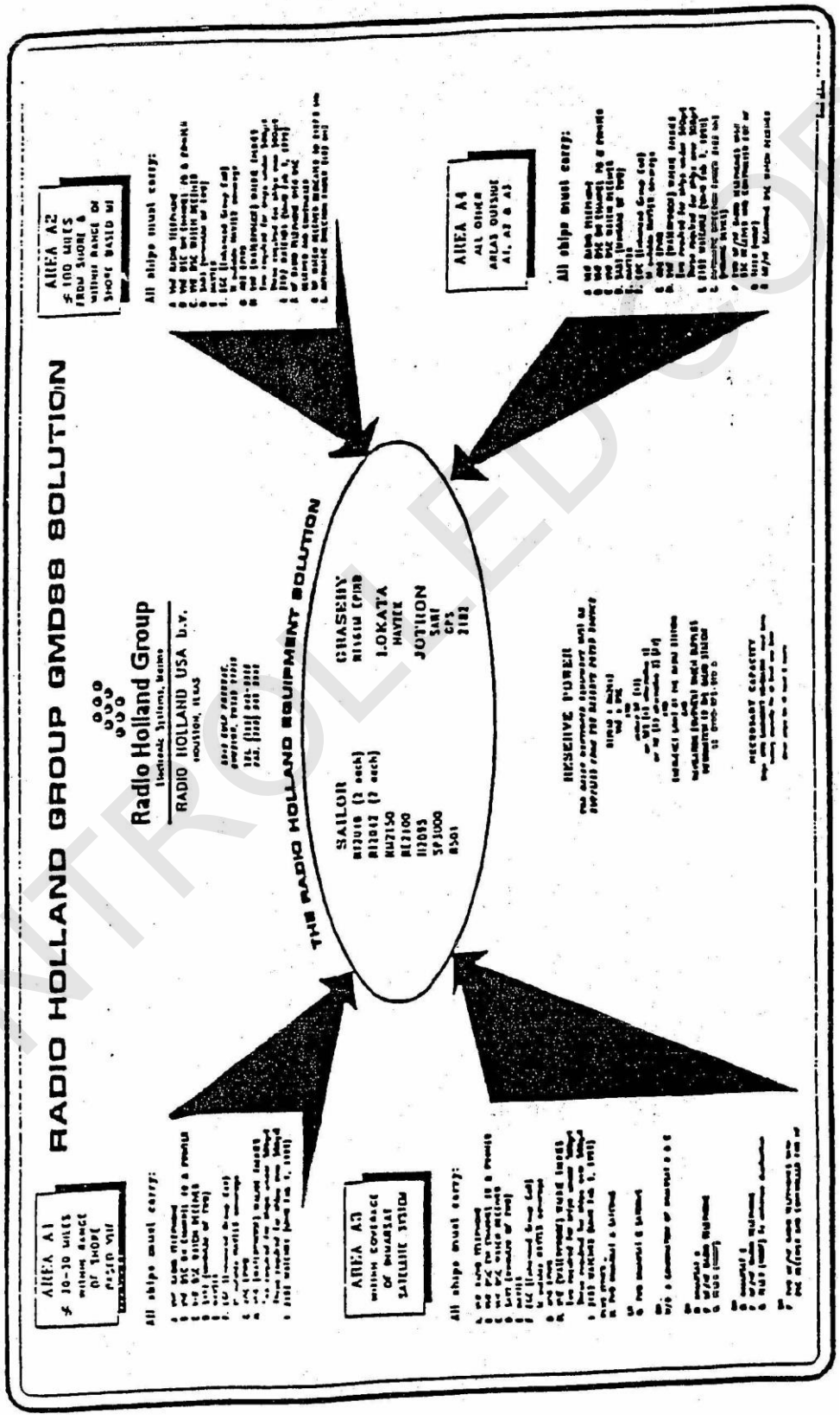


FIGURE 2

GMDSS Operational Areas: (See figure 2)

The concept of Sea Areas is based on having the equipment on board that will allow for reliable alerting based on the approximate distance the ship operates from shore. Once a ship has applied for a specific sea area, it must re-apply and be approved for another sea area if its sea area of operation changes. No waivers that will be granted. This is done to avoid the possibility of the ship sailing outside the range of its alerting capability. The sea areas are:

Al: Within range of a VHF Coast Station with DSC alerting (approx. 20-30 nautical miles)
A2: Outside Al, within range of a Medium Frequency (MF) coast radio station with DSC (approx. 150 nautical miles)
A3: Outside Al & A2, within coverage area of INMARSAT geo-stationary satellite system (between approx. 70 degrees North and 70 South)
A4: Remaining area outside Al, A2, A3 (i.e. Polar Regions)

Summary of GMDSS Carriage Requirements: (See Figure 2)

- Sea area Al ships will carry VHF equipment and either a satellite or VHF EPIRB.
- Sea Area A2 ships will carry VHF and MF equipment and a satellite EPIRB.
- Sea Area A3 ships will carry VHF, MF, a satellite EPIRB and either HF or satellite Communications equipment.
- Sea Area A4 ships will carry VHF, MF and HF equipment and a satellite EPIRB.
- All ships will carry equipment for receiving MSI broadcasts.

Brief Equipment Descriptions:

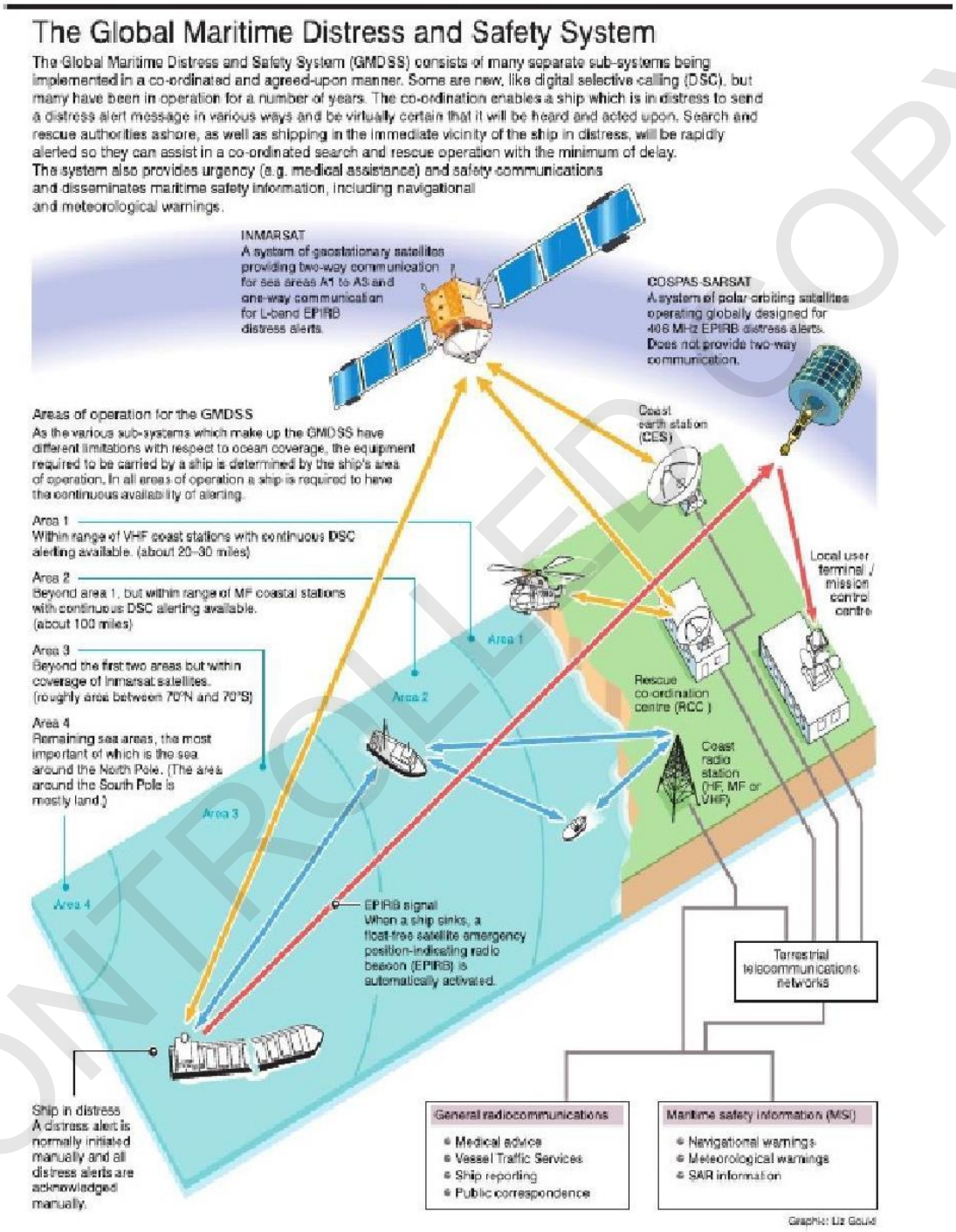
VHF Radio with Digital Selective Call (DSC)

DSC uses channel 70 as an emergency channel (159.525 MHz)
DSC allows selection of a specific shore station, ship or all ships

VHF Radio with channels 6, 13 and 16:

DSC is not required on this radio.
This is the same radio normally in use on all ships.

Channel6:	156.3 MHz.	Ship to aircraft
Channell3:	156.65 MHz.	Bridge to Bridge
Channell6:	156.8 MHZ.	Radiotelephone DISTRESS with Watch



2.0 Principles of maritime radio communications.

NAVTEX Receiver:

If the ship trades in an area where NAVTEX service is provided, it must can-y this MF receiver. It works on 518 kHz in English and 514 kHz in the local language of the broadcasting shore station. One can program the type of information received, except for distress information. Distress information will be received regardless.

INMARSAT Satellite Communications System:
The standard A system provides a full variety of services; Telephony, Direct Printing Telegraphy, Data Communications, Facsimile & Slow Sean TV.

INMARSAT Enhanced Group Call (EGC):
This satellite receiver allows group oriented calls to ships for Maritime Safety Information. The EGC capability is built-in to INMARSAT-C stations, but INMARSAT-A stations require a separate stand alone EGC receiver.

MF 2182kHz Radiotelephone Transmitter with Alarm Signal Generator:
This is the same "SSB" type of radio transceiver normally in use aboard ships.

MF 2182kHz Watchkeeping Receiver:
This is the same receiver normally used aboard ships dedicated for watchkeeping

MF Radio Telephone Installation with DSC
The MF 2182 kHz radiotelephone radios being built for GMDSS have the capability of Alarm Signal Generation on 2182 kHz and DSC on 2187.5 kHz.

The following may be substituted for the MF Radio Installation:

- MF/HF Radio Installation (1.6- 4 MHz, 4-27 MHz)
- DSC on 2187.5 and 5 DSC HF Frequencies
- Receive/Transmit (R/T) on 2182 kHz + 5 R/T HF Frequencies
- Narrow Band Direct Printing (NBDP) on 2174.5 kHz + 5 NBDP Frequencies

406 MHz Satellite Emergency Position Indicating Radio Beacon (EPIRB):
This float-free device should be located in a place that allows easy access and transportability. It must be capable of automatic or manual activation and must be capable of being operable from

the navigation bridge. Please note that an EPIRB operating in the L-Band (1.6 GHz) may be used in place of the 406 MHz EPIRB. The L-Band EPIRB must have the same capabilities to the survival craft. (Note: The lanyard must not be tied to the sip or the EPIRB will go under with the ship.)

Survival Craft:
Two 9 GHz Search and Rescue Transponders (SART)

The SARTs are mounted on each survival craft at least one meter above the water. The SART provides a highly recognizable signal on any radar screen operating on 3 cm (9 GHz). It's useful range depends on the height above the water with range of 5 miles or less. The SART is used to assist in locating survival craft even in adverse weather.

Three portable two-way VHF Radios:
Waterproof portable VHF radios are required to be carried in survival craft.

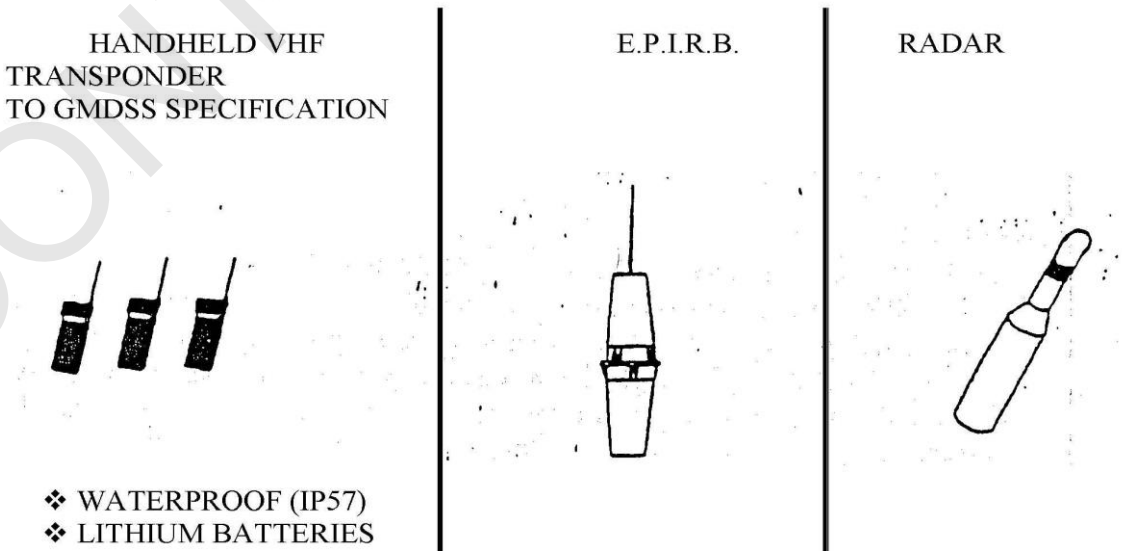
Note: Vessels sailing in Area A4 outside INMARSAT coverage are required to carry an MF/HF Radio Installation.

Implementation and Carriage Requirement Timetable: (See figure 3)

The GMDSS is being implemented in stages and as a result, the IMO has developed a timetable for the carriage of equipment. GMDSS is to be implemented in stages from 1 February 1992 to 1 February 1999. GMDSS will be compulsory for all passenger ships and cargo vessels above 300 (Gross Registered Tons) GRTs. The implementation will require these ships to carry new types of equipment. The equipment carriage requirements depend on the vessel area of operation.

All ships CONSTRUCTED after 1 February 1992 are to be fitted with SART's and two-way VHF radiotelephones for survival craft.

SURVIVAL CRAFT EQUIPMENT



- STORED IN LIFEBOAT

Two for 300 GT to 500 GT Three for 500 GT or greater	SARTAT /COSPAS 406 MHz or L Band	One for 300 to 500 GT Two for 500 GT or

All ships CONSTRUCTED before 1 February 1992 are to be fitted with SART's and two-way VHF radiotelephone by 1 February 1995.

All ships to be fitted with NAVTEX receiver (or EGC receiver if ship sails outside area of NAVTEX coverage) and a satellite EPIRB by 1 August 19993.

All ships to be fitted with at least one 9 GHz (3 cm) radar by 1 February 1995.

All ships to comply with appropriate GMDSS requirements by 1 February 1999.

Transition Period:

Although the IMO recommends that the Administrations introduce GMDSS as early as possible, the regulations allow for a 7 year transition period (February 1992 to February 1999).

During this period there will be both ships with GMDSS equipment and ships that have not made the change from the other systems.

To provide for mutual distress alerting between such ships, most GMDSS equipped ships will be required to retain the 2182 kHz watchkeeping receiver and means of transmitting the Radiotelephone two-tone alarm signal on 2182 kHz.

Although GMDSS ships are not required to maintain a 500 kHz watch, it is important to recognize that many ships will continue to operate under the 500 kHz Morse system. This is especially true where the expense of the equipment and the advantages of having electronics repair capability aboard the ship are important to the shipping company. These ships will be capable of operating both under the GMDSS and 500 kHz systems

Safety of Life at Sea (SOLAS) Requirements:

SOLAS regulations require that every ship be capable of performing the following functions an efficient manner.

l. Of transmitting ship-to-shore distress alerts by at least 2 separate and independent means, each using a different communications service.
2. Of receiving shore-to-ship alerts.
3. Of transmitting and receiving ship-to-ship alerts
4. Of transmitting and receiving search and rescue coordinating communications.
5. Of transmitting and receiving on-scene communications.
6. Of transmitting and receiving locating signals.

7. Of transmitting and receiving Maritime Safety Information.
8. Of transmitting and receiving general radio communication relating to management and operation of the ship.
9. Of transmitting and receiving bridge-to-bridge communications.

Maintenance Requirements:

The SOLAS regulations require that each Administration must ensure that the radio equipment is maintained to provide the availability of the functions stated above.

Ship engaged in trading within Areas Al and A2 are requiring ensuring availability by using either of the methods listed below. Trading within Areas A3 and A4 are required to employ combination of at least 2 of the following methods:

- Duplication of Equipment:
- Equipment that can perform the same function in terms of communications. It does not have to be the exact same equipment (i.e. HF instead of duplicate INMARSAT Standard- A or Standard-C. Still must make provisions for EGC receiver.)
- Shore-based Maintenance:
- Arrangements with a service company do not need to be service contracts.
- On-board Maintenance:
- Requires a crew member holding a GMDSS Maintainer Certificate/License.

The regulations allow ship owners to select options that do not include the need to provide on-board maintenance. Regardless of the method chosen, no ship will be permitted to leave port if the ship cannot perform all the GMDSS functions. Should the ship operate in port where maintenance availability is questionable, the ship owner may choose to carry a GMDSS Maintainer to avoid delays.

GMDSS Communications System:

The GMDSS system is made up of shore range, medium range, long range, and satellite communications, an understanding of the structure of the system will help you work with the system's components.

- Terrestrial Communications - short-range VHF

Short range communications provided by VHF. DSC may be used for initial calls followed by normal radiotelephone. NBDP (Telex) is not used on VHF.

- Terrestrial Communications - Medium-Range MF

Medium range communication is provided by JVIF in the 2 MHz band. DSC is used for initial distress alerts from ships followed by radiotelephone or NBDP Telex communications.

- Satellite Communications- INMARSAT

Satellites are used for both ship-to-shore and shore-to-ship communications. The INMARSAT system uses 4 geo-stationary satellites which are located directly above the equator. These satellites operate in the 1.5 and 1.6 GHz (L-band) range. The system provides capabilities for distress alerts as well as broadcast of Marine Safety Information (MSI) and commercial

communications. The INMARSAT system also provides for distress alerting by L-Band EPIRB's operating in the 1.6 GHz range.

- Satellite Communications- COSPAS-SARSAT

The COSPAS-SARSAT system of polar orbiting satellites is used for detection and location of 406.025 MHz EPIRB's (referred to as the 406 MHz EPIRB). Note these satellites are not geo-stationary. It may take as much as 3 hours before an EPIRB signal is detected because the polar orbiting satellite must pass over or "see" the EPIRB signal. The satellite can also detect and locate EPIRB's operating on 121.5 and 243.0 MHz. The 406 MHz EPIRB is the required EPIRB. The FCC requires that the EPIRB also have 121.5 MHz horning capability in order to allow location by aircraft. Not all countries have adopted this additional USA requirement.

Communications for Dissemination of Marine Safety Information:

Marine Safety Information (MSI) provides crucial information that can avoid an accident or injury, provides distress alert information to cet1ain vessels and assists in Search and Rescue (SAR) operations. MSI also uses the information provided by ships in preparing the broadcasts. The information provided by and for ships includes ship position and movement reports, navigational and meteorological warnings and all other safety and urgency massages. MSI is broadcast using NBDP on HF and Enhanced Group Call (EGC) on the INMARSAT system. MSI is also transmitted via the INMARSAT Satellites. These broadcasts can be received on an INMARSAT-C ship terminal since it has built in EGC capability. INMARSAT-A ship terminals cannot receive EGC and therefore a separate EGC receiver is necessary.

Frequencies for MSI Broadcast in NBDP by Coast Stations:

490.0 k:Hz (after full implementation of GMDSS Feb. 1999.)
518.O k:Hz (NAVTEX Service)
4209.5 kHz. (NAVTEX Service)
4120.0 kHz
6314.0 kHz
8416.5 kHz
12579.0 k:Hz
16806.5 k:Hz
19680.5 kHz
22376.0 kHz
26100.5 kHz

Another automatic system used for reception of local weather and navigational information is know as NAVTEX and operates on frequency 518 kHz.
GMDSS Distress Alerting:
Distress alerting can be accomplished by 406 MHz EPIRB, L-Band EPIRB, INMARSAT-A, or INMARSAT -C. The Coast Earth Station (CES) will connect the call directly to the Marine Rescue Coordinating Center (MRCC). Each CES operating in the INMARSAT system has direct phone and telex line connection to the MRCC or RCC.

DSC alerts may be sent by MF, HF or VHF to a Coast Station for further transmission to a RCC. Ship Stations which receive a DSC alert may, only if necessary, relay an alert to a Coast

Station by DSC on MF, HF or VHF. Ship Station may also use INMARSAT-C or INMARSAT-C to relay an alet1 directly to a RCC.

GMDSS has well established procedures for distress alerting. These procedures recognize that a vessel in distress may use any means possible to make its distress and position know, even if GMDS S procedures are not followed.

GMDSS Distress, Urgency, and Safety Communications:
GMDSS follows regulations and procedures which are obligatory in the maritime mobile service. This section contains the regulations and procedures for the operational use of the GMDSS. Neither provision nor regulation prevents the use by stations on board ships, or aircraft engaged in SAR, of any means at their disposal to assist a station in distress.

DISTRESS & SAFETY FREQUENCIES FOR USE IN GMDSS

DSC DISTRESS & SAFETY CALLING	RADIOTELEPHONY DISTRESS & SAFETY TRAFFIC	NBDP DISRESS & SAFETY TRAFFIC
2187.5 kHz	2182.0 kHz	2174.5 kHz
4207.5 kHz	4125.0 kHz	4177.5 kHz
6312.0 kHz	6215.0 kHz	6268.0 kHz
8414.5 kHz	8291.0 kHz	8376.5 kHz
12577.0 kHz	12290.0 kHz	12520.0 kHz
16804.5 kHz	16420.0kHz	16695.0 kHz
VHF CH 70	VHF CH 16	- * -

The transmission of a DISTRESS ALERT indicates that a mobile unit or person is in distress and requires immediate assistance.

Distress, Urgency and Safety Communications rely on use of MF, HF, VHF and satellite communications for alerts and have absolute priority over general communications signals. Distress alerts on MF, HF and VHF are sent using DSC. The Distress Alert shall only be sent on the authority of the Master.

All stations which receive a distress alert by DSC shall immediately cease any transmission capable of interfering with distress traffic and shall continue to maintain a listening watch until the call has been acknowledged. If the call is not acknowledged, then the ship may act as relay using DSC to a coast station.

The DSC distress alert signal shall provide:

1. Ship identification (9 digit Maritime Mobile Service Identity (MMSI) number)
2. Ship position
3. Mode to be used for subsequent communication (SSB, NBDP, INMARSAT) (normally SSB Radiotelephone (J#E emission). If NBDP is to be used, Forward Error Correcting (FEC) mode shall be used since it can be received by all stations.)
4. May contain nature of the distress (fire, explosion, sinking, etc.)

3.0 GMDSS communication Systems

Transmission of ship-to-shore distress alerts are used to warn Rescue Coordination Center (RCC) via Coast Stations (CS) or via Coast Earth Stations (CES). Ship-to-Ship distress alerts are used to warn other ships in the vicinity of the particular ship in distress.
If the alert signal were made on 2182 kHz, the two-tone alarm signal would have to be sent prior to the call. Many bridge watch receivers on 2182 kHz will only respond after sensing the two-tone alarm signal.

A distress call can only be sent on the authority of the Master.
Transmission of a DISTRESS by Radiotelephony:

The Distress Signal: The signal is MAYDAY. This signal indicates that immediate assistance is required.

The Distress Call:
MAYDAY (spoken 3 times)
THIS IS (OR DE spoken as DELTA ECHO)
NAME OF VESEL IN DISTRESS (spoken 3 times)
The Distress Message:
MAYDAY
NAME AND CALL SIGN OF VESSEL IN DISTRESS
POSITION/TIME
NATURE OF DISTRESS
TYPE OF ASSISTANCE REQUIRED
OTHER RELEVANT INFORMATION WHICH MAY ASSIST RESCUE
OVER (Waiting for a response)

Example:
MAYDAY, MAYDAY, MAYDAY
THIS IS M/V NEVERSAIL/NXYZ
POSITION 37.4 ON 71.35W 1500Z
TAKING ON WATER
REQUEST IMMEDIATE ASSISTANCE
EPIRB AND SART ACTIVATED
20 PERSONS ON BOARD
OVER

Transmission on a Shore-to-Shore Distress Alert Relay:

A station or RCC which receives a distress alert shall initiate the transmission of a shore-to-ship distress alert relay. The relay shall be appropriately addressed to all ships, to a selected group of ships, to a specific ship, or to a specific area, by means of satellite or terrestrial communications. The distress alert relay shall contain the identification of the ship in distress, its position and any other information which may facilitate the rescue.

Transmission of a Distress Alert by a Station not Itself in Distress:

A station that learns a vessel is in distress may transmit a distress alert in any of the following cases.

- When the vessel is not in a position to transmit a distress alert.
- When the Master of the vessel, not itself in distress, considers that further help is necessary.

MAYDAY Relay calls should be preceded by the Two-Tone Alarm Signal when possible.

The station transmitting the distress alert relay should indicate that it is not in distress itself by using the following format.

MAYDAY RELAY (spoken 3 times)
THIS IN M/V VIGILANT (spoken 3 times)

The relay call is then followed by the received distress message.

Procedure for Acknowledgment of Receipt of Distress Alerts:
A coast station using DSC to acknowledge the receipt of a distress alert shall acknowledge with DSC on the same frequency on which the call was received.

This acknowledgement shall include the identification of the ship in distress and will be addressed to all ships.

Ship stations that receive a distress alert shall inform the Master immediately.
Ship stations in areas where reliable communications with one or more coast stations should delay acknowledgement for a short period so that receipt can be acknowledged by a coast station.

Ship stations operating in areas where reliable communications with a coast station are not practicable should, as soon as possible, acknowledge receipt and inform a RCC through a Coast Station or Coast Earth Station.
A ship station receiving a DSC alert on HF should wait 3 minutes, and if no acknowledgement is heard from a coast station, should relay the alert to a coast station.

A ship station acknowledging receipt of a DSC distress alert should acknowledge receipt by using radiotelephony on the distress and safety frequency associated with the same band on which it received the alert.
If a ship station acknowledgment by DSC on the same frequency used for the transmission of the alert.

Acknowledgment by radiotelephony should be given in the following form:

The distress signal MAYDAY.

The name/call sign of the station in distress (Spoken 3 times)
The words THIS IS (or DE spoken as DELTA ECHO)
The name/call sign of the station acknowledging receipt (Spoken 3 times)
The word RECEIVED (or RRR spoken as ROMEO ROMEO ROMEO)
The distress signal MAYDAY

Acknowledgment by NBDP Receiving a distress alert signal should follow the form below.

The distress signal MAYDAY
Call sign of the station sending the distress
The word DE
The call sign of the station acknowledging receipt of the distress alert
The signal RRR
The distress signal MAYDAY

Making Preparations for Handling Distress Traffic:

On receipt of a distress alert transmitted by DSC, ship stations and coast stations must set a watch on the radiotelephone distress and safety frequency associated with the DSC frequency on which the distress was received.

Ship stations with NBDP equipment must set a watch on the NBDP frequency associated with the distress and safety frequency alert signal if it was indicated that NBDP is to be used for subsequent communications.

If possible, a watch on the radiotelephone frequency associated with the distress alert frequency should also be maintained.

Distress Traffic:

Distress traffic consists of messages relating to the immediate assistance required by the ship in distress, including SAR and on-scene communications.
When establishing distress traffic communications by radiotelephony, all calls should be preceded by the distress signal MAYDAY.
For distress traffic by NBDP, all Telex messages should be preceded by at least one carriage return, line feed, one letter shift and the distress signal MAYDAY.
Distress communications by NBDP should be in the Forward Error Correction (FEC) broadcast mode so that all stations can copy the traffic. The Automatic Request for Repetition (ARQ) mode may be used when it is advantageous to do so.
How Distress Traffic Is Controlled:
The RCC, the On-Scene Commander (OSC), the Coordinator Surface Search (CSS), the Coast Station involved or the ship in distress may impose silence on any stations which interfere with distress by using the following commands.

In radiotelephony	SEELONCE MAYDAY
In NBDP (FEC mode)	SILENCE MAYDAY

Stations not in distress and not taking part in a distress operation my impose silence on interfering stations by using the command

Radiotelephony	SEELONCE DISTRESS

Any ship aware of distress traffic and cannot itself render assistance should monitor such traffic until that assistance is being provided.

All stations which are aware of distress traffic, and which are not taking part, are forbidden to transmit on the frequencies on which the distress traffic is taking place, except in the following circumstances.

When complete silence is no longer considered necessary, the control station shall transmit, on the frequency used for distress traffic, a message addressed to "all stations" indicating that restricted working may by resumed by using the following form:

MAYDAY
HELLO ALL STATIONS (or CQ spoken as CHARLIE QUEBEC) 3 times
The words THIS IS (or DE spoken as DELTA ECHO)
The name/call sign of the station sending the message
The time of handing in of the message
The name/call sign of the vessel in distress
PRU-DONCE

When distress traffic has ceased the controlling station will initiate a message indicating that distress traffic has ended and that normal working may resume by using the following form:

In radiotelephony:

MAYDAY
HELLO ALL STATIONS (or CQ spoken as CHARLIE QUEBEC) 3 times
The words THIS IS (or DE spoken as DELTA ECHO)
The name/call sign of the station sending the message
The time of handing in of the message
The name/call sign of the station which was in distress
The words SEELONCE FEENEE

In NBDP:

MAYDAY
CQ
DE
The call sign of the station sending the message
The time of handing in of the message
The name/call sign of the station which was in distress
SILENCE FINI

How On-scene Communications Are Controlled:

Control of on-scene communications is the responsibility of the unit coordinating Search and Rescue (SAR) operations.

Simplex frequencies are used so that all on-scene stations can have access to relevant information.

The preferred on-scene frequencies are:

In radiotelephony In NBDP
156.8 MHz (CH 16 VHF) 2174.5 kHz
2182 kHz

In addition, the frequencies 3023 kHz, 4125 kHz, 123.1 MHz and 156.3 MHz (CH 06) may be used for ship-to-aircraft on-scene radiotelephony communications.
The selection of frequencies is the responsibility of the unit coordinating the search and rescue operations.

4.0 Other GMDSS equipment.

Urgency and Safety communications include:

Navigational and meteorological warnings and urgent information

Ship-to-ship safety of navigation communications
Ship reporting communications
Communications supporting SAR
Communications related to navigation and movement of ships
Other urgency and safety communications

Urgency Communications:

A radiotelephony or DSC urgency call shall be sent only on the authority of the Master.

The DSC urgency call format and the radiotelephone urgency signal indicate that the calling station has an urgent message to transmit concerning the safety of a mobile unit or person.
The urgency message shall be preceded by the urgency signal PAN-PAN repeated 3 times and the identification of the calling station.

The urgency call and message shall be sent on one or more of the distress and safety calling frequencies.

In the case of a long message, medical call, or in areas of heavy communications traffic where messages have to be repeated, the urgency message may be sent on a working frequency.

Stations receiving an urgency call should listen for 3 minutes and if no message is heard, the nearest Coast Station should be advised and normal working may resume if it does no interfere with the urgency traffic.

The announcement of the urgency message shall be made on one or more of the DSC frequencies using the urgency call format:

In Radiotelephony:

The urgency signal consists of the words PAN-PAN repeated 3 times. The following is an example of the urgency call and message from the vessel M/V EXPRESS which has lost rudder steering and requires a tow.

PAN PAN PAN PAN PAN PAN
HELLO ALL STATIONS (Spoken 3 times)
THIS IS

M/V EXPRESS (Spoken 3 times)
POSITION 37.50N 75.32 W
LOST RUDDER STEERING, DRIFTING NORTH AT 3 KNOTS
REQUIRE A TOW URGENTLY
OVER

In NBDP, the urgency message will be preceded by the urgency signal and the identification of the transmitting station. NBDP urgency communications shall be established in the Forward Error Correction (FEC) mode. The Automatic Request for Repetition (ARQ) mode may be used afterwards if advantageous (Station-To-Station).

Example of an urgency call and message from the M/V EXPRESS which has lost rudder steering:

PAN PAN
DE
NXYZ (call sign)
POSITION 37.50N 75.32W
LOST RUDDER STEERING DRIFTING NORTH AT 3 KNOTS
REQUIRE A TOW URGENTLY
OVER

Civilian or military personnel, whose sole purpose is medical transport, will follow their urgency signal with the word MEDICAL as follow:

PAN PAN MEDICAL (Spoken 3 times)

Safety Communications:

The DSC safety call format and the radiotelephony signal indicate that the calling station has an important navigational or meteorological message to transmit.

The announcement of the safety message shall be sent on one or more of the DSC frequencies.

The safety message shall be preceded by the safety signal, repeated 3 times and the identification of the transmitting station.

In radiotelephony, the safety signal is the word SECURITIE

Example of a safety call followed by a radiotelephony safety message:

SECURITE SECURITE SECURITE
HELLO ALL STATIONS
THIS IS M/V EXPRESS
WE HAVE LOST OUR RUDDER
WE ARE ANCHORED IN THE WEST BOUND TRAFFIC LANE
REQUEST THAT ALL SHIPS KEEP CLEAR
OVER

Intership Safety of Navigation:

The frequency 156.65 MHz (CH13) is used for intership navigation safety communications (Bridge-to-Bridge).

Use of Other Frequencies for Distress, Urgency, Safety, Communications:

Radiocommunications for distress, urgency and safety may be conducted on any appropriate frequency, including those used for public correspondence.

Element 7C2 – NOROW BAND DIRECT PRINING

NBDP is a high frequency radio Telex terminal providing general error-free telex message transfer and distress message handling via MF/HF SSB radiotelephone over several channels at 100 baud. (Also called SITOR; Simplex Teletype Over Radio.) Normally a NBDP terminal consists of a CRT visual display, a keyboard, a 3.5" floppy disk drive and a printer.
General telex communications are made with other maritime stations or coast stations.

GMDSS requires an NBDP terminal for Maritime Safety Information (MSI) on all passengers' ships and cargo vessels of 300 GRT or more navigating in Sea Area A4 as a computer installation or A3 as an alternative to INMARSAT.

Automatic Telex Over Radio (ATOR)

Telex operates in one of the operator select modes of FEC (Forward Error Correction), SELFEC (Selective Forward Error Correction), or ARQ (Automatic Request for Repetition.

Forward Error Correction (FEC) Mode:
This mode allows broadcast to all stations and is one way only. Information is sent as continuous repeat of each character every 250 millisecond. The receiving station has 2 opportunities to receive each character. If a character is missed, both transmissions a space will be printed. If a number of characters are missing due to noisy received signals, the telex modem will revert to standby.

Selective Forward Error Correction (SELFEC) Mode:
This is similar to FEC, but it can only by received by one specified station. Again, this is a way mode.

Automatic Request for Repetition (ARQ) Mode:
In ARQ, the "sending" station transmits a block of 3 characters and the "receiving" stations responds with either a 1-character acknowledgment of the receipt of a valid block or negative acknowledgment indicating that the block should be resent. Following the acknowledgement, the "transmitting" station will send a new block or retransmit the previous block, as required. The advantage of this mode is that the message can be correctly receive in very poor conditions. This is used between 2 specific stations only.

FREQUENCIES FOR MSI NBDP BRADCASTS BY COAST STATIONS

490 kHz* 518 kHz

4209.5 kHz**	4210.0 kHz
6314.0 kHz	8416.5 kHz
12579.0 kHz	16806.5 kHz
19680.5 kHz	22376.0 kHz

* For use after full implementation of GMDSS – February 1999.
** NAVTEX service.

INMARSAT

Introduction

The development of satellite communications and advanced communications technology provided one of the motivating factors for development of the GMDSS at the IMO.
INMARSAT services include Telephony, Direct Printing Teletype, Data Communication, Facsimile and Slow-Scan Television.

Satellite communications are used ship-to-shore, shore-to-ship and ship-to-ship.
INMARSAT system uses a network of 4 geostationary satellites which provide a mean receiving distress alerting from ships using Ship Earth Stations (SES). Subsequent two-way communications use telephone or telex. Broadcast of Maritime Safety Information (MSI) alsoprovided by the INMARSAT system.

INMARSAT Satellites are located above the equator and are geostationary in that they remain in the same position with respect to a given point on the surface of the Earth. They are 36000 Kilometers or 23300 miles above the equator, over the Atlantic (2), Indian, and Pacific regions. There are both operational and back-up satellites.

The satellites are:

Atlantic Ocean Region West	AOR-W	55.5W
Atlantic Ocean Region East	AOR-E	15.5W
Indian Ocean Region	IOR	64.5 E
Pacific Ocean Region	POR	180 E

Each satellite has an area of coverage called the footprint. Within each coverage area there is a Network Coordination Station (NCS) and a number of Coast Earth Stations (CES). The term

Land Earth Station also refers to CES. The NCSs and CESs provide the link from a ship to the terrestrial telephone, telex and data networks, Each NCS and CES in the program must meet INMARSAT high standards and provide reliable connections with an associate with Rescue Coordination Center (RCC) in the event of an emergency.

INMARSAT-A is a system providing Voice, Fax, Telex, Data and Slow-scan TV on a real time basis. It provides Distress Alerting. It does not have EGC.

INMARSAT-B is a digital version of "A", making it more efficient than "A" and will eventually replace "A".

INMARSAT-C is a lightweight, relatively inexpensive digital system providing store and forward telex and distress alerting. No voice services.

INMARSAT-M is a mobile digital system that has limitations and does not meet GMDSS requirements. (Los speed data only, no telex, no video and low quality voice communications.)

5.0 Distress alerting

The Operational Control Center (OCC) will co-ordinate all the INMARSAT daily operation system.
OCC has been set up in the INMARSAT headquarters.
OCC is operating on an around-the-clock basis to perform its duties, as listed below.

(1) Communication and arrangement with the Satellite Control Centers: INTELSAT, ESA and CGC.
(2) Communications and arrangement with the NCSs and CESs.
(3) Acquisition, statistical processing and distribution of various operational data.
(4) Communications and arrangement concerning various types of tests using the satellites.

Note: OCC is equipped with two SESs to conduct communication with Network Coordination Station and CESs in AOR and IOR. These ship terminals are the JRC Model JUE-15( ) and one JUE-45A.

Space Segment

The INMARSAT space segment consists of geostationary satellites and their associated facilities (TT&C) for the tracking, telemetry, and command, monitoring the satellites and other facilities and equipment needed to support them.
INMARSAT has decided to lease all space segments for it's first generation needed in three ocean regions. Each region shall have at least two satellites: one for operational and the other for stand-by.

The satellites have channel capacities as listed below.

Satellite	Channel Capacity (equivalent to voice channel)
MARISAT	10 CHANNELS
MARECS	50 / 60 CHANNELS
INMARSAT V MCS	30 CHANNELS
INMARSAT-2	250 CHANNELS

The second generation of INMARSAT satellites has been launched one by one after Oct 1990 to fill the expected increase of traffic demands. However, the Voice Activated Carrier Suppression system has been introduced to increase channel capacity practically.

Coast Earth Station (CES)
Satellite Ocean Region and Coast Earth Station

The service area of the INMARSAT system is basically determined by the longitudinal location of the associated geostationary satellite.
The legal limitations and physical problems which will disturb the communication service are also described hereafter.

Geostationary satellite orbital location.
The longitudinal location of each satellite in the geostationary orbit must be determined so as to adequately cover each ocean area.

The satellites must cover the following areas:
Atlantic Ocean Region: Umm al-Aish station in Kuwait and the Gulf of Mexico.
Indian Ocean Region: Eik station in Norway, Yamaguchi station in Japan.
Pacific Ocean Region: Singapore station.

It is impossible to make a definite plan on the longitudinal location of a satellite in the geostationary orbit. Because the final position of the satellite is closely related to the location of the CECs which are planned to be located along the fringe of the tentative satellite coverage (E1 5° line). It is necessary to confirm by a field communication test whether such CES can perform reliable communication services.

REGION	OPERATIONAL SATELLITES	S'TD-BY SATELLITE
AOR-W	INMARSAT-2 F4 May'92 54.0°W	MAREC B2 Nov'90 55.5°W
AOR-E	INMARSAT-2 F2 Apr' 91 15.5°W	MARISATF1 '76 14.6°E INTEL-V MCS-B May'83 18.5°W
IOR	INMARSAT-2 F1 Dec'90 63.0°E	INTEL-V MCS-A Sept'82 64.5°E MARISAT F3 Oct'76 72.5°E
POR	INMARSAT-2 F3 Jan'92 178.0°E	INTEL-V MCS-D Mar'84 180°E MARISAT F2 '76 176.1°E

In the Atlantic Ocean Region, May 1, 1982 the MARISAT-F1 which has 10 voice equivalent channels had been replaced with the MARECS-A satellite (Europe) having 50 voice equivalent channels. Then, Jan 1985 it has been again replaced with the MARECS-B2.

In Indian Ocean, the MARISAT-F3 has been replaced with the INTELSAT MCS-A having 30 voice equivalent channels since 1982.

In Pacific Ocean, MARISAT-F2 has been first replaced with MARECS-B2 (50 voice channels) Jan 1985, then some trouble of MARECS A in AOR has decreased its channel capacity from 50 to 30 and MARECS-A and MARECS-B2 to be swapped.

Atlantic Ocean Region was divided into two regions as AOR-W and AOR-E by changing the location of one out of 2 near-by satellites. And four-satellite operation excluded coverage gap.

After that, these 1st generation satellites have become difficult to deal with the increasing traffic in all ocean regions. And each of 2nd generation satellite was located in place of it at every ocean region respectively.

The dedicating satellite channels in the four ocean regions are listed below.

REGION	VOICE	TELEX (excluding NCS)
AOR-W	?	154 (equivalent to 7 voice channels) --------- 5 CESs
AOR-E	?	374 (equivalent to 17 voice channels) -------- 14 CESs
IOR	?	330 (equivalent to 15 voice channels) -------- 14 CESs
POR	?	198 (equivalent to 9 voice channels) --------- 9 CESs

IOR	Eik	(Norway)	04
	Thermopylae	(Greece)	05
	Arvi	(India)	06
	Odessa	(Ukraine)	07
	Ata	(Turkey)	10
	Beiging	(China)	11
	Burum	(Netherland)	12
	Gnangara	(Australia)	13-1
	Boumehen	(Iran)	14
	Jedda	(Saudi Arabia)	15
	Psary	(Poland)	16
POR	Santa Paula	(U.S.A.)	01
	Perth	(Australia)	02
	Yamaguchi	(Japan)	03
	Kumsan	(Korea)	04
	Ventosa	(Singapore)	10
	Beijing	(China)	11
	Nakhodka	(Russia)	12
	Niles Cayon	(U.S.A.)	13-1

CESs under planning is listed in the next table shown below.

REGION	COAST EARTH STATION	COUNTRY
AOR-E	BALCARCE (MAR DEL PLATA)	ARGENTINA
	BUITRAGO	SPAIN
	BARNA	BULGARIA
		CUBA
IOR	KARACHI	PAKISTAN
	VARNA	BULGARIA
POR	LAKE COWICHAN	CANADA

These CESs are installed and operated by associated Signatories or authorized organizations in the countries. Accordingly, the charges rated per CES are slightly different.

Since there are multiple CESs in each region, a ship sailing within the region must use a predetermined Coast Earth Station ID number shown in next table for selecting desired CES.

The ships in the region with this satellite. If the result of the test is not good, the satellite shall be moved to a new position. The next figure indicates the service areas of EL 5° relative to the orbital locations of the INMARSAT satellites. The INMARSAT system allows a maximum of 15 CESs in each ocean region. The CESs have the following major roles in addition to the primary role of making communication circuit.

(1) Assign telex channel to SES via NCS to establish telex circuit.
(2) Transfer ship's request for voice channel assignment to NCS.

INMARSAT CESs in service are listed in next table.

CESs in operation (1/2)

REGION	COAST EARTH STATION		ID
AOR-W	Southbury	(USA)	01
	Goonhilly	(UK)	02
	Eik	(NORWAY)	04
	Pleumeul Boodou	(France)	11
	Niles Canyon	(U.S.A.)	13-1
	South Bury	(U.S.A.)	01
	Goonhilly	(UK)	02
	Maadi	(Egypt)	03
	EIK	(Norway)	04
	Fucino	(Italy)	05
	Umm Al-Aish	(Kuwait)	06
	Odessa	(Ukraine)	07
AOR-E	Ata	(Turkey)	10
	Pleumeul Bodou	(France)	11
	Burum	(Netherland)	12
	Staten Island	(USA)	13-1
	Tangua	(Brazil)	14
	Raisting	(Germany)	15
	Psary	(Poland)	16
IOR	Anatolia	(Turky)	01
	Perth	(Australia)	02
	Yamaguchi	(Japan)	03

NETWORK COORDINATION STATION (NCS)

One of the CESs in each ocean region server as a Network Coordination Statin (NCS) under the contract with INMARSAT and performs additional functions necessary for control and signaling purposes.

The NCS station:
- Assigns telephone and high speed data channels from a common pool;
- Retransmits on a common signaling channel telex channel assignment massages received from CESs;
- Determining if an addressed ship earth station is busy with another call.
- Transmits INMARSAT service announcements as an all shops group (broadcast) call.

The following CESs serve as NCSs:
- Southbury in the Atlantic Ocean Region East and West (USA COMSAT).
- Yamaguchi in the Indian Ocean Region (Japan KDD).
- Ibaraki in the Pacific Ocean Region (Japan KDD).

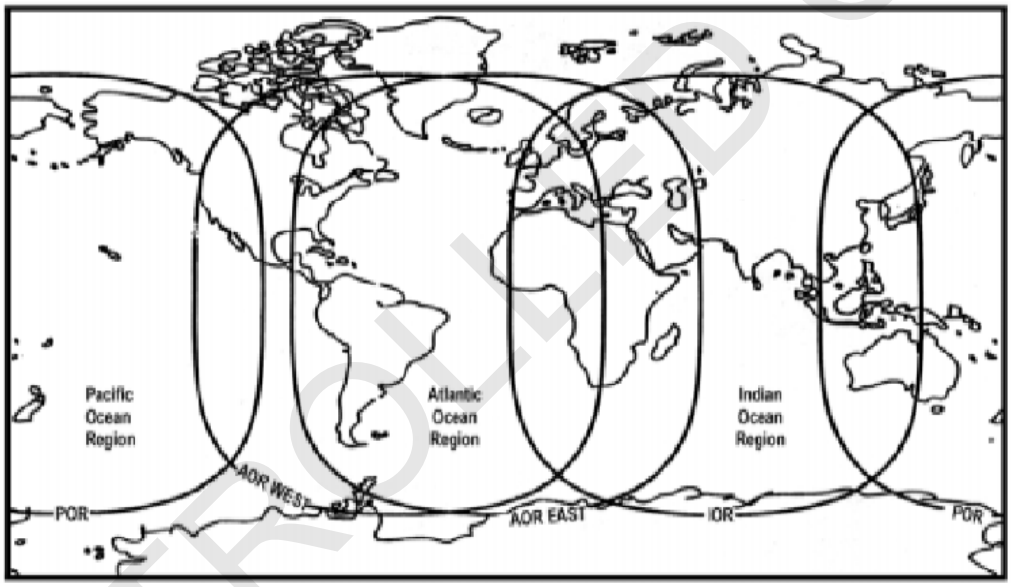
The NCS continuously transmits the "common TDM carrier #0".

The signaling channel in the "common TDM carrier" is called the common signaling channel.

Ship Earth Station (SES):
Specifications and Type – Approval of SES.

The SESs being used in the INMARSAT system can be classified foughly into the following:

(1) Those equipment designed to comply with MARISAT. Specifications and type-approved by MARISAT. They have been automatically type-accepted Feb. 1982 by INMARSAT and supposed to be expired on Aug. 31 1991. However, INMARSAT has changed this termination recently such that new commissioning test for MARISAT SES will not be conducted after certain date which has not been fixed.



Communications Priority Categories:

There are 4 categories of priorities in the INMARSAT System:
- Routine (0)
- Safety (1)
- Urgency (2)
- Distress (3)

Distress Alerting by Ship Earth Stations (SES)

The INMARSAT system provides priority access to distress situations. Each SES is capable of initiating a distress priority. This alert is automatically recognized by the INMARSAT system and a satellite channel is assigned immediately. If all channels are busy, the distress call will preempt a call and a channel will be provided to the SES that initiated the distress call.

Routing of Distress Alerts:

The distress priority activates the allocation of satellite channel and automatically router alert to the appropriate rescue authority. A distress call using a CES will be automatic connected to a Marine Rescue Coordination Center (MRCC).

Initiation of a Distress Alert:
Initiation of a distress alert from a SES is simplified by the use of a "distress button" provided on most SES terminals. Or by imputing a few key strokes on the terminals keyboard.

6.0 Miscellaneous Skills and operational Procedures For General comunications

Merits

(1) Capable of multiple access
(2) Wide coverage
(3) Capable of high-quality and wide-band communications
(4) Suitable for mobile communications
(5) Economical

Problems
Time Delay in Communications

A long-distant telephone circuit usually has two-wire/four-wire converters at the terminal equipment. Mismatched converters will generally cause an echo. This echo-effect will be audibly enhanced with the increase of the time delay. The geostationary satellite is about 35800 km away from the closest earth surface and more than 40000 km apart from the farthest point of the service area. Either of these distances is more or less the same as the entire circumference of the earth.

Radio wave takes 530 m sec. (= 40000 km * 4/300000 km) to travel back and forth between two earth stations via satellite. In particular, when talking over the telephone, the time delay is objectionable. For this reason echo suppressors are always used in the satellite communication circuit to give the necessary attenuation. Recently echo cancellers have been developed and put into practical use. Of course, some inconvenience for conversation due to the delay will still remain, even if the echo can be suppressed or eliminated. Therefore, the connection of a long distance communication circuit between a ship and a land subscriber outside the maritime satellite coverage is tried to avoid using satellite link twice in order to minimize the delay time.

Geostationary Satellite and Its Coverage

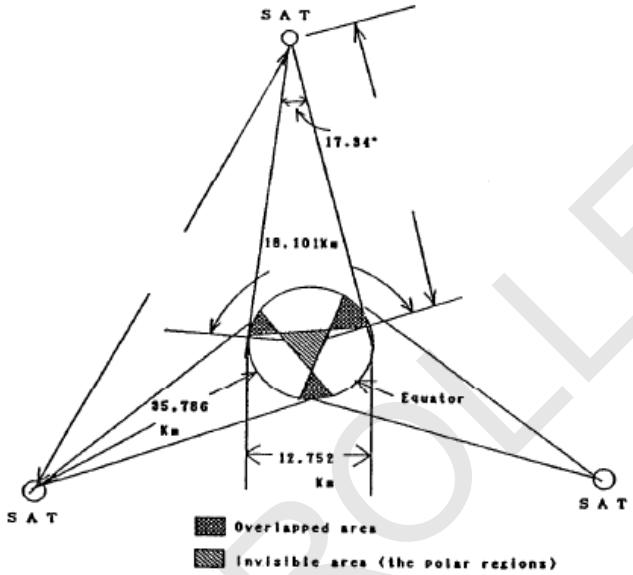
Though geostationary satellites look stationary as seen from the earth, they are synchronized with the earth's rotation. The geostationary satellite is a formal nave given by the International Telecommunication Union (ITU).

The time (T) required for a satellite to revolve round the earth is given by the Kepler's law as follows:

T = 84.4 (1 + h/R) 3/2

T: Time required for a satellite to revolve round the earth (minute).
h: Satellite height above the equator; 35,786 km.
R: Radius of the earth; 6,376 Km.

A geostationary satellite should have a revolution period of 24 hours (more exactly, 23 hours 56 minutes 04 seconds).
Therefore, the satellite height right above the equator should be about 35,800 Km and its revolution speed is 3.1 Km/sec eastward as shown in next figure.



speed=11,070Km/HR
=3.07Km/sec

Invisible area:
Lat 81.3° to 90° N & S
(from EL 0° to -°)

Unstable communication Area:
Lat 76° & 81.3° N & S
(from EL 5° to 0°)
Japan Sohwa Antarctic Base
Lat 70° S

Blocking

The Geostationary Satellite Communications System uses microwaves between SESs and satellite. The microwave has a remarkable nature of straight propagation and no diffraction unlike HF and VHF. If any obstruction exists in this microwave propagation path, the microwave will be interrupted. Various types of blockings are illustrated in next figure. Great care must be taken in selecting the relative location of the SES antenna and an onboard structure to avoid blocking. These blocking problems can mostly be resolved by installing the antenna at a place higher than the on deck obstructions, such as stacks and masts. However, the antenna of a higher location will have more vibration and may be exposed to high temperature exhaust smoke.
Therefore, the location of the Above-Deck-Equipment (ADE) must be determined so that the vibrations and temperature do not exceed the tolerances specified in the individual installation manual.

Effect of Solar Eclipse by the Earth

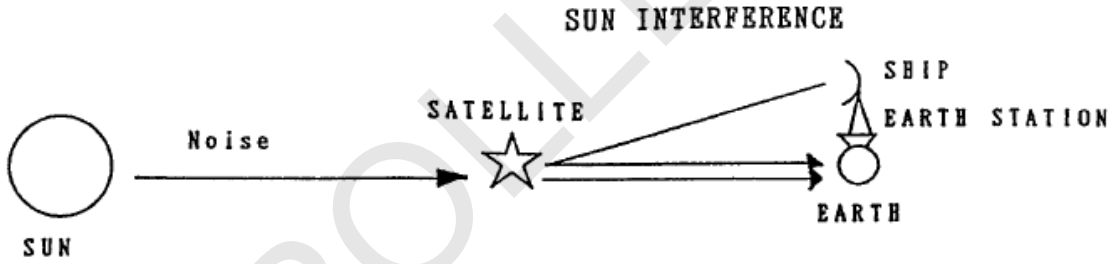
The geostationary satellite enters into a shadow of the earth at midnight around the vernal and autumnal equinoxes.

Maximum solar eclipse, time per day ---69 minutes period of eclipse time --- about 45 days a year.

During this time period, no power is generated in the solar cells, the power supply of the satellite.
To cope with this situation, chemical batteries in particular, Nickel-cadmium (Ni-Cd) batteries are mostly used at present.

Sun Interference
The sun interference occurs at the time of the vernal and autumnal equinoxes every year.

Cause:
When the sun comes closest to the geostationary satellite, the sun, the satellite and the earth are in a straight line as shown.



Interference time duration: Several seconds to several minutes at maximum every day.

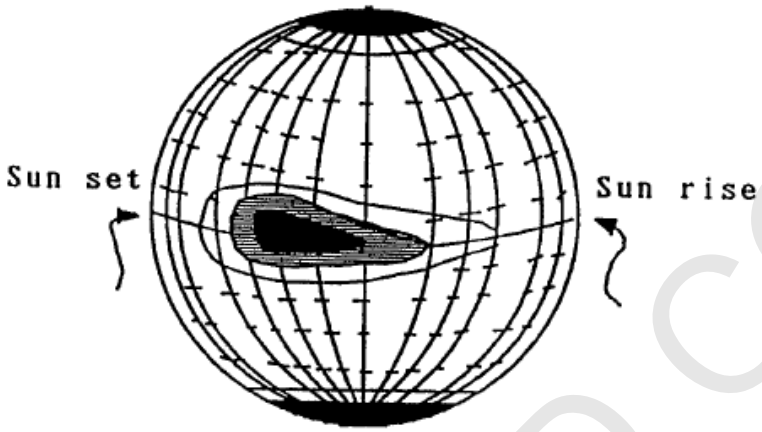
Time period: Five days in each equinox (twice a year)

During this time period, the sun noise entering into the receiver results in reduction of the signal – to noise ratio. The sun noise interferences with RF signals propagating between two earth stations via the satellite and disables the communication. This phenomenon is called "sun interference". It cannot be avoided, unless the satellite involved is switched to a spare satellite.

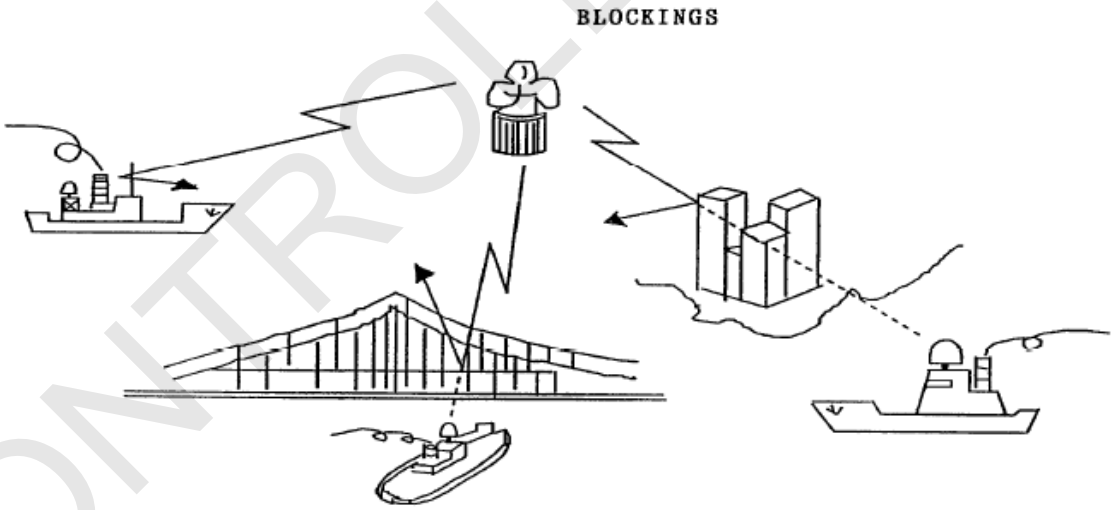
However, each earth station will be subjected to the sun interference for an integrated time of only several minutes at maximum a year (0.02% of a year).

In addition, the occurrence hours can be predicted.
Therefore, the sun interference is not so serious in actual practice.

SINTILATION DISTRIBUTION over HEMISPHERE NIGHT



Intensity distribution of ionospheric scintillation is averaged in the year when the sun activity was comparatively high.
Thicker-shadowed area indicates more intensive scintillation.



INMARSAT-A SHIP EARTH STATIONS

Communications Capability:

INMARSAT-A equipment has the capability of providing telephone, telex, fax and communications. It also has capabilities of broadcast and group calling, paging and video.

Directional Antenna:

A narrow beam with (i.e. high gain) dish antenna is required. The dish is protected by fiberglass housing or radome. The beam antenna is gyro stabilized and synchronized to the satellite.

Antenna Stabilization:

The antenna must remain pointed toward the satellite at all times. This is automatically achieved by the antenna being mounted on a multi-axis platform which is stabilized again pitch and toll motions, and contains elevation and azimuth axis. The azimuth is controlling the ship's gyro compass which feeds information to the SES terminal to counteract course changes. In the event of power failure, the operator will have to reposition dish by imputing the azimuth angle and elevation in order to restore communications to the operation manual for detailed instructions.

Antenna Radiation Hazard:

As with any radio or radar system, the ship's crew should be made aware of the radiation hazards of radio frequency beam emitted from the dish antenna. Extreme and extended exposure to radio frequency radiation can cause cancer, birth defects, eye damage, and neurological damage.

Obstruction of Antenna by Mast or Superstructure Shadow:

Any part of the ship superstructure or other objects within 30 feet of the dish antenna which cause a shadow sector of greater than 6 degrees in any azimuth down to -5 elevation degrees are likely to seriously degrade performance. This shadow problem is evidenced by loss of signal when the ship is on certain headings. The practical remedy while at sea is to change the heading of the ship.

GMDSS requires the dish antenna to be located so there will not be a shadow problem over 360 degree view from -5 degrees to zenith. If the ship has experienced a shadow problem in the past, the dish antenna will have to be relocated.

Power Supply Requirements:
The equipment shall be powered by at least 3 separate shipboard power sources

- The main generating source
- The emergency generating source
- A source independent of the ship
- Electrical system (such as an uninterruptible Power (UPS))

Reception of Enhanced Group Call (EGC) Information:

Most INMARSAT-A equipment does not have EGC capability. Therefore, a separate EGC receiver is required.

Coast Earth Stations (CES) Offering INMARSAT-A Service:

Details of CES providing INMARSAT-A service together with their identification numbers and charges for commercial services may be found in the List of Coast Stations published by the International Telecommunication Union (ITU). Charges are listed in international currency of

gold francs or special rights.

International Telex Service Code:

This code is used for sending commercial messages to telex stations ashore. Full details of this code can be found in Part C of the Manual for Use by the Maritime Mobile and Maritime Mobile- Satellite Services published by the International Telecommunication Union (ITU).

Procedures: Generating Distress Alerts

Voice Distress Alert Using Goonhilly CES:

Select Call Type Voice
Select Goonhilly CES (2)
Select Distress Priority (3)
Initiate a request for channel assignment
The ship will be connected to Falmouth Marine Rescue Coordinating Center

After being connected to the MRCC, the format of the distress message should be:

MAY DAY MAY DAY MAY DAY
Name and Call Sign
Position
Nature of Distress
Type of assistance required
Any other relevant information

Telex Distress Alert Using Goonhilly CES:

Select Call Type Telex
Select Goonhilly CES (2)
Select Distress Priority (3)
Initiate a request for channel assignment

After being connected to the MRCC, the format of the distress message should be:
SOS SOS SOS
Name and call sign
Position
Nature of Distress
Type of assistance required
Any other relevant information

If an invalid I.D. number is used for the Coast Earth Station (CES) selection, the priority distress call will be intercepted by the Network Coordinating Station (NCS) and will be round to the Rescue Coordination Center (RCC) associated with that NCS. The RCC will then recall the distress to another RCC if necessary.

INMARSAT-C SHIP EARTH STATIONS
Communications Capabilities:

INMARSAT-C is a two-way data messaging system that enables operators of an INMARSAT-C equipped ship to transmit and received messages from other SES as well as telex and data subscribers anywhere in the world. The INMARSAT-C operates on a store and forward basis. This means that the message is sent to an interim "mailbox" and is sent from this "mailbox" to the end destination. This mode does not allow real-time "chat" communications as does INMARSAT-A. The normal delivery time for messages is only a few minutes. The INMARSAT-C also provides ship-to-shore fax service. Fax message cannot be sent from shore-to-ship as it can with INMARSAT-A. INMARSAT-C is not capable of voice communications.

INMARSAT-C terminals are compact and affordable. If the INMARSAT-A station has shadow problems with the dish antenna, it is usually cheaper to add INMARSAT-C then it is to move the INMARSAT-A dish antenna. Since the INMARSAT-C antenna is small and omni-directional, it is easy to find a location which will not have a shadow problem.

PROCEDURES: GENERATING DISTRESS ALERTS

All INMARSAT-C terminals contain a distress message generator. The easiest way to generate the alert is to "push 2 buttons" (usually). These cause a "default" distress message containing the following information:

- Identity of the SES
- The nature of the distress (you can select this before alerting, or you can send "Maritime Unspecified")
- The most recent entry of ship position, course and speed (entered every 4 hours or automatically if coupled to ship's NAV system. Some "C" terminals have built-in Global
- Positioning (GPS).

The SES equipment provides an indication to the operator that the distress alert is being transmitted and an indication of receipt of acknowledgment from a CES.

Routing a Distress Alerts:
The generation of a distress alert does not require the operator to designate a CES INMARSAT-C SES will issue the distress alert to the preferred CES (an entry in the digital message generator) or, if this entry has not been made. To the CES most recent communication with the SES. The issuance of a distress alert does not require the operator have address information as the CES will automatically route a distress priority call dedicated communications channels to its associated RCC.

Starting Up an INMARSAT-C Terminal (Logging-On):

On initial switch on of the terminal, or if it has been switched off, it is necessary to perform the log-off procedure. The send of a message to an already logged-off terminal will be advised that the terminal is not active and the message could not be delivered. Failure to log-off a terminal will result in the term of remaining registered as active and unnecessary delays in advising the sender of non-delivery a message.

Omni-directional Antenna:

INMARSAT-C has the advantage over INMARSAT-A by using narrow bandwish communications. This permits use of low power and a small light weight omni-directional antenna for communications. The antenna does not require stabilization nor input from the ship gyrocompass.

Shadow Sectors:

Objects within 3 feet of the antenna which cause a shadow sector of more than 2 degrees will degrade performance of the equipment. Obstacles fore and aft directions down to -5 degree and in the port and starboard directions down to -15 degrees must be considered.

Radiation Hazard:
There is no concentration of radio frequency energy and therefore the hazard to ship personnel is minimized. Precautions should still be taken when within 3 feet of the antenna.

Coast Earth Stations Offering Distress Service:
A list of CES offering distress service can be found in the ITU list of coast Stations.

International Telex Service Code

Full details of this code can be found in Part C of the Manual for use by the Maritime Mobile and Maritime Satellite Services published by the International Telecommunication Union (ITU).

Enhanced Group Calling (EGC) System:

EGC is an integral part of the INMARSAT service. EGC provides an automated service for addressing messages to either predetermined groups of ships, all ships in fixed or variable geographic areas. EGC can address messages to selected individual ships, ships of a particular fleet (owner) or nationality (flag), or all ships. Message of NAV area warnings and weather forecasts can be directed to a fixed geographical area. Messages related to shore-to-ship distress alerts or local warnings can be direct3d to a specific area.

SOLAS Requirements:

The IMO has selected EGC as one of the primary means of promulgating Maritime Safety Information (MSI). It is a requirement of GMDSS that EGC be carried by all ships engaged on voyages in any area of INMARSAT coverage.

Promulgation of MSI by EGC:

MSI includes all messages related to the safety of ships at sea. Messages in this category include shore-to-ship distress alerts, SAR coordination communications, navigational warnings and forecasts. Use of EGC allows reception of MSI anywhere in the INMARSAT area of coverage.

SafetyNET Messages:
SafetyNET messages provide MSI type information through INMARSAT system. Therefore SafetyNET coverage extends beyond coastal service NAVTEX.

The origin of EGC and SafetyNET Messages can originate from authorized users and will be broadcasted to the appropriate ocean region by a CES. Authorized users include SAR authorities, NAVAREA coordinators, and meteorological bureaus.

Priority of EGC Messages will be transmitted by the CES according to their priority such asM distress, urgency, safety, routine.

EGC Equipment on Ships:

Most INMARSAT-C terminals have EGC capability already built-in. EGC watchkeep occurs unless the SES terminal is transmitting. Ships equipped with INMARSAT-A will require an ECG receiver if the ship does not already have EGC capability.

Reception of a Distress Alert:

The receipt of a distress alert will be marked by visual and audible alarms to attract attention of the bridge watchkeeper.

Programming of EGC Receivers:

Some EGC receivers allow the operator to program to receive only those coastal marine safety messages which are required by the vessel. The distress function is not affected.

Unique Message Identity:

Each EGC message is uniquely identified. The EGC receiver automatically suppresses the storage and printing of repeated messages if the original message was correctly received.

Interfacing with Position Fixing Equipment:

EGC receivers are normally interfaced to the ship position fixing system (SATNAV, LORAN, etc.). If this is not possible, regular updating of the ship position is necessary or receives will print "all ships" messages addressed to any geographical area.

NAVTEX SYSTEM
Introduction

The NAVTEX system is a service for the automatic dissemination of local Maritime Safety Information (MSI) by Narrow Band Direct Printing (NBDP) in the broadcast Forward Error Correction (FEC) mode. The NAVTEX system operates on the Medium Frequency (MF) of 518 kHz and the High Frequency of 4209.5 kHz.

INMARSAT also uses the term NAVTEX or NAVTEX re-broadcast by Enhanced Group Call (EGC) to describe the facility provided in EGC receivers for the reception of local Maritime Safety Information (MSI). This is in recognition that the INMARSAT EGC SafetyNET provides a similar service to NAVTEX.

Information Provided:

NAVTEX provides navigational safety information relevant to all sizes and types of vessels within a local (coastal) area. It also carries routine meteorological forecasts and warnings.

Broadcast Schedules:

Each NAVTEX station throughout the world is allocated a 20 minute period every 4 hours to make the necessary broadcasts.

Coast Stations Broadcasting NAVTEX Information:

Stations, Frequencies and broadcasting times are detailed in the List of Radio determinations and Special Services Stations published by the International Telecommunication Union (ITU).

Mode of Broadcasts:

NAVTEX messages are broadcast in the FEC mode using English.

Shipboard Equipment:

A dedicated receiver tuned to 518 kHz or 4209.5 kHz with an integrated printer is used to receive NAVTEX.

Automatic Operation:

Once switched on and programmed, the NAVTEX receiver will automatically receive print broadcasts.

Message Prefix/Format:

All NAVTEX messages are prefixed with a 4-character group. The first character indicates the identity of the station; the second indicates the category of the message, the third and fourth indicate the serial number of the message (01-99).

Selection of Received Information:

The NAVTEX receiver can be programmed to receive selected messages. As each NAVTEX message has unique identity, the receiver will not respond to messages already received.

Subject Indicator Character:

A subject indicator character identifies different classes of messages. The NEVTEX received can be programmed to reject certain classes of messages if they are not required.

The following subject indicator characters are in use:

A Navigational Warnings
B Meteorological Warnings
C Ice Reports

D	Search and Rescues 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 (possible other languages)
W	Same
X	Same
Y	Same
Z	No Message on Hand

Subject indicators A, B, and D cannot be rejected and will always be printed.

Information Which Cannot Be Rejected:

A NAVTEX receiver cannot be programmed to reject navigational warnings meteorological warnings (B) and search and rescue information (D).

DIGITAL SELECTIVE CALLING (DSC)
Introduction:

DSC is a technique of transmitting digital codes to enable a station to selectively establish contacts and transfer information to another station or a group of stations. Certain frequencies in the MF, HF, and VHF bands are designated for DSC use (a total of 7).

The transmission speed of a DSC call is 100 baud at MF and HF, and 1200 baud at VHF. Error correction coding is included, involving the transmission of each character twice, together with an overall message check character, which is used to ensure the technical integrity of the DSC system.

DSC Watchkeeping by Ships:

All vessels subject to GMDSS regulations must keep a continuous DSC watch on certain MF, HF and VHF DSC frequencies.

In the case of vessels not having INMARSAT EGC, watch must be maintained on 2187.5, 8414.5 and at least one other HF DSC channel that is appropriate to the distance from a DSC equipped coast station and the time of day for propagation.

The DSC equipment may be a dedicated receiver or can be part of the MF or MF/HF radio.

In addition to the MF, HF DSC watchkeeping, all ships must keep a DSC watch on the VHF channel (70).

DSC Watchkeeping by Coast Stations:

Coast stations will keep a DSC watch on those frequencies determined appropriate by their administration.

Information contained in a DSC message:

A DSC call is primarily to establish contact between one or more stations. All DSC messages contain the identity of the calling station, the identity of the station being called, and a message containing information indicating the purpose of the call.

Maritime Mobile Service Identity (MMSI):

Each coast and ship station using DSC will be assigned a 9 Digit MMSI number for use of DSC frequencies.

Initial and Subsequent calls on DSC:

After the initial call, communications will normally be conducted on MF, HF, or VHF radiotelephony or on MF, HF using NBDP.

DSC Operation:

- The MMSI of the station to be contacted is entered in the DSC controller.
- The purpose of the contact may also be entered.
- The transceiver is tuned to the selected frequency.
- The DSC controller is activated.
  "The station being called will automatically acknowledge the call through its controller"
- The full message may now be sent.

Distress Alerts using DSC:
DSC techniques are used for transmitting distress alerts from ships, the associated acknowledgments and are used for relaying distress alerts by ships and coast stations.

Urgency and Safety Message Announcements by DSC:

DSC may also be used by ships to make an announcement that an urgency or safety messages will follow on the correspo9nding radiotelephony or NBDP frequency.

Composition of a DSC Distress Alert:

A DSC distress alert will be automatically addressed to all ships. The alert will be received by all ships and coast stations within propagation range of the frequency used. The alert may be initiated by using the DSC controller. Once the DSC distress alert has been initiated, the DSC controller will send the following information.

Format Specifier	Distress (Automatically included)
Self identification	9 Digit MMSI number
Nature of distress	One of 9 (Selected manually in DSC Controller)

	Fire or explosion Flooding Collision Grounding Listing Sinking Disabled Abandoning Ship Undesignated Distress (Nature of distress was not selected)
Ship Coordinates	Ships Position in LAT/LON (Manual or automatic if coupled to NAV source)
Time	Time of ships position
Telecommand	Tells if subsequent comm. will be Radiotelephone or NBDP

If the DSC controller is interfaced with the ships NAV equipment, the LAT/LON will automatically be entered into the message. It is important to verify that the position information displayed on the DSC controller is accurate and current.

If the NAV system is not interfaced, the operator must enter this information into the DS controller before transmission of the DSC alert to avoid giving an incorrect position.

DSC distress alert attempts:

The DSC controller will continue to send the alert several times (for 36 seconds) until a station has acknowledged the call. If the call is not acknowledged after 36 seconds, the controller will wait 4 minutes and start again. This repetition will continue until the call has been acknowledged.

DSC controllers for HF equipment will allow selection of one or multiple frequencies for a DSC distress alert. VHF uses only channel 70 for DSC distress alerts.
The operator may select a single frequency or a multiple frequency call mode. A single frequency call attempt consists of 5 consecutive calls on a single DSC frequency. The alert will be repeated if not answered. The multiple frequency call attempt consists of 6 consecutive calls made over one MF and 5 HF DSC frequencies.

Reception of a DSC Distress Alert:

The reception of a DSC distress alert by a ship is indicated by an audible and visual alarm.
Alphanumeric information is displayed which contains the details of the vessel in distress. The message will nominate whether subsequent communications are to be conducted radiotelephone or NBDP (except in the case of VHF DSC distress alerts).

DSC Acknowledgment of a Distress Alert:

DSC distress alert acknowledgments are normally transmitted by coast stations in a respond to a received DSC distress call from a ship. However ships receiving a DSC distress alert MF, HF,

or VHF may generate and transmit an acknowledgment of a DSC distress alert and should the coast station not acknowledge.

The acknowledgement from a coast station indicates to the ship in distress and others, that the distress has been received and that search and rescue is being notified.

Ship stations should acknowledge the DSC distress alert on the radiotelephone frequency associated with the DSC frequency on which the alert was received (or the NBDP frequency of this was the mode of subsequent communication specified in the DSC distress alert). If these reply modes are unsuccessful, the ship may then acknowledge by DSC.

The distress acknowledgment is transmitted as a single DSC call on the same frequency that the DSC distress alert was received.

A Distress Acknowledgment contains the following:

Address	All ships
Priority	Distress
Self Identity	Own 9 Digit MMSI number
Command	Distress acknowledgment
Distress identity	9 digit MMSI number of ship in distress
Message	Nature of distress, position & time
Telecommand	Mode for subsequent communications

DSC Distress Alert Relays:

If appropriate, ships should transmit a DSC distress alert relay on behalf of another vessel. DSC distress alert may also be transmitted by a coast station to alert ships in the area of distress. This would be done if the original distress was received by a means other than DSC communications, or if the original alert was received on a DSC frequency not monitored by a ships in the area.

A DSC Distress Alert Relay contains the following:

Address	All stations (or single station)
Priority	Distress
Self Identity	Own 9 digit MMSI number
Command	Distress relay
Distress identity	9 digit MMSI number of ship in distress
Message	Nature of distress, position & time
Telecommand	Mode for subsequent communications

Subsequent Communications to a DSC Distress Alert:

For the coordination and control of Search and Rescue (SAR) operations, RCCs require communications with the ship in distress as well as with units participating in the operation. The methods and modes of communication will be governed by the capabilities available on board the ship in distress as well as those assisting.
On-scene communications are normally short-range made on the radiotelephone VHF or MF distress and safety frequencies. However, SES can use INMARSAT communications (including NBDP) as a supplement to their VHF and MF facilities.

Ship's Position:

If the DSC controller is interfaced with the navigation equipment the position will be continuously updated automatically. If the equipment is not interfaced, the position must be manually updated at 4 hour intervals or less.

DSC Alert & Subsequent Communications Frequencies:

DSC	Radiotelephone (J3E)	NBDP Telex (J2B)
2187.5 kHz	2182.0 kHz	kHz
4207.5 kHz	4125.0 kHz	kHz
6312.0 kHz	kHz	kHz
8414.5 kHz	kHz	kHz
12577.0 kHz	kHz	kHz
16804.5 kHz	kHz	kHz

These frequencies may be used for distress, urgency, and safety alerts and subsequent communications. The DSC Distress, Urgency and Safety frequencies must not be used for establishing commercial communications.

SURVIVAL CRAFT
COSPAS-SARSAT System EPIRB's:

The COSPAS-SARSAT System is a satellite aided search and rescue system used to load emergency Position Indicating Radio Beacons (EPIRB's) on frequencies of 121.5 MHz, 406.025 MHz. The 4 satellites are in low polar orbit and use de Doppler effect frequency shift to locate the beacon. Doppler shift refers to a shift in frequency in relation to the relative motion between the satellite and the EPIRB. Doppler shift is the same EPIRB transmissions are detected by the COSPAS-SARSAT satellites and are relayed ground receiving stations called a Local User Terminal (LUT). The LUT processes the signals to determine the beacon's location.

The LUT will then relay this information to Mission Control
Center (MCC). The MCC will then relay this information to a RCC. They are 20 LUTs.
121.5 MHz EPIRBs have not been accepted as satellite EPIRB's for the GMDSS because their coverage is local and limited to areas where satellite transmissions can be received by at least one LUT. (Satellites must be within line of sight of both the EPIRB and a group of terminal for detection to occur.) However, each LUT can locate 406 MHz beacons transmitting from any location on the globe.

The 121.5 MHz signal emitted from the EPIRB can be used as a horning signal to aid SAR.

Signal from the 406 MHz beacons are relayed to the LUT and are also stored in the satellite memory. The 406 MHz EPIRB has a uniquely coded registration number (vessel identification number), and therefore the RCC can identify the actual vessel in distress. The instantly relayed data provides both local and stored data modes. The stored data is broadcasted continuously from the satellite, thus providing global coverage.

VHF 156.525 MHz. (Channel 70) EPIRBs are approved for Sea Area 1 only.

Testing EPIRB's:

Testing EPIRB's is required. Periodically examine them for water tightness, battery expiration date and signal presence.

- **Class A** (121.5/243 MHz auto-activated):
  Class B (121.5/243 MHz manually-activated)
  Class S (121.5/243 MHz Float-Free for Survival craft)

FCC rules allow actual on-air testing of Class A, B and S EPIRB's. These units can be on the air for 3 audio sweeps, or one second, during the first 5 minutes of each hour only. Signal can be detected on FM 99.5 MHz. or between stations on an AM radio in close proximity of the EPIRB.

- **Class C** (VHF ch. 15 or 16):

These units can be on the air during the first 5 minutes of each hour only for not more than 5 seconds. Signal can be detected by a marine VHF radio on channel 15 or 16.

- **Category I** (406/121.5 MHz, auto-activated, float-free, satellite)
- **Category II** (406/121.5 MHz. manually-activated, float-free, satellite)

Tested through their self-test feature only. It is illegal to test a 406 MHz. EPIRB on the air.

INMARSTAT System EPIRB's (L-BAND):

L-Band EPIRB's use the geostationary INMARSAT satellite system. These EPIRBs operate float free in the 1.6 GHz, The unique identification number of the vessel in distress, position and the fact that the EPIRB is within the footprint of a geostationary INMARSAT satellite, provides rapid distress alerting and Search and Rescue operations. The alert receive time is normally within 2 minutes with 1 watt of radiated power. This is much faster than the potential 3 hour delay of the COSPAS-SARSAT system (awaiting for an orbiting satellite to Passover the EPIRB).

The satellite transmits this information to a Coast Earth Station (CES). The CES relays the information to an associated Rescue Coordination Center (RCC) for action.

INMARSAT L-Band EPIRB's are approved by GMDSS.

Search and Rescue Transponder (SART):

The purpose of the SART is to allow locating survival craft. GMDSS requires at least one SART on each side of all Passenger ships in a location easily accessible to the survival craft, Cargo ships of 500 GRT and upward are also required to carry 2 SARTs, one on each side of the ship in a location easily accessible to the survival craft. However, cargo ships of 300-500 GRT are required to have only 1 SART.

The SART operates in the 9 GHz band (3 cm or X band) radar and generates a series of blips on a radar screen extending along its line of bearing when it has been interrogated by standard ship

or aircraft radar operating in the same band. The SART can be expected operate with a range of 5 nautical miles when interrogated by ship radar.

The height of the SART antenna above water is key. It must be mounted at least 3 feet about water by using a mounting pole. Do not mistake the mounting pole for the SART antenna. This could result in the SART being mounted upside down and degrade performance.

As with any beacon, once it has been turned on, leave it on. Ship radars should be set for miles range. On Activation, the SART will provide a visible and/or audible indication of correct position when it is being interrogated by radar signals.
To improve performance under heavy swell conditions, SART antennas are omnidirectioned and horizontally polarized.

EPIRB's and SART's are powered by batteries located inside the unit. The batteries must be replaced by the expiration date written on the case of the unit, or if the unit has been activated in an emergency or left on accidentally. The SART will have sufficient battery capacity to operate for 96 hours (4 days).

VHF HANDHELD PORTABLE RADIOS

GMDSS also requires that waterproof VHF handheld portable radios be provided for each survival craft. Three (3) VHF portable radios sets (as a minimum) are required on each survival craft. This requirement applies to all passenger ships and cargo ships exceeding 500 Gross Rated Tons (GRT). Two (2) sets minimum are required on cargo vessels between 300 and 500 (GRT).

The VHF radios must be capable on VHF 156.8 MHz (the distress and safety frequency) and at least one other frequency.

General Specifications:
• The power rating shall be minimum 1 watt.
• If the power rating is greater than 1 watt, then a 1 watt switch is required.
• The radio shall be water tight at 1 meter for 5 minutes.
• The battery shall be good for 8 hours operation.
• The battery shelf life shall be 2 years.

SHIPS REQUIREMENTS
Ship Carriage Requirements

By the terms of the SOLAS Convention, the GMDSS provision apply to cargo ships of 300 gross tons and over and ships carrying more than 12 passengers on international voyages. Unlike previous shipboard carriage regulations that specified equipment according to size of vessel, the GMDSS carriage requirements stipulate equipment according to the area the vessel operates in.
These sea areas are designated as follows:

Sea Area A1
An area within the radiotelephone coverage of at least one VHF coast station in which continuous
Digital Selective Calling /DSC – a radio receiver that performs distress alerting and safety calling on HF, Mf and VHF frequencies) is available, as may be defined by a Contracting Government to the 1974 SOLAS Convention. This area extends from the coast to about 20 miles off-shore.

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 100 miles off-shore.

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°N to 70°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.

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.

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 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 NAVTEX service is available.
5. Receiver capable of receiving SafetyNET anywhere NAVTEX is not available.
6. Satellite emergency position indicating radiobeacon (EPIRB), manually activated or 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).
8. Until 1 February 1999, a 2182 kHz watch receiver.

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

Sea Area A1

1. General VHF radio telephone capability.
2. Free-floating EPIRB transmitting DSC on channel 70 VHF, or satellite EPIRB.
3. 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

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

Sea Areas A1, A2 and A3

1. Radio telephone MF 2182 kHz and DSC 2187.5 kHz.
2. Equipment capable of maintaining a continuous DSC watch on 2187.5 kHz.
3. INMARSAT A, B or C (class 2) SES Enhanced Group Call (EGC), or HF as required for sea area A4.
4. Capability of initiating a distress alert by two of the following:
    a. INMARSAT A, B or C (class 2) SES.
    b. Manually activated satellite EPIRB.
    c. HF/DSC radio communication.

Sea Area A4

1. HF/Mf receiving and transmitting equipment for band 1605-27500 kHz, using DSC, radiotelephone and direct printing.
2. 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.
3. Ability to initiate a distress alert from a navigational position via the Polar Orbiting System on 406 MHz (manual activation of 406 MHz satellite EPIRB).

COMMUNICATIONS

The INMARSAT System

The International Maritime Satellite Organization (INMARSAT), a key player within GMDSS, is an international consortium comprising over 75 international partners who provide maritime safety communications for ships at sea. In accordance with its convention, INMARSAT

provides the space segment necessary for improving distress communications, efficiency and management of ships, as well as maritime correspondence services.

The basic components of the INMARSAT system include the INMARSAT space segment, Land Earth Stations (LES), and mobile Ship Earth Stations (SES).

The INMARSAT space segment consists of 11 geostationary satellites. Four operational INMARSAT satellites provide primary coverage, four additional satellites (including satellites leased from the European Space Agency (ESA) and the International Telecommunications Satellite Organization (INTELSAT)) serve as spates and three remaining satellites (leased from COMSAT Corporation, the U.S. signatory to INMARSAT) serve as back-ups.

The polar regions are not visible to the operational satellites and coverage is available from 70°N to 70°S. Satellite coverage (See figure) is divided into four regions, which are:

1. Atlantic Ocean – East (AOR-E)
2. Atlantic Ocean – West (AOR-W)
3. Pacific Ocean (POR)
4. Indian Ocean (IOR)

The LES's provide the link between the Space Segment and the land-based National/International fixed communications networks. These communications networks are funded and operated by the authorized communications authorities of a participating nation. This network links registered information providers to the LES. The data then travels from the LES to the INMARSAT Net-work Coordination Station (NCS) and then down to the SES's on ships at sea. The SES's provide two-way communications between ship and shore. INMARSAT A, the original INMARSAT system, operates at a transfer rate of up to 9600 bits per second and is telephone, telex and facsimile (fax) capable. It is being replaced by a similarly sized INMARSAT B system that uses digital technology to give better quality fax and higher data transmission rates.

INMARSAT C provides a store and forward data messaging capability (but no voice) at 600 bits per second and was designed specifically to meet the GMDSS requirements for receiving MSI data on board ship. These units are small, lightweight and use an omni-directional antenna.

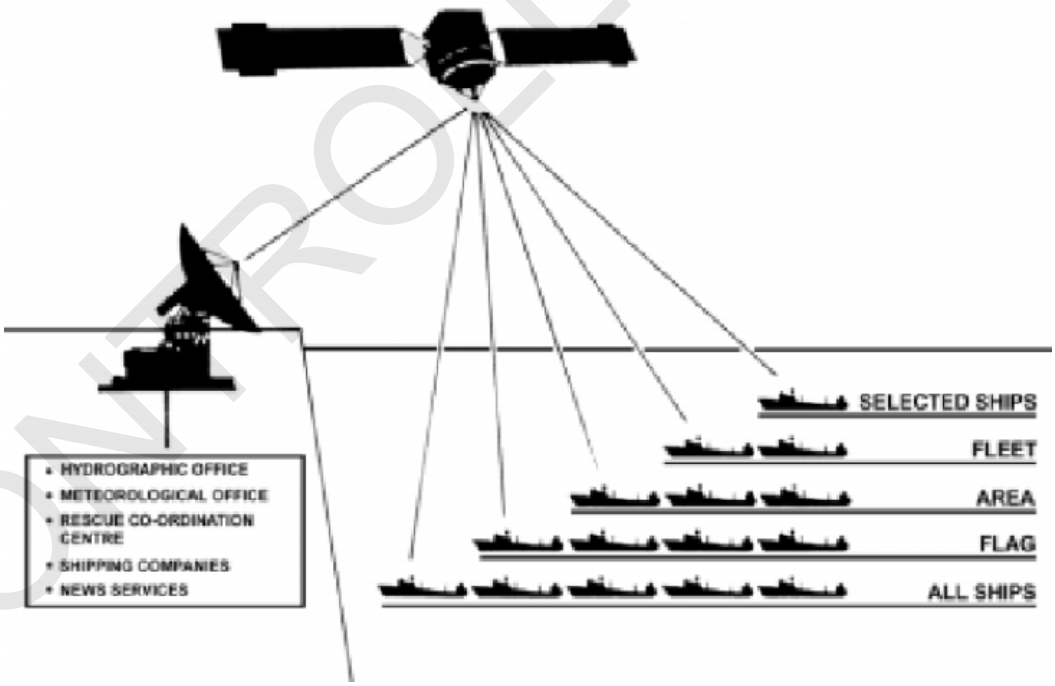
SafetyNET

SafetyNET is a service of INMARSAT C's Enhanced Group Call (EGC) system. The EGC system (see figure) is a method used to specifically address particular regions or ships. Its unique addressing capabilities allow messages to be sent to all vessels in both fixed geographical areas or to predetermine groups of ships. SafetyNET is the service designated by the IMO through which ships receive maritime safety information. The other service under the EGC system, called FleetNET, is used by commercial companies to directly (and privately) communicate to their individual fleets.

SafetyNET is an international direct-printing satellite-based service for the promulgation of navigational and meteorological warnings, and distress alerts, forecasts, and other safety messages. It fulfills an integral role in GMDSS as developed by the IMO. The ability to receive

SafetyNET service information is necessary for all ships that sail beyond coverage of NAVTEX (approximately 200 miles from shore) and is recommended to all administrations having the responsibility for marine affairs and mariners who require effective MSI service in waters not served by NAVTEX.

SafetyNET can direct a message to a given geographic area based on EGC addressing. The area may be fixed, as in the case of a NAVAREA or weather forecast area, or it may be uniquely defined by the originator. This is particularly useful for messages such as local storm warnings or a ship-to-shore distress alert for which it would be inappropriate to alert ships in an entire ocean region. SafetyNET messages can be originated by a Registered Information Provider anywhere in the world and broadcast to the appropriate ocean area through an INMARSAT-C LES. Messages are broadcast according to their priority (i.e., Distress, Urgent, Safety, and Routine). Virtually all navigable waters of the world are covered by the operational satellites in the INMARSAT system. Each satellite broadcasts EGC traffic on a designated channel. Any ship sailing within the coverage area of an INMARSAT satellite will be able to receive all the SafetyNET messages broadcast over this channel. The EGC channel is optimized to enable the signal to be monitored by SES's dedicated to the reception of EGC messages. This capability can be built into other standard SES's. It is a feature of satellite communications that reception is not generally affected by the position of the ship within the ocean region, atmospheric conditions, or time of day.



Messages can be transmitted either to geographic areas (area calls) or to groups of ships (group calls):

1. **Area calls** can be a fixed geographic area such as one of the 16 NAVAREA's or to temporary geographic area selected by the originator. Area calls will be received automatically by any ship whose receiver has been set to one or more fixed areas or recognizes an area by geographic position.

2. **Group Calls** will be received automatically by any ship whose receiver acknowledges the unique group identity associated with a particular message.

Reliable delivery of messages is ensured by forward error correction techniques. Experience has demonstrated that the transmission link is generally error-free and low error reception is achieved under normal circumstances.

Given the vast ocean coverage by satellite, some form of discrimination and selectivity in printing the various messages is required. Area calls will be received by all ships within the ocean region coverage of the satellite; however, they will be printed only by those receivers that recognize the fixed area or the geographic position in the message. The message format includes a preamble that enables the microprocessor in a ship's receiver to decide to print those MSI messages that relate to the present position, intended route or a fixed area programmed by the operator. This preamble also allows suppression of certain types of MSI that are not relevant to a particular ship. As each message will also have a unique identity, the reprinting of messages already received correctly is automatically suppressed.

MSI is promulgated by various information providers around the world. Messages for transmission through the SafetyNET service will, in many cases, are the result of coordination between authorities. Information providers will be authorized to broadcast via SafetyNET by IMO. Authorized information providers are:

1. National hydrographic offices for navigational warnings.
2. National weather services for meteorological warnings and forecasts.
3. Rescue Coordination Centers for ship-to-shore distress alerts and other urgent information.
4. In the U.S., the International Ice Patrol for North Atlantic ice hazards.

Each information provider prepares their SafetyNET messages with certain characteristics recognized by the EGC service. These characteristics, known as "C" codes are combined into a generalized message header format as follows: C1:C2:C3:C4:C5. Each "C" code controls a different broadcast criterion and is assigned a numerical value according to available options. A sixth "C" code, "C0" may be used to indicate the ocean region (i.e.. AOR-E, AOR-W, POR, IOR) when sending a message to an LES which operates in more than one ocean region. Because errors in the header format of a message may prevent its being released, MSI providers must install an INMARSAT SafetyNET receiver to monitor the broadcasts it originates. This also ensures quality control.

The "C" code are transparent to the mariner but are used by information providers to identify various transmitting parameters. C1 designates the message priority from distress to urgent, safety, and routine. MSI messages will always be at least at the safety level. C2 is the service code or type of message (for example, long range NAVAREA warning or coastal NAVTEX warning) It also tells the receiver the length of the address (the C3 code) it will need to decode. C3 is the address code. It can be the two digit code for the NAVAREA number for instance, or a 10 digit number to indicate a circular area for a meteorological warning. C4 is the repetition code which instructs the LES in how long and when to send the message to the NCS for actual broadcast. A six minute echo (repeat) may also be used to ensure that an urgent (unscheduled)

message has been received by all ships affected. C5 is a constant and represents a presentation code, International Alphabet number 5, "00".
Broadcasts of MSI in the international SafetyNET service are in English.

NAVTEX

NAVTEX is a maritime radio warning system consisting of a series of coast stations transmitting radio teletype (standard narrow-band direct printing, also sometimes called Sitor) safety messages on the internationally standard medium frequency of 518 kHz. It is a GMDSS requirement for the reception of MSI in coastal and local waters. Coast stations transmit during previously arranged time slots to minimize mutual interference. Routine messages are normally broadcast four times daily. Urgent messages are broadcast upon receipt, provided that an adjacent station is not transmitting. Since the broadcast uses the medium frequency band, a typical station service radius ranges from 100 to 500 NM day and night (although a 200 mile rule of thumb is applied in the U.S.). Interference from or receipt of stations farther away occasionally occurs at night.

Each NAVTEX message broadcast contains a four-character header describing: identification of station (first character); message content or type (second character); and message serial number (third and fourth characters). This header allows the microprocessor in the shipboard receiver to screen messages from only those stations relevant to the user, messages of subject categories needed by the user and messages not previously received by the user. Messages so screened are printed as they are received, to be read by the mariner when convenient. All other messages are suppressed. Suppression of unwanted messages is becoming more and more a necessity to the mariner as the number of messages, including rebroadcast messages, increases yearly. With NAVTEX, a mariner will not find it necessary to listen to, or sift through, a large number of non-relevant data to obtain the information necessary for safe navigation.

The NAVTEX receiver is a small unit with an internal printer, which takes a minimum of room on the bridge. Its antenna is also of modest size, needing only a receive capability.

Maritime Safety Information (MSI)

Major categories of MSI for both NAVTEX and SafetyNET are:

1. Navigational warnings
2. Meteorological warnings
3. Ice reports
4. Search and rescue information
5. Meteorological forecasts
6. Pilot service messages (not in the U.S.)
7. Electronic navigation system messages (i.e., OMEGA, LORAN, DECCA, GPS, DGPS, SATNAV, etc.)

Broadcasts of MSI in NAVTEX international service are in English, but may be in languages other than English, to meet requirements of the host government.

Digital Selective Calling (DSC) is a method of automatically placing a call directly from one radio to another. This is accomplished by addressing the call so it will be received automatically

by the other radio. It permits a radio to be used like a telephone. Since the DSC system will sound an alarm (much like a ringing telephone) when it senses an incoming call, there is no need for dedicated, aural watch-standing. DSC techniques can be used with VHF, HF and MF radio communications. DSC's principal uses are in distress alerting and safety calling. Numerous frequencies have been assigned. They are 2187.5 kHz in the MF band; 4207.5 kHz, 6312 kHz, 8414.5 kHz, 12577 kHz and 16804.5 kHz in the HF band; and 156.525 MHz (channel 70) in the VHF band.

Emergency Position-Indicating Radio Beacons

Emergency Position-Indicating Radio Beacons (EPIRB) is designated to transmit a satellite alert in the event of sudden accident either automatically or manually. The automatic models are designed and mounted so that they will float free of a sinking vessel and be activated by seawater. The manual ones are controlled by a switch. Under GMDSS, satellite EPIRBs will operate either on 1.6 GHz (the INMARSAT E, L Band) or the 406 MHz frequency used by the COSPAS-SARSAT system.

GMDSS requires 1 satellite EPIRB along with 2 search and rescue transponders (SART's).
These SART's generate a series of response signals when interrogated by any ordinary 9 GHz radar set. The signals produce a line of 20 blips on the radar screen of the rescue ship or aircraft.
Under GMDSS, the COSPAS-SARSAT and INMARSAT communication systems are the two basic media through which the EPIRB signal is relayed to ground and sea stations. COSPASSARSAT is a joint international satellite-aided SAR system operated by multi-national organizations in Canada, France, the U.S. and the Russian Federation. It uses low polar orbiting satellites which receive and relay distress signals from EPIRBs and determine their position.
INMARSAT, with over 75 member nations, operates a global satellite EPIRB system (excluding the poles). Further details of the COSPAS-SARSAT system are found in next chapter, Position Reporting System.

Position Reporting Systems

Purpose

The purpose of position reporting system is to monitor vessel position and inform authorities and other vessels of an emergency or distress at sea so that a response can be coordinated among those best able to help. It is important that distress information be immediately available to Search and Rescue (SAR) coordinators so that assistance can be obtained with the least delay. Establishing communications is sometimes difficult even when automatic alarms are used, and determination of SAR capabilities and intentions of vessels is time-consuming, unless the essential information has been made readily available beforehand by their participation in a position reporting system.

The convention on Safety of Life at Sea (SOLAS) obligates the master of any vessel who becomes aware of a distress incident to proceed to the emergency and assist until other aid is at hand or until released by the distressed vessel. Other international treaties and conventions impose the same requirement. Position reporting systems permit determination of the most appropriate early assistance, provide the means for a timely resolution of distress cases, and enable vessels responding to distress calls to continue their passage with a minimum amount of delay.

Other resolutions recommend that governments encourage participation in position reporting schemes by ensuring that no costs are incurred by the vessel for participation.
There are currently many positions reporting in operation throughout the world. The particulars of each system are given in publications of the International Maritime Organization (IMO).
Masters of vessels making off-shore passages are requested by the U.S. Coast Guard to always participate in the AMVER System and to participate in the other systems when in the areas covered by them.

AMVER

The Automated Mutual-Assistance Vessel Rescue System (AMVER)

AMVER, operated by the United States Coast Guard, is an international maritime mutual assistance program which assists search and rescue efforts in many offshore areas of the world.
Merchant ships of all nations making offshore passages are encouraged to send movement (sailing) reports and periodic position reports voluntarily to the AMVER Center in New York via selected radio stations. Information from these reports is entered into a computer which maintains dead reckoning positions for the vessels.
Information concerning the predicted location and SAR characteristics of each vessel is available upon request to recognized SAR agencies of any nation or to vessels needing assistance.
Predicted locations are disclosed only for reasons related to marine safety.

Messages sent within the AMVER System are at no cost to the ship or owner. Benefits to shipping include: (1) improved chances of aid in emergencies, (2) reduced number of calls for assistance to vessels no favorably located and (3) reduced time lost for vessels responding t calls for assistance. An AMVER participant is under no greater obligation to render assistance during an emergency than a non-participating vessel.

All AMVER messages are addressed to Coast Guard, New York, regardless of the station to which the message is delivered, except those sent to Canadian stations which should be addressed to AMVER Halifax or AMVER Vancouver. This avoids incurring charges to the vessel.

In addition to the information calculated from sailing plans and position reports, the AMVER Center stores data on the characteristics of vessels. This includes the following: vessel name; international call sign; nation of registry; owner or operator; Type of rig; type of propulsion; gross tonnage; length; normal cruising speed; radio schedule; radio facilities; radio telephone installed; surface search radar installed; doctor normally carried. Vessels can assist the AMVER Center in keeping this data accurate by sending a complete report by message, letter, or by completing a SAR Information Questionnaire available from AMVER, and sending corrections as the characteristics change. Corrections may be included in regular AMVER reports as remarks.
For AMVER participants bound for U.S. ports there is an additional benefit. AMVER messages which include the necessary information are considered to meet the requirements of 33 CFR 161 (Notice of arrival).

AMVER System Communications Network

An extensive radio network supports the AMVER system. Propagation conditions, location of vessel, and message density will normally determine which station should be contacted to establish communications. To ensure that no charge is applied, all AMVER messages should be passed through specified radio stations. Those which currently accept AMVER messages and apply to coastal station, ship station, or landline charge are listed in each issue of the AMVER Bulletin, together with respective call sigh, location, frequency bands, and hours of guard, Although AMVER messages may be sent through other stations, the Coast Guard cannot reimburse the sender for any charges.

The AMVER Bulletin

The AMVER Bulletin, published quarterly by the U.S. Coast Guard, provides information on the operation of the AMVER System of general interest to the mariner. It also provides up-to date information on the AMVER communications network and Radio Wave Propagation Charts which indicate recommended frequencies for contacting U.S. coast radio stations participating in the AMVER System, according to the time of day and the season of the year.

AMVER Participation

Instructions guiding participation in the AMVER System are available in the following languages: Chinese, Danish, Dutch, English, French, German, Greek, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Spanish and Swedish. The AMVER Users Manual is available from: Commander, Atlantic Area, U.S. Coast Guard, Governors Island, NY, 10004; Commander Pacific Area, U.S. Coast Guard, Government Island, Alameda, CA 94501; and at U.S. Coast Guard District Offices, Marine Safety Offices, Marine Inspection Offices and Captain of the Port offices in major U.S. ports. Requests for instructions should state the language desired if other than English.

Search and Rescue operation procedures are contained in the Merchant Ship Search and Rescue Manual (MERSAR) published by the International Maritime Organization (IMO). U.S. flag vessels may obtain a copy of MERSAR from local Coast Guard Marine Safety Offices and Marine Inspection Offices or by writing to U.S. Coast Guard (G-OSR), Washington, DC 20593. Other flag vessels may purchase MERSAR directly from IMO.
In connection with a vessel's first AMVER-plotted voyage, the master is requested to complete a questionnaire providing the radio watch schedule, available medical and communications facilities, and other useful characteristics. Stored in the AMVER computer, this information can be electronically processed in an emergency, while a position is calculated.

Any vessel of any nation departing on an offshore passage of 24 hours duration or greater is encouraged to become a participant in the AMVER System by sending appropriate AMVER messages in one of several formats. The messages may be transmitted at any convenient time as long as the information is accurate.

There are five types of AMVER Reports.

1. Sailing Plan.
2. Departure Report.
3. Arrival Report.

4. Position Report.
5. Deviation Reports.

AMVER permits sailing plan and departure information to be combined into a single report. It also accepts sailing plan information separately.

Only the above five types of AMVER messages require specific formats. (See DMAHTC Pub. 117, Radio Navigational Aids). Other messages relating to a vessel's AMVER participation or data, such as facts on her SAR capabilities, may also be sent via the AMVER communications network.

Additional information concerning the AMVER system may be obtained by writing to: Commandant, U.S. Coast Guard, Washington, DC 20590, or by writing or visiting Commander, Atlantic Area, U.S. Coast Guard, Governors Island, New York, NY 10004. The AMVER System in the Pacific is coordinated by Commander, Pacific Area, U.S. Coast Guard, Government Island, and Alameda, CA 94501.
Other countries such as Canada are a formal part of the AMVER System and provide radio stations for relay of AMVER reports, as well as coordinating rescue efforts in certain regions.
Applicable instructions have been promulgated by official publications of the participating countries.

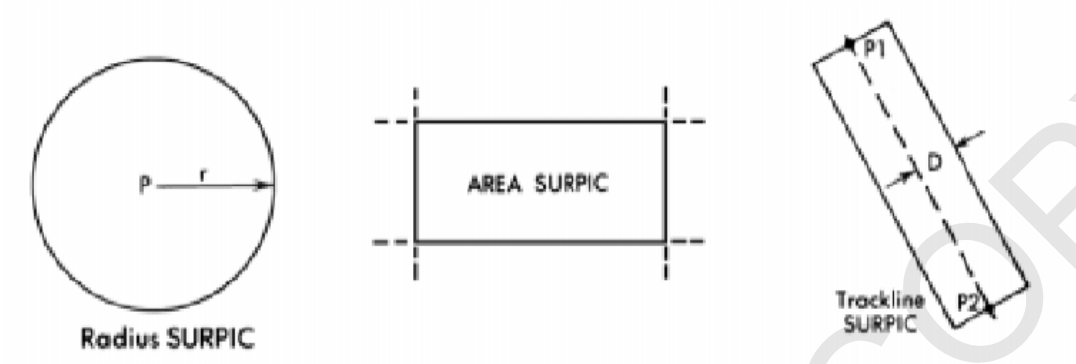
AMVER Reporting Required

The U.S. Maritime Administration regulations state that certain U.S. flag vessels and foreign flag "War Risk" vessels must report and regularly update their voyages to the AMVER Center. This reporting is required of the following: (a) U.S. flag vessels of 1,000 tons or greater, operating in foreign commerce; (b) foreign flag vessels of 1,000 gross tons or grater, for which an Interim War Risk Insurance Binder has been issued under the provisions of Title XII, Merchant Marine Act., 1936.

AMVER Plot Information

The information stored in the computer can be used to provide several types of display according to the needs of controllers at Rescue Coordination Centers. The surface picture (SURPIC) can be displayed as a Radius SURPIC (see next figure). When requesting a Radius SURPIC, the controller specifies the date and time, a latitude and longitude to mark the center (P), the radius (in nautical miles) that the SURPIC should cover ®, and whether the names of all ships are desired (or only those with doctors, or perhaps those heading either east or west):
A Radius SURPIC may be requested for any radius from 1 to 999 miles. A sample request is as follows:

"REQUEST 062100Z RADIUS SURPIC OF DOCTOR-SHIPS WITHIN 800 MILES OF 43.6N 030.2W FOR MEDICAL EVALUATION M/V SEEN SEAS"



Radius SURPIC, Area SURPIC and Trackline SURPIC

The Area SURPIC is obtained by specifying the date, time, and two latitudes and two longitudes.

The controller can limit the ships to be listed as with the Radius SURPIC. There is no maximum or minimum size limitation on an Area SURPIC.

A sample Area SURPIC request is as follows:

"REQUEST 151300Z AREA SURPIC OF WESTBOUND SHIPS FROM 43N TO 31N LATITUDE AND FROM 130W TO 150W LONGITUDE FOR SHIP DISTRESS M/V EVENING SUN LOCATION 37N, 140W."

The Trackline SURPIC is obtained by specifying the date and time, two points (P1 and P2), whether the trackline should be course line or great circle, what the half-width (D) coverage should be (in nautical miles), and whether all ships are desired (or only doctor ships, or just those east or westbound). The half-width (D) specified should not exceed 100 miles. When received, the SURPIC will list ships in order from P1 to P2. There is no maximum or minimum distance between P1 to P2.

A sample Trackline SURPIC request is as follows:

"REQUEST 310100Z GREAT CIRCLE TRACKLINE SURPIC OF ALL SHIPS WITHIN 50 MILES OF A LINE FROM 20.1N 150.2W TO 21.5N 158.0W FOR AIRCRAFT PRECAUTION."

A location vessel is used to determine the location of a specific ship. It permits a controller to determine the DR position of an AMVER participant wherever located.

A sample Location Vessel request is as follows:
"REQUEST PRESENT POSITION, COURSE, AND SPEED OF M/V POLARIS."

A Radius SURPIC as it would be received by a rescue center, listing all ships within a 200 mile radius of 26.2N, 179.9W, is shown in the next figure.

Name	*Call sign*	*Position*	*Course*	*Speed*	*SAR data*	*Destination and ETA*
CHILE MARU	JAYU	26.2 N 179.9E	C294	12.5K	H 1 6 R T X Z	KOBE 11
CPA 258 DEG. 012 MI. 032000Z						
WILYAMA	LKBD	24.8N 179.1W	C106	14.0K	H X R T V X Z	BALBOA 21
CPA 152 DEG. 092 MI. 032000Z						
PRES CLEVELAND	WITM	25.5N 177.0W	C284	19.3K	H 2 4 R D T X Z S	YKHAMA 08
CPA 265 WILL PASS WITHIN 10 MI 040430Z						
AENEAS	GMRT	25.9N 176.9E	C285	16.0K	H 8 R N V X Z	YKHAMA 10
CPA 265 DEG. 175 MI. 032002Z						

Radius SURPIC as received by a rescue center.

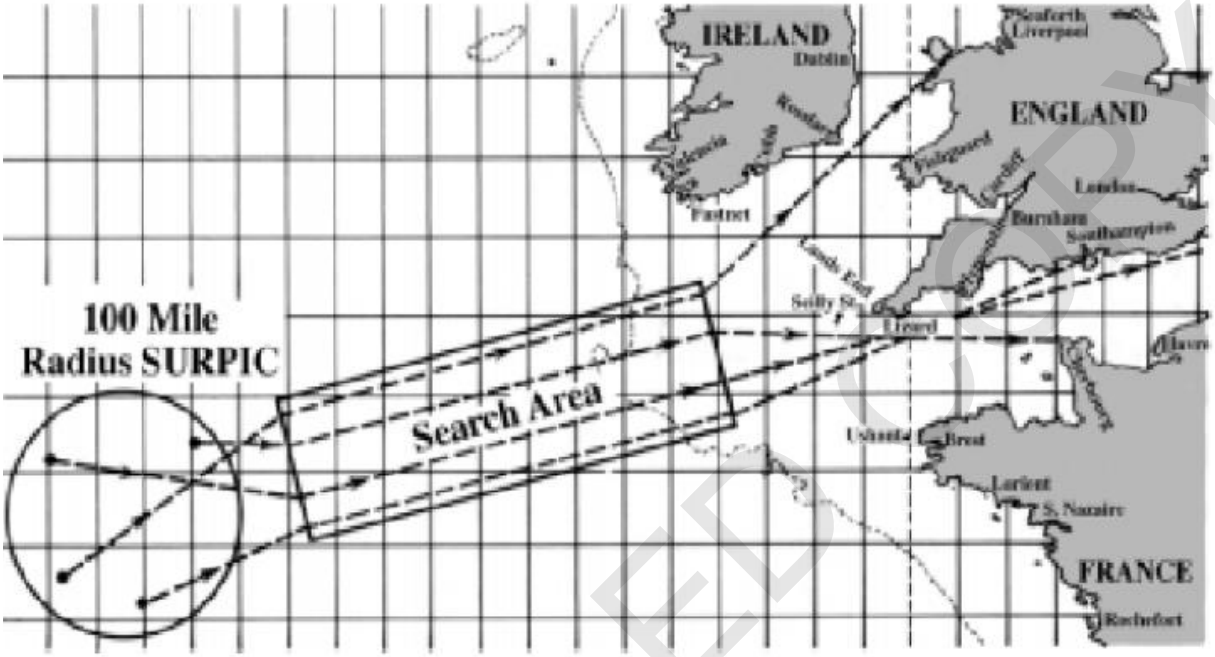
Uses of AMVER Plot Information

An example of the use of Radius SURPIC is depicted in figure 2907. In this situation rescue authorities believe that a ship in distress, or her survivors, will be found in the rectangular area. The Rescue Coordination Center requests a listing of all eastbound ships within 100 miles of a carefully chosen position. Once this list is received by the Rescue Coordination Center a few moments later, messages can be prepared for satellite transmission to each vessel, or arrangements made to contact them by radio.

Each ship contacted may be asked to sail a course line between two specified points, one at the beginning of the search area and one at the end. By carefully assigning ships to areas of needed coverage, very little time need be lost from the sailing schedule of each cooperating ship. Those ships joining the search would report their positions every few hours to the Rescue Coordination Center, together with weather data and any significant sightings. In order to achieve saturation coverage, a westbound SURPIC at the eastern extremity of the search area would also be used.

The trackline SURPIC is most commonly used as a precautionary measure for aircraft. Rarely, if ever, is a major airliner forced to ditch at sea anymore. But occasions sometimes arise where a plane loses of one or more of its engines.

A Trackline SURPIC, provided from the point of difficulty to the destination, provides the pilot with the added assurance of knowing the positions of vessels beneath him and that they have been alerted, SURPIC's have been used successfully to save the lives of pilots of small aircraft.



Use of Radius SURPIC

EMERGENCY POSITION INDICATING RADIOBEACONS (EPIRB'S)

Description and Capabilities

Emergency Position Indicating Radiobeacons (EPIRB's), devices which cost from $200 to over $1500, are designed to save lives by automatically alerting rescue authorities and indicating the distress location. EPIRB types are described below:

Type	Frequency	Description
Class A	121.5/243 MHz	Float-free, automatic activating, detectable by aircraft and satellite. Coverage limited (see Figure 2908).
Class B	121.5/243 MHz	Manually activated version of Class A.
Class C	VHF Ch. 15/16	Manually activated, operates on maritime channels only. Not detectable by satellite.
Class S	121.5/243 MHz	Similar to Class B, except that it floats, or is an integral part of a survival craft.
Category I	121.5/406 MHz	Float-free, automatically activated. Detectable by satellite anywhere in the world.
Category II	121.5/406 MHz	Similar to Category I, except manually activated.

EPIRB classifications.

121.5/243 MHz EPIRB (Class A, B, S): These are the most common and least expensive type of EPIRB, designed to be detected by over flying commercial or military aircraft. Satellites were designed to detect these EPIRB's but are limited for the following reasons:

1. Satellite detection range is limited for these EPIRB's (satellites must be within line of sight of both the EPIRB and ground terminal for detection to occur).
2. EPIRB design and frequency congestion cause them to be subject to a high false alert/false alarm rate (over 99%); consequently, confirmation is required before SAR forces can be deployed.
3. EPIRB's manufactured before October 1988 may have design or construction problems (e.g. some models will lead and cease operating when immersed in water) or may not be detectable by satellite.

POSITION REPORTING SYSTEMS

Feature	*121.5/406 MHz EPIRB*	*121.5/243 MHz EPIRB*
Frequencies	406.025 MHz (locating) 121.500 MHz (homing)	121.500 MHz (civilian) 243.000 MHz (military)
Primary Function	Satellite alerting, locating, identification of distressed vessels.	Transmission of distress signal to passing aircraft and ships.
Distress Confirmation	Positive identification of coded beacon; each beacon signal is a coded, unique signal with registration data (vessel name, description, and telephone number ashore, assisting in confirmation).	Virtually impossible; no coded information, beacons often incompatible with satellites; impossible to know if signals are from EPIRB, ELT, or non-beacon source.
Signal	Pulse digital, providing accurate beacon location and vital information on distressed vessel.	Continuous signal allows satellite locating at reduced accuracy; close range homing.
Signal Quality	Excellent; exclusive use of 406 MHz for distress beacons; no problems with false alerts from non-beacon sources.	Relatively poor; high number of false alarms caused by other transmitters in the 121.5 MHz band.
Satellite Coverage	Global coverage, worldwide detection; satellite retains beacon data until next earth station comes into view.	Both beacon and LUT must be within coverage of satellite; detection limited to line of sight.
Operational Time	48 hrs. at -20°C.	48 hrs. at -20°C.
Output Power	5 watts at 406 MHz, .025 watts at 121.5 MHz.	0.1 watts average.
Strobe Light	High intensity strobe helps in visually locating search target.	None.
Location Accuracy (Search Area) and Time Required	1 to 3 miles (10.8 sq. miles); accurate position on first satellite overflight enables rapid SAR response, often within 30 min.	10 to 20 miles (486 sq. miles); SAR forces must wait for second system alert to determine final position before responding (1 to 3 hr. delay).

Summary comparison of 121.5/406 MHz and 121.5/243 MHz EPIRB's.

Class C EPIRB's: These are manually activated devices intended for pleasure craft which do not venture far offshore, and for vessels on the Great Lakes. They transmit a short burst on VHFFM 156.8 MHz (Ch. 16) and a longer horning signal on 156.75 MHz (Ch. 15). Their usefulness depends upon a coast station or another vessel guarding channel 16 and recognizing the brief, recurring tone as an EPIRB. Class C EPIRB's are not recognized outside of the United States.
Class C EPIRB's cannot be manufactured or sold in the United States after February 1995. Class C EPIRB installed on board vessels prior to February 1995 may be utilized until 1 February 1999 and not thereafter.

406 MHz EPIRB's (Category I, II): The 406 MHz EPIRB was designed to operate with satellites. Its signal allows a satellite local user terminal to locate the EPIRB (much more accurately than 121.5/243 MHz devices) and identify the vessel (the signal is encoded with the vessel's identity) anywhere in the world. There is no range limitation. These devices also include a 121.5 MHz horning signal, allowing aircraft and rescue vessels to quickly find the vessel in distress. These are the only type of EPIRB which must be tested by Coast Guard-approved independent laboratories before they can be sold for use within the United States.
An automatically activated, float-free version of this EPIRB has been required on SOLAS vessels (cargo ships over 300 tons and passenger ships on international voyages) since 1 August 1993.
The Coast Guard requires U.S. commercial fishing vessels to carry this device (unless they carry a Class A EPIRB), and will require the same for other U.S. commercial no inspected vessels which travel more than 3 miles offshore.
Mariners should be aware of the differences between capabilities of 121.5/243 MHz and 121.5/406 MHz EPIRB's, as they have implications for alerting and locating of distress sites, as well as response by SAR forces. The advantages of 121.5/406 MHz devices are substantial, and are further enhanced by EPIRB-transmitted registration data on the carrying vessel. Owners of 121.5/406 MHz EPIRB's furnish registration information about their vessel, survival gear, and emergency points of contact ashore, all of which greatly enhance the response. The database for U.S. vessels is maintained by the National Oceanographic and Atmospheric Administration, and is accessed worldwide by SAR authorities to facilitate SAR response.

Testing EPIRB's
EPIRB owners should periodically check for water tightness, battery expiration date, and signal presence, FCC rules allow Class A, B and S EPIRB's to be turned on briefly (for three audio sweeps, or 1 second only) during the first 5 minutes of any hour. Signal presence can be detected by an FM radio tuned to 99.5 MHz, or an AM radio tuned to any vacant frequency and located close to an EPIRB. FCC rules allow Class C EPIRB's to be tested within the first 5 minutes of any hour, for not more than 10 seconds. Class C EPIRB's can be detected by a marine radio tuned to channel 15 or 16. All 121.5/406 MHz EPIRB's have a self-test function that should be used in accordance with manufacturers' instructions at least monthly.

The COSPAS-SARSAT System

COSPAS is a Russian acronym for "Space System for Search of Distressed Vessels", SARSAT signifies "Search and Rescue Satellite-Aided Tracking", COSPAS-SARSAT is an international satellite-based search and rescue system established by the U.S., Russia, Canada and France to locate emergency radiobeacons transmitting on the frequencies 121.5, 243 and 406 MHz. Since

its inception, the COSPAS-SARSAT system (SARSAT satellite only has contributed to saving over 3000 lives.

The USCG receives data from MRCC stations and SAR Points of Contact (SPOC). See figure.

Country	*Location*	*Designator*	*Status*
Australia	Canberra	AUMCC	In Operation
Brazil	San Paulo	BBMCC	Under Test
Canada	Trenton	CMCC	In Operation
Chile	Santiago	CHMCC	Under Test
France	Toulouse	FMCC	In Operation
Hong Kong	Hong Kong	HKMCC	In Operation
India	Bangalore	INMCC	In Operation
Indonesia	Jakarta	IONCC	Under Test
ITDC	Taipei	TAMCC	TBD
Japan	Tokyo	JAMCC	In Operation
New Zealand			In Operation
Norway	Bodo	NMCC	In Operation
Pakistan	Lahore	PAMCC	—
Singapore	Singapore	SIMCC	—
Spain	Maspalomas	SPMCC	In Operation
Russian Federation	Moscow	CMC	In Operation
United Kingdom	Plymouth	UKMCC	In Operation
United States	Suitland	USMCC	In Operation

Participants in COSPAS/SARSAT system.

Operation of the COSPAS-SARSAT System

If an EPIRB is activated, COSPAS-SARSAT pick up the signal, locates the source and passes the information to a land station. From there, the information is relayed, either via coast radio or satellite, to Rescue Coordination Centers, rescue vessels and nearby ships. This constitutes a one-way only communications system, from the EPIRB via the satellite to the rescuers. It employs low altitude, near polar orbiting satellites and by exploiting the Doppler principle, locates the transmitting EPIRB within about two miles. Due to the low polar orbit, there may by a delay in receiving the distress message unless the footprint of the satellite is simultaneously in view with a monitoring station. However, unlike SafetyNET, worldwide coverage is provided.

As a satellite approaches a transmitting EPIRB, the frequency of the signals it receives is higher than that being transmitted; when the satellite has passed the EPIRB, the received frequency is lower. This creates a notable Doppler shift. Calculations which take into account the earth's rotation and other factors then determine the location of the EPIRB.

The 406 MHz EPRIB's incorporates an identification code. Once the satellite receives the beacon's signals, the Doppler shift is measured and the beacon's digital data is recovered from the signal. The information is time-lagged, formatted as digital data and transferred to the repeater downlink for real time transmission to any local user terminal. The digital data coded into each 406 MHz EPRIB's memory provides distress information to SAR authorities for more rapid and efficient rescue. The data includes a maritime identification digit (MID, a 3 digit number identifying the administrative country) and either a ship station identifier (SSI, a 6 digit

number assigned to specific ships), a ship radio call sign or a serial number to identify the ship in distress.
With the INMARSAT E satellite EPIRB's, coverage does not extend to very high latitudes, but within the coverage area the satellite connection is instantaneous. However, to establish the EPIRB's position, an interface with a GPS receiver or other sensor is needed.

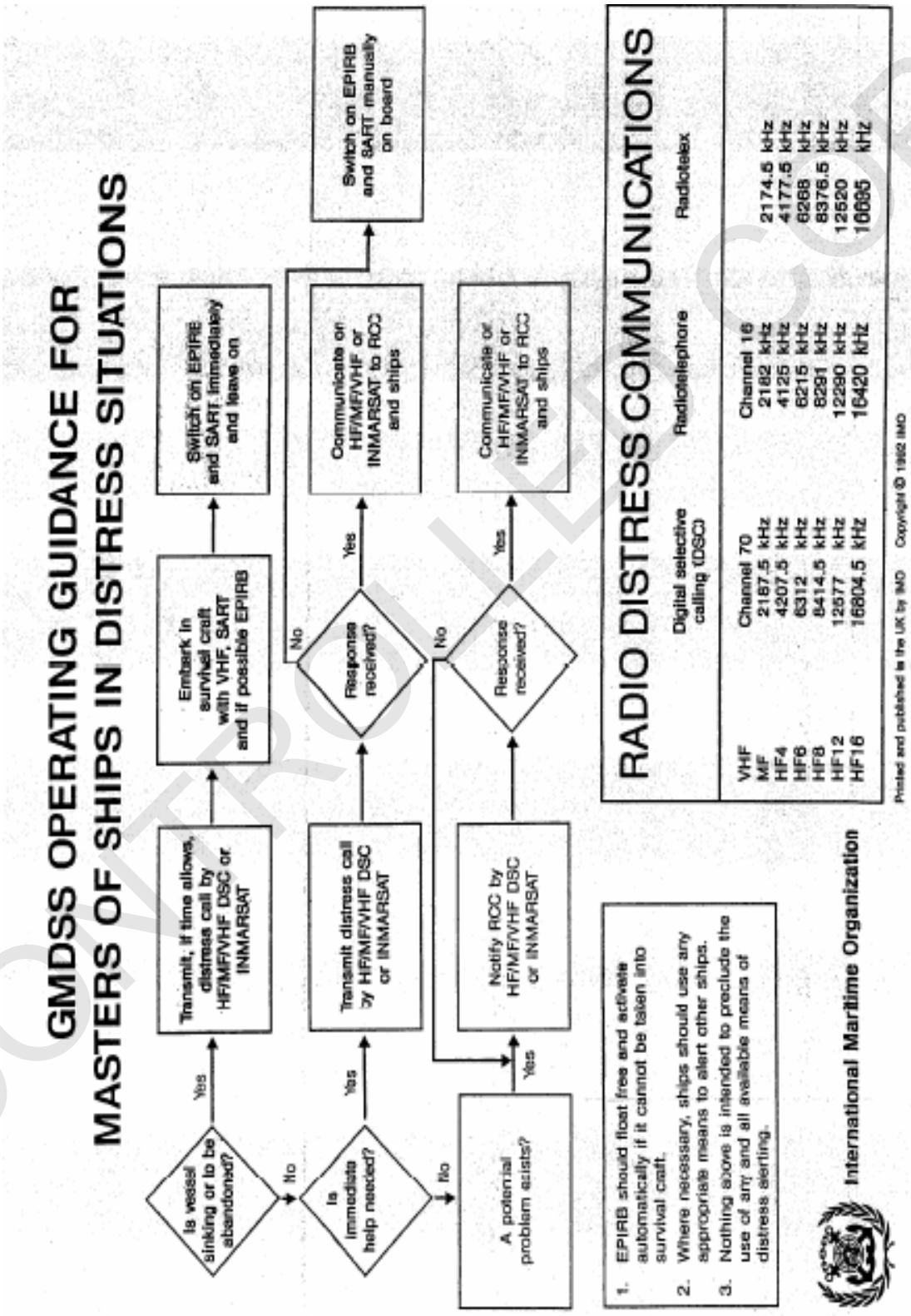
Alarm, Warning and Alerting Signals.

For MF (i.e. 2182 kHz), the EPIRB signal consists of either (1) a keyed emission modulated by a tone of 1280 Hz to 1320 Hz with alternating periods of emission and silence of 1 to 1.2 seconds each; or (2) the radiotelephone alarm signal followed by Morse code B (V · · ·) and/or the call sign of the transmitting ship, sent by keying a carrier modulated by a tone of 1300 Hz or 2200 Hz. For VHF (i.e. 121.5 MHz and 243 MHz), the signal characteristics are in accordance with the specifications of Appendix 37A of the ITU Radio Regulations. For 156.525 MHz and UHF (i.e. 406 MHz to 406.1 MHz and 1645.5 MHz to 1646.5 MHz), the signal characteristics are in accordance with CCIR recommendations.

The purpose of these signals is to help determine the position of survivors for SAR operations. They indicate that one or more persons are in distress, may no longer be aboard a ship or aircraft, and may not have a receiver available.

Any vessel or aircraft receiving an EPIRB signal while no distress or urgent traffic is being passed shall initiate a distress message on the assumption that the EPIRB sending station is unable to transmit a distress message. The keying cycles for MF EPIRB's may be interrupted for speech transmission.

7 Assessment and discussion



Annex

PANAMA MARITIME AUTHORITY
Directorate General of Merchant Marine

Office of the Department of Merchant Marine Circular No.103
Maritime Safety

To: Owners/Operators of Panamanian flag Vessels, Class Societies and Authorized Organizations

Subject: GMDSS equipment requirements

Regarding the installation of GMDSS equipment on vessels or units that carry the Panamanian flag the following:

1. The Sea Areas are determined by the Contracting governments on land that can provide the Sea Area services. For this reason any vessel or unit that operates solely within the territorial waters of any given coastal state shall comply with the Coastal State requirements for the GMDSS equipment.

2. For vessels that engage in international trade along the coast, they shall determine what Sea Areas services are provided within their area of navigation so as to establish the GMDSS equipment needed. For this information you need to contact the NAVAREA coordinators or the Coastal States involved. They should be able to provide literature regarding this and probably a recommendation for the equipment. Please find attached a list of NAVAREA coordinators and a NAVAREA map.

3. In the case that a vessel trades along the coast and no Sea Area A1 or A2 services are provided, the vessel shall be fitted for Sea Area A3 equipment.

4. If a vessel or unit will be taken out of service within two years of 1 February 1999 the operator/owners can obtain an exemption for some requirements of GMDSS if they contact the administration prior to 1 February 1999. There is no guarantee of approval for any requests received after that date.

5. For special situations that may render the full application of SOLAS Chapter IV Regulations 7 to 11 unreasonable or unnecessary please contact our office via fax or email. Send your request with the following information:

a. vessel name,
b. call letters,
c. IMO number,
d. gross tonnage,
e. area of navigation,
f. Sea Area services provided within the area of navigation,
g. request (be specific regarding SOLAS regulations that the request is about),
h. SOLAS regulation on which the request is based on,
i. special conditions

August 1998

Inquiries concerning the subject of this Circular or any requests should be directed to:

Directorate General of Merchant Maritne, New York Office
Department of Maritime Safety
West 48th Street, 10 floor
New York, NY 10036,
U.S.A.
Phone: ++1 (212) 869-6440
Fax: ++1 (212) 575-2285 / 2288
Email: gsimons@segumar.com

PANAMA MARITIME AUTHORITY

Directorate General of Merchant Marine
International Representative Office, New York

Merchant Marine Circular No. 118

To: Owners/Operators of Panamanian flag Vessels, Class Societies and Authorized Organizations

Subject: Amendments to MMC No. 106 GMDSS (Radio Qualified Personnel on board Panamanian Flag Vessels) update policy

This notice will supersede Merchant Marine Circular No. 106 of January 1999

The purpose of this Merchant Marine Circular is to remind shipowners/operators and masters of Panamanian registered ships of the full implementation of Global Maritime Distress and Safety System (GMDSS). This requirement became mandatory for ships of over 300 GT on February 1, 1999. It also introduces revision of MMC No.106 and the new policy of this Administration concerning Radio Qualified Personnel on board Panamanian Flag Vessels.

After consultation with various organizations of the maritime industry, beginning February 1, 2002, this Administration will require that GMDSS vessels carry a minimum of two (2) Watchstanding Deck Officers or one (1) Dedicated Radio Officer with the GMDSS Radio Operator Certificate General or Restricted, depending upon the ship's intended Sea Area of operation.

January 2002
Inquiries concerning the subject of this Circular or any request should be directed to:
Directorate General of Merchant Marine, New York Office
International Representative Office
6 West 48th Street, 11 floor
New York, NY 10036
U.S.A.
Phone: ++1 (212) 869-6440
Fax: ++1 (212) 575-2285/2288

PANAMA MARITIME AUTHORITY

Directorate General of Merchant Marine
Office of the Department Merchant Marine Circular No.105
Of Maritime Safety

To: Owners/Operators of Panamanian flag Vessels, Class Societies and Authorized Organizations
Subject: Global Maritime Distress and Safety System (GMDSS) Fines

Due to the fact that:

- the GMDSS equipment requirements for 1 February 1999 were announced seven years ago;
- many shipowners/operators waited to the last minute to order the equipment and make the installations;
- manufacturers of the equipment cannot meet the last minute demand for equipment;
- Port State Control Authorities will detain vessels that are found not in compliance with the GMDSS requirements after 1 February 1999 or that do not have proper documentation from the flag regarding an extension for implementation;

the Directorate General of Merchant Marine has established the following fines for failure to comply with the GMDSS requirements on time:

A. Extensions may be granted only to those vessels that have ordered the equipment and have a definite delivery and installation date. Fines for these extensions shall be imposed as follows:

1. Extensions for the installation of the GMDSS equipment required by 1 February 1999 will be granted before 1 February 1999 upon payment of a fine of US$ 3,000.00 per vessel.
2. Extensions for the installation of the GMDSS equipment required by 1 February 1999 will be granted after 1 February 1999 upon payment of a fine of US$ 6,000.00 per vessel.

Both of the above fines are to be paid in advance to the "Directorate of Consular and Maritime Affairs" by International money order or check (that can be drawn in a U.S. bank) and sent to the address at the end of this circular. Upon receipt of payment, the Department of Maritime Safety (SEGUMAR) will issue the extension letter to the company that requested it, and send it by fax and regular mail, unless requested otherwise. Please make sure the request contains the following information:

a. Name of the vessel
b. Call letters
c. IMO number
d. Year keel laid
e. Date that equipment will be delivered (shipowners/operators shall send a clear copy of the order receipt)
f. Date that equipment will be installed (the extension letter will be granted based on this date)
g. Postal Address to where the extension letter shall be sent to

The above fines do not apply when the vessel has been detained in a port.

A. In other cases, fines shall be imposed as follows:

1. For vessels are identified as "not in compliance" with the GMDSS equipment requirements after 1 February 1999, a fine of US$ 8,000.00 shall be imposed. SEGUMAR will inform of any such cases to the Legal Department of the Directorate.

2. For vessels that requested an exemption for GMDSS equipment requirements under the understanding that the vessel would be put out of service within two (2) years of 1 February 1999, and if the owners/operators do not comply with the condition to put the vessels out of service, a fine of US$ 10,000.00 shall be imposed.

A. For registration purposes:

1. Vessels seeking permanent registration and vessels requesting any change in their Patente of Navigation after 1 February 1999, shall have all the GMDSS equipment installed on board before the Administration issues a permanent Patente of navigation. The Radio-communications Department of the Directorate will require that all vessels of 300 gross tonnage and upwards present a GMDSS certification prior to the issuance of a Radio License.

January 1999
Inquiries concerning the subject of this Circular or any requests should be directed to:
Directorate General of Merchant Marine, New York Office
Department of Maritime Safety (SEGUMAR)
6 West 48th Street, 10 floor
New York, NY 10036,
U.S.A.
phone: ++1 (212) 869-6440
fax: ++1 (212) 575-2285 / 2288

PANAMA MARITIME AUTHORITY
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6 West 48th Street, 10 floor
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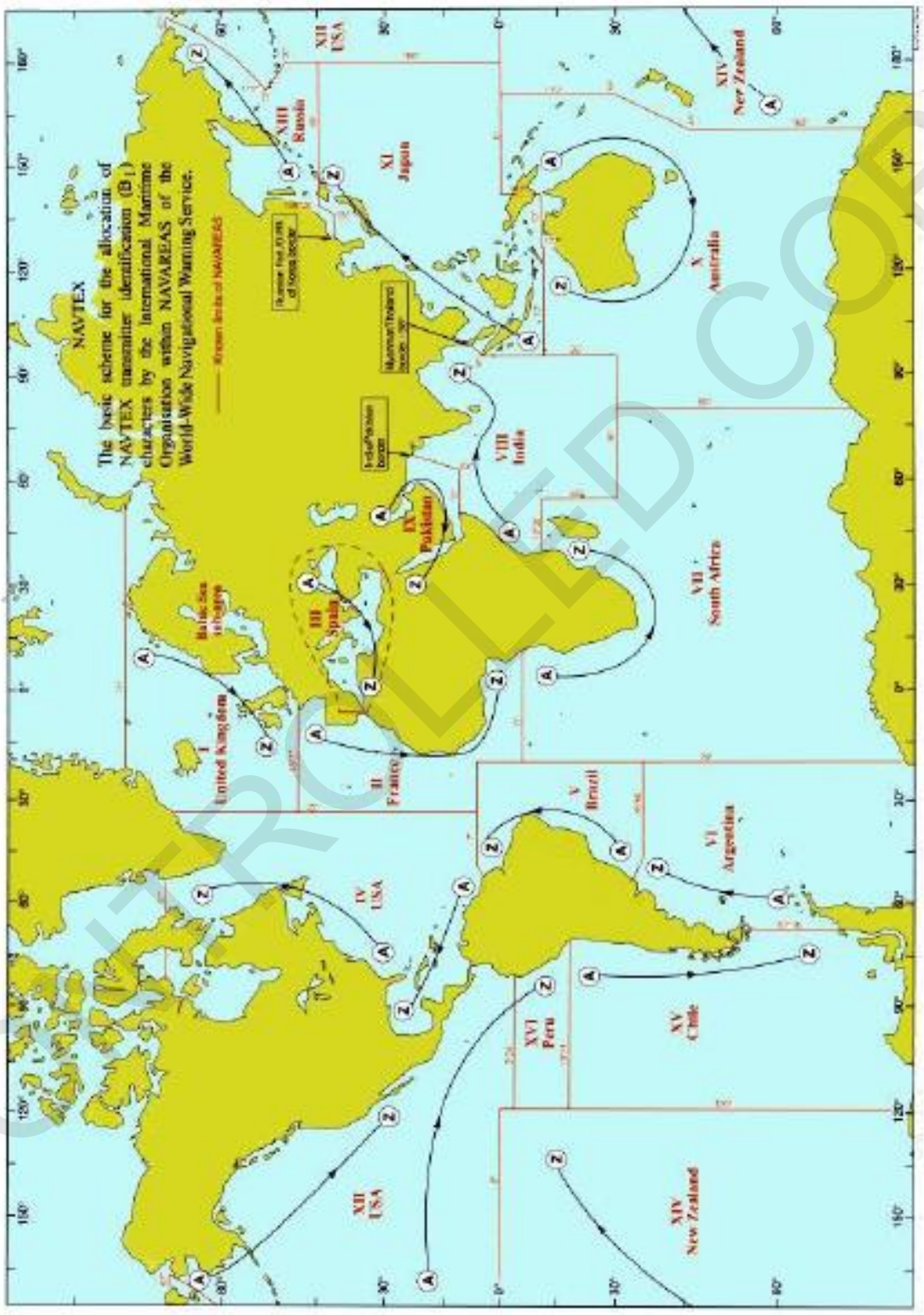
phone: ++1 (212) 869-6440
fax: ++1 (212) 575-2285 / 2288



LONDON SE1 7SR

Telephone: 020 7735 7611
Fax: 020 7587 3210
Telex: 23588 IMOLDN G

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Ref. T2/6.01

COMSAR/Circ.30
20 January 2003

LIST OF NAVAREA CO-ORDINATORS

1. The Sub-Committee on Radio communications and Search and Rescue (COMSAR), at its seventh session (13 to 17 January 2003), updated the list of NAVAREA coordinators, as reproduced in annex.

2. Member Governments are invited to bring the annexed list to the attention of the NAVAREA coordinators shown in the annex and to other national Maritime Safety Information (MSI) providers concerned, for information.
3. This circular supersedes COMSAR/Circ.24.

***

ANNEX

NAVAREA CO-ORDINATORS

NAVAREA I (United Kingdom)
United Kingdom Hydrographic Office
Admiralty Way
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Tel: +44 1823 723316
Fax: +44 1823 322352
E-mail: rnwuser@ukhornw.u-net.com

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Swedish Maritime Administration
BALTICO
SE-601 78 NORRKOPING
Tel: +46 11 19 10 45 (24 hours)
Fax: +46 11 238945 (07-15 UTC)
Fax: +46 8 601 7969 (15-07 UTC)
Telex: 64320 BALTICOS (07-15 UTC)
Telex: 16060 STORDOS (15-07 UTC)
E-mail: ntm.baltico@sjofartsverket.se
Internet: www.sjofartsverket.se

NAVAREA II (France)
Directeur
etablissement principal du service
hydrographique et oceanographique
de la Marine (EPSHOM)
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BP 30316 BREST CEDEX
Tel: +33 2 98 22 15 99
Fax: +33 2 98 22 14 32
E-mail: coord.navarea2@shom.fr

NAVAREA III (Spain)
Instituto Hidrográfico de la Marina
Plaza San Severiano no 3
11007 CADIZ
Tel: 34 (956) 599409/599414
Fax: +34 (956) 599396
Telex: 76147 MEDCO E/76102 MARIH E
Teleg: Instituto Hidrografico CADIZ, Spain
E-mail: ihmesp@retemail.es

NAVAREA IV and XII (USA)
National Imagery and Mapping Agency
Attn: PTNM (Mail Stop D-44)
4600 Sangamore Rd.
Bethesda, Maryland 20816-5003
Tel: +1 (301) 227 3147
Fax: + 1 (301) 227 3731
Telex: 898334/EASYLINK MBS 62554950
Teleg: NIMA NAVSAFETY BETHESDA MD
E-mail: navsafety@nima.mil

NAVAREA V (Brazil)
Director
Diretoria de Hidrografia e Navegacao
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Ponta da Armacao
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E-mail: snautica@hidro.gov.ar

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Fax: +27 (21) 787 2228
E-mail: hydrosan@iafrica.com

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Fax: +91- 0135- 748373
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E-mail: nho@sancharnet.in
Internet: www.hydroindia.org

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NAVAREA X (Australia)
Maritime Duty Officer
Australian Search and Rescue (AusSAR)
Australian Maritime Safety Authority (AMSA)
GPO Box 2181
CANBERRA CITY ACT 2601
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Fax: +61 2 6230-6868
E-mail: rccaus@amsa.gov.au

COMSAR/Circ.30
ANNEX
Page 2
I:\CIR COMSAR\30.doc
NAVAREA XI (Japan)
Hydrographic and Oceanographic Department
Japan Coast Guard
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Chuo-ku, Tokyo 104-0045
Tel: +81 (3) 3541 - 3817
Fax: +81 (3) 3542 - 7174
Telex: 2522222 JAHYD J
E-mail: tuho@jodc.go.jp

NAVAREA XIII (Russian Federation)
Chief, Head Department of Navigation and Oceanography
8,11 liniya, B-34
ST. Petersburg 199034
Tel: +7 812 213 81 09
Fax: +7 812 323 75 48
Telex: 121531 NAVIO RU
Teleg: St. PETERSBURG HYDROGRAPHIA
E-mail: gunio@homepage.ru

NAVAREA XIV (New Zealand)
Joint Geospatial Support Facility
Private Bag 32-901
Devonport
Auckland 9
Tel: +64 (9) 445-5709
Fax: +64 (9) 445-5589
E-mail: iain.lamont@nzdf.mil.nz

NAVAREA XV (Chile)
Director, Hydrographic and Ocenaographic
Service of the Chilean Navy
Casilla 324
Valparaiso
Tel: +56 32 266666
Fax: +56 32 266542
E-mail: shoa@shoa.cl
Internet : www.shoa.cl

NAVAREA XVI (Peru)
Direcciün de Hidrografía y Navegación
Av. Gamarra No. 500
Chucuito
Callao
Tel: (51-1) 4658312/4296019/4299063
Fax: (51-1) 4652995
E-mail: dihidronav@dhn.mil.pe

SOLAS CHAPTER IV
RADIOCOMMUNICATIONS

PART A - GENERAL
1. Application
2. Terms and definitions
3. Exemptions
4. Functional requirements

PART B - UNDERTAKINGS BY CONTRACTING GOVERNMENTS

5. Provision of radiocommunication services
   5.1. Global Maritime Distress and Safety System identities

PART C - SHIP REQUIREMENTS

6. Radio installations
7. Radio equipment - General
8. Radio equipment - Sea area Al
9. Radio equipment - Sea areas Al and A2
10. Radio equipment - Sea areas Al, A2 and A3
11. Radio equipment - Sea areas Al, A2, A3 and A4
12. Watches
13. Sources of energy
14. Performance standards
15. Maintenance requirements
16. Radio personnel
17. Radio records
18. Position-updating

CHAPTER IV – RADIOCOMMUNICATIONS

PART A – GENERAL

Regulation 1
Application

1 Unless expressly provided otherwise, this chapter applies to all ships to which the present regulations
apply and to cargo ships of 300 tons gross tonnage and upwards.

2 This chapter does not apply to ships to which the present regulations would otherwise apply while such ships are being navigated within the (Great Lakes of North America and their connecting and tributary waters as far east as the lower exit of the St. Lambert Lock at Montreal in the Province of
Quebec, Canada*

* Such ships are subject requirements relative to radio for safety purposes as contained in the relevant agreement between Canada and the United States of America.

3 No provision in this chapter shall prevent the use by any ship, survival craft or person in distress, of any means at their disposal to attract attention, make known their position and obtain help.

Regulation 2
Terms and definitions

1 For the purpose of this chapter, the following terms shall have the meanings defined below:

.1 Bridge-to-bridge communications means safety communications between ships from the position from which the ships are normally navigated.

.2 Continuous watch means that the radio watch concerned shall not be interrupted other than for brief intervals when the ship's receiving capability is impaired or blocked by its own communications or when the facilities are under periodical maintenance or checks.

.3 Digital selective calling (DSC) means a technique using digital codes which enables a radio station to establish contact with, and transfer information to, another station or group of stations, and complying with the relevant recommendations of the International Radio Consultative Committee (CCIR).

.4 Direct-printing telegraphy means automated telegraphy techniques which comply with the relevant recommendations of the International Radio Consultative Committee (CCIR).

.5 General radiocommunication means operational and public correspondence traffic, other than distress, urgency and safety messages, conducted by radio.

.6 INMARSAT means the organization established by the Convention on the International Maritime Satellite Organization (INMARSAT) adopted on 3 September 1976.

.7 International NAVTEX Service means the coordinated broadcast and automatic reception on 518 kHz of maritime safety information by means of narrow-band direct-printing telegraphy using the English language*.

.8 Locating means the finding of ships, aircraft, units or persons in distress

* Reference is made to the NAVTEX Manual approved by the Organization

.9 Maritime safety information means navigational and meteorological warnings, meteorological forecasts and other urgent safety related messages broadcast to ships.

.10 Polar orbiting satellite service means a service which is based on polar orbiting satellites which receive and relay distress alerts from satellite EPIRBs and which provides their position.

.11 Radio Regulations means the Radio Regulations annexed to, or regarded as being annexed to, the most recent International Telecommunication Convention which is in force at any time.

.12 Sea area Al means an area, within the radiotelephone coverage of at least one VHF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government.

.13 Sea area A2 means an area, excluding sea area Al, 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*.

.14 Sea Area A3 means an area, excluding sea areas Al and A2, within the coverage of an INMARSAT geostationary satellite in which continuous alerting is available.

.15 Sea Area A4 means an area outside sea areas Al, A2 and A3.

.16 Global Maritime Distress and Safety System identities means maritime mobile services identity, the ship's call sign, Inmarsat identities and serial number identity which may be transmitted by the ship's equipment and used to identify the ship.

2 All other terms and abbreviations which are used in this chapter and which are defined in the Radio Regulations and in the International Convention on Maritime Search and Rescue (SAR), 1979, as it may be amended, shall have the meanings as defined in those Regulations and the SAR Convention.

* Reference is made to the Recommendation on the Provision of Radiocommunication Services for the Global Maritime Distress and Safety System, adopted by the Organization by resolution A.801 (19).

Regulation 3

Exemptions

1 The Contracting Governments consider it highly desirable not to deviate from the requirements of this chapter; nevertheless the Administration may grant partial or conditional exemptions to individual ships from the requirements of regulations IV/7 to 11 provided:

.1 such ships comply with the functional requirements of regulation IV/4; and

.2 the Administration has taken into account the effect such exemptions may have upon the general efficiency of the service for the safety of all ships.

2 An exemption may be granted under paragraph 1 only:

.1 if the conditions affecting safety are such as to render the full application or regulations IV/7 to 11 unreasonable or unnecessary; and

.2 in exceptional circumstances, for a single voyage outside the sea area or sea areas for which the ship is equipped.

3 Each Administration shall submit to the Organization, as soon as possible after the first of January in each year, a report showing all exemptions granted under paragraphs 1 and 2 during the previous calendar year and giving the reasons for granting such exemptions.

Regulation 4

Functional requirements

1 Every ship, while at sea, shall be capable:

.1 except as provided in regulations IV/8.1.1 and 10.1.4.3, of transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radiocommunication service;

.2 of receiving shore-to-ship distress alerts;

.3 of transmitting and receiving ship-to-ship distress alerts;

.4 of transmitting and receiving search and rescue coordinating communications;

.5 of transmitting and receiving on-scene communications;

.6 of transmitting and, as required by regulation V/19.2.3.2, receiving signals for locating*;

* Reference is made to Resolution A.614(15) on Carriage of Radar Operating in the Frequency Band 9,300—9,500 MHz adopted by the Organization.

.7 of transmitting and receiving* maritime safety information;

.8 of transmitting and receiving general radiocommunications to and from shore-based radio systems or networks subject to regulation IV/15.8; and

.9 of transmitting and receiving bridge-to-bridge communications.

* It should be noted that ships may have a need for reception of certain maritime safety information while in port.

PART B - UNDERTAKINGS BY CONTRACTING GOVERNMENTS**

Regulation 5

Provision of radiocommunication services

1 Each Contracting Government undertakes to make available, as it deems practical and necessary either individually or in co-operation with other Contracting Governments, appropriate shorebased facilities for space and terrestrial radiocommunication services having due regard to the recommendations of the Organization***. These services are:

.1 a radiocommunication service utilizing geostationary satellites in the Maritime Mobile-Satellite Service;

.2 a radiocommunication service utilizing polar orbiting satellites in the Mobile-Satellite Service;

.3 the Maritime Mobile Service in the bands between 156 MHz and 174 MHz;

.4 the Maritime Mobile Service in the bands between 4,000 kHz and 27,500 kHz; and

.5 the Maritime Mobile Service in the bands between 415 kHz and 535 kHz and between 1,606 kHz and 4,000 kHz.

2 Each Contracting Government undertakes to provide the Organization with pertinent information concerning the shore-based facilities in the Maritime Mobile Service, Mobile-Satellite Service and Maritime Mobile-Satellite Service, established for sea areas which it has designated off its coasts.

** 1 Each Contracting Government is not required to provide all radiocommunication services.
2 The requirements should be specified for shore-based facilities to cover the various sea areas.

*** Reference is made to the Recommendation on the Provision of Radiocommunication Services for the Global Maritime Distress and Safety System, adopted by the Organization by resolution A.801 (19).

Regulation 5-1

Global Maritime Distress and Safety System identities

1 This regulation applies to all ships on all voyages.

2 Each Contracting Government undertakes to ensure that suitable arrangements are made for registering Global Maritime Distress and Safety System (GMDSS) identities and for making information on these identities available to Rescue Co-ordination Centres on a 24-hour basis. Where appropriate, international organizations maintaining a registry of these identities shall be notified by the Contracting Government of these assignments.

PART C - SHIP REQUIREMENTS
Regulation 6

Radio installations

1 Every ship shall be provided with radio installations capable of complying with the functional requirements prescribed by regulation IV/4 throughout its intended voyage and, unless exempted under regulation IV/3, complying with the requirements of regulation IV/7 and, as appropriate for the sea area or areas through which it will pass during its intended voyage, the requirements of either regulation IV/8, 9, 10 or 11.

2 Every radio installation shall:

.1 be so located that no harmful interference of mechanical, electrical or other origin affects its proper use, and so as to ensure electromagnetic compatibility and avoidance or harmful interaction with other equipment and systems;

.2 be so located as to ensure the greatest possible degree of safety and operational availability;

.3 be protected against harmful effects of water, extremes of temperature and other adverse environmental conditions;

.4 be provided with reliable, permanently arranged electrical lighting, independent of the main and emergency sources of electrical power, for the adequate illumination of the radio controls for operating the radio installation; and

.5 be clearly marked with the call sign, the ship station identity and other codes as applicable for the use of the radio installation.

3 Control of the VHP radiotelephone channels, required for navigational safety, shall be immediately available on the navigating bridge convenient to the conning position and, where necessary, facilities should be available to permit radiocommunications from the wings of the navigating bridge. Portable VHF equipment may be used to meet the latter provision.

4 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 radiocommunication installations required on board for that 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. If the satellite EPIRB is used as the secondary means of distress alerting and is not remotely activated, it shall be acceptable to have an additional EPIRB installed in the wheelhouse near the conning position.

5 In passenger ships, information on the ship's position shall be continuously and automatically provided to all relevant radiocommunication equipment to be included in the initial distress alert when the button or buttons on the distress panel is pressed.

6 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 radiocommunication service the distress alerts have been received.

Regulation 7
Radio equipment — General

1 Every ship shall be provided with:

.1 a VHF radio installation capable of transmitting and receiving:

.1 DSC on the frequency 156.525 MHz (channel 70). It shall be possible to initiate the transmission of distress alerts on channel 70 from the position from which the ship is normally navigated*; and

.2 radiotelephony on the frequencies 156.300 MHz (channel 6), 156.650 MHz (channel 13) and 156.800 MHz (channel 16);

.2 a radio installation capable of maintaining a continuous DSC watch on VHF channel 70 which may be separate from or combined with, that required by subparagraph .1.1;

* Certain ships may be exempted from this requirement (see regulation IV/9.4).

.3 a radar transponder capable of operating in the 9 GHz band, which:

.1 shall be so stowed that it can be easily utilized; and
.2 may be one of those required by regulation III/6.2.2 for a survival craft;

.4 a receiver capable of receiving International NAVTEX service broadcasts if the ship is engaged on voyages in any area in which an International NAVTEX service is provided;

.5 a radio facility for reception of maritime safety information by the INMARSAT enhanced group calling system if the ship is engaged on voyages in any area of INMARSAT coverage but in which an International NAVTEX service is not provided. However, ships engaged exclusively on voyages in areas where an HF direct-printing telegraphy maritime safety information service is provided and fitted with equipment capable of receiving such service, may be exempt from this requirement*;

.6 subject to the provisions of regulation IV/8.3, a satellite emergency position-indicating radio beacon (satellite EPIRB) which shall be:

. 1 capable of transmitting a distress alert either through the polar orbiting satellite service operating in the 406 MHz band or, if the ship is engaged only on voyages within INMARSAT geostationary satellite service operating in the 1.6 GHz band**;

.2 installed in an easily accessible position;

.3 ready to be manually released and capable of being carried by one person into a survival craft;

.4 capable of floating free if the ship sinks and of being automatically activated when afloat; and

.5 capable of being activated manually.

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

* Reference is made to the Recommendation on Promulgation of Maritime Safety Information, Assembly resolution A.705 (17).
** Subject to the availability of appropriate receiving and processing ground facilities for each ocean region covered by INMARSAT satellites.

Regulation 8

Radio equipment — Sea area Al

1 In addition to meeting the requirements of regulation IV/7, every ship engaged on voyages exclusively in sea area Al shall be provided with a radio installation capable of initiating the transmission of ship-to-shore distress alerts from the position from which the ship is normally navigated, operating either:

.1 on VHP using DSC; this requirement may be fulfilled by the EPIRB prescribed by paragraph 3, either by installing the EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or

.2 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated; or

.3 if the ship is engaged on voyages within coverage of MF coast stations equipped with DSC, on MF using DSC; or

.4 on HF using DSC; or

.5 through the INMARSAT geostationary satellite service; this requirement may be fulfilled by:

.1 an INMARSAT ship earth station*; or
.2 the satellite EPIRB, required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated.

2 The VHP radio installation, required by regulation IV/7.1.1, shall also be capable of transmitting and receiving general radiocommunications using radiotelephony.

3 Ships engaged on voyages exclusively in sea area Al may carry, in lieu of the satellite EPIRB required by regulation IV/7.1.6, an EPIRB which shall be:

.1 capable of transmitting a distress alert using DSC on VHF channel 70 and providing for locating by means of a radar transponder operating in the 9 GHz band;

.2 installed in an easily accessible position;

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

.3 ready to be manually released and capable of being carried by one person into a survival craft;

.4 capable of floating free if the ship sinks and being automatically activated when afloat; and

.5 capable of being activated manually.

Regulation 9

Radio equipment — Sea areas Al and A2

1 In addition to meeting the requirements of regulation IV/7, every ship engaged on voyages beyond sea area Al, but remaining within sea area A2, shall be provided with:

.1 an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies:

.1 2,187.5 kHz using DSC; and

.2 2,182 kHz using radiotelephony;

.2 a radio installation capable of maintaining a continuous DSC watch on the frequency 2,187.5 kHz which may be separate from, or combined with, that required by subparagraph .1.1;and

.3 means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either:

.1 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated;

or

.2 on HP using DSC; or

.3 through the INMARSAT geostationary satellite service;

this requirement may be fulfilled by:

.1 the equipment specified in paragraph 3.2; or

.2 the satellite EPIRB, required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated.

2 It shall be possible to initiate transmission of distress alerts by the radio installations specified in paragraphs 1.1 and 1.3 from the position from which the ship is normally navigated.

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

.1 a radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000

kHz or between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by paragraph 1.1; or

.2 an INMARSAT ship earth station.

4 The Administration may exempt ships constructed before 1 February 1997, which are engaged exclusively on voyages within sea area A2, from the requirements of regulations IV/7. I.I.I and 7.1.2 provided such ships maintain, when practicable, a continuous listening watch on VHF channel 16. This watch shall be kept at the position from which the ship is normally navigated.

Regulation 10

Radio equipment — Sea areas Al, A2 and A3

1 In addition to meeting the requirements of regulation IV/7, every ship engaged on voyages beyond sea areas Al and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of paragraph 2, be provided with:

.1 an INMARSAT ship earth station capable of:

.1 transmitting and receiving distress and safety communications using direct-printing telegraphy;

.2 initiating and receiving distress priority calls;

.3 maintaining watch for shore-to-ship distress alerts, including those directed to specifically defined geographical areas;

.4 transmitting and receiving general radiocommunications, using either radiotelephony or direct printing telegraphy; and

.2 an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies:

.1 2,187.5 kHz using DSC; and

.2 2,182 kHz using radiotelephony; and

.3 a radio installation capable of maintaining a continuous DSC watch on the frequency 2,187.5 kHz which may be separate from or combined with that required by subparagraph .2.1; and

.4 means of initiating the transmission of ship-to-shore distress alerts by a radio service operating either;

.1 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB' required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated,' or

.2 on HF using DSC; or

.3 through the INMARSAT geostationary satellite service, by an additional ship earth station or by the satellite EPIRB required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated.

2 In addition to meeting the requirements of regulation IV/7, every ship engaged on voyages beyond sea areas Al and A2, but remaining within sea area A3, shall, if it does not comply with the requirements of paragraph 1, be provided with:

. 1 an MF/HF radio installation capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz:

.1 using DSC;
.2 using radiotelephony; and
.3 using direct-printing telegraphy; and

.2 equipment capable of maintaining DSC watch on 2,187.5 kHz, 8,414.5 kHz and on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz; at any time, it shall be possible to select any of these DSC distress and safety frequencies. This equipment may be separate from, or combined with, the equipment required by sub paragraph .1; and

.3 means of initiating the transmission of ship-to-shore distress alerts by a radiocommunication service other than HF operating either:

.1 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by regulation IV/7.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated;

or

.2 through the INMARSAT geostationary satellite service this requirement may be fulfilled by:

.1 an INMARSAT ship earth station; or
.2 the satellite EPIRB, required by regulation IV/7.1.6, either by installing the satellite EPIRB close to. or by remote activation from, the position from which the ship is normally navigated; and

.4 in addition, ships shall be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on working frequencies in the bands between 1,605 kHz and 4.000 kHz and between 4,000 kHz and 27,500 kHz.
This requirement may be fulfilled by the addition of this capability in the equipment required by subparagraph .1.

3 It shall be possible to initiate transmission of distress .alerts by the radio installations specified in subparagraph 1.1, 1.2, 1.4, 2.1 and 2.3 from the position from which the ship is' normally navigated.

4 The Administration may exempt ships constructed before 1 February 1997, and engaged exclusively on voyages within sea areas A2 and A3, from the requirements of regulations IV/7. I.I.I and 7.1.2 provided such ships maintain, when practicable, a continuous listening watch on VHF channel 16. This watch shall be kept at the position from which the ship is normally navigated.

Regulation 11

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

1 In addition to meeting the requirements of regulation IV/7, ships engaged on voyages in all sea areas shall be provided with the radio installations and equipment required by regulation IV/10.2, except that the equipment required by regulation IV/10.2.3.2 shall not be accepted as an alternative to that required by regulation IV/10.2.3.1, which shall always be provided. In addition, ships engaged on voyages in all sea areas shall comply with the requirements of regulation IV/10.3.

2 The Administration may exempt ships constructed before 1 February 1997, and engaged exclusively on voyages within sea areas A2, A3 and A4, from the requirements of regulation IV/7.I.I.I and 7.1.2 provided such ships maintain, when practicable, a continuous listening watch on VHF channel 16. This watch shall be kept at the position from which the ship is normally navigated.

Regulation 12

Watches

1 Every ship, while at sea shall maintain a continuous watch:

.1 on VHF DSC channel 70, if the ship, in accordance with the requirements of regulation IV/7.1.2, is fitted with a VHF radio installation;

.2 on the distress and safety DSC frequency 2,187.5 kHz, if the ship, in accordance with the requirements of regulation IV/9.1.2 or 10.1.3, is fitted with an MF radio installation;

.3 on the distress and safety DSC frequencies 2,187.5 kHz and 8,414.5 kHz and also on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz, appropriate to the time of day and the geographical position of the ship, if the ship, in accordance with the requirements of regulation IV/10.2.2 or 11.1, is fitted with an MF/HF radio installation. This watch may be kept by means of a scanning receiver;

.4 for satellite shore-to-ship distress alerts, if the ship, in accordance with the requirements of regulation IV/10.1.1, is fitted with an INMARSAT ship earth station.

2 Every ship, while at sea, shall maintain a radio watch for broadcasts of maritime safety information on the appropriate frequency or frequencies on which such information is broadcast for the area in which the ship is navigating.

3 Until 1 February 2005 or until such other date as may be determined by the Maritime Safety Committee, every ship while at sea shall maintain, when practicable, a continuous listening watch on VHF channel 16. This watch shall be kept at the position from which the ship is normally navigated.

Regulation 13

Sources of energy

1 There shall be available at all times, while the ship is at sea, a supply of electrical energy sufficient to operate the radio installations and to charge any batteries used as part of a reserve source or sources of energy for the radio installations.

2 A reserve source or sources of energy shall be provided on every ship, to supply radio installation, for the purpose of conducting distress and safety radiocommunications, in the event of failure of the ship's main and emergency sources of electrical power. The reserve source or sources of energy shall be capable of simultaneously operating the VHF radio installation required by regulation IV/7.1.1 and, as appropriate for the sea area or sea areas for which the ship is equipped, either the MF radio installation by regulation IV/9.1.1, the MF/HF radio installation required by regulation IV/10.2.1 or 11.1, or the INMARSAT ship earth station required by regulation IV/10.1.1 and any of the additional loads mentioned in paragraphs 4, 5 and 8 for a period of at least:

.1 one hour on ships provided with an emergency source of electrical power, if such source of power complies fully with all relevant provisions of regulation II-1/42 or 43, including the supply of such power to the radio installations; and

.2 six hours on ships not provided with an emergency source of electrical power complying fully with all relevant provisions of regulation II-1/42 or 43, including the supply of such power to the radio installations.
The reserve source or sources of energy need not supply independent HF and MF radio installations at the same time.

3 The reserve source or sources of energy shall be independent of the propelling power of the ship and the ship's electrical system.

4 Where, in addition to the VHF radio installation, two or more of the other radio installations, referred to in paragraph 2, can be connected to the reserve source or sources of energy, they shall be capable of simultaneously supplying, for the period specified, as appropriate, in paragraph 2.1 and 2.2, the VHF radio installation and:

.1 all other radio installations which can be connected to the reserve source or sources of energy at the same time; or

.2 whichever of the other radio installations will consume the most power, if only one of the other radio installations can be connected to the reserve source or sources of energy at the same time as the VHF radio installation.

5 The reserve source or sources of energy may be used to supply the electrical lighting required by regulation IV/6.2.4.

6 Where a reserve source of energy consists of rechargeable accumulator battery or batteries:

.1 a means of automatically charging such batteries shall be provided which shall be capable of recharging them to minimum capacity requirements within 10 hours; and

.2 the capacity of the battery or batteries shall be checked, using an appropriate method*, at intervals not exceeding 12 months, when the ship is not at sea.

7 The sitting and installation of accumulator batteries which provide a reserve source of energy shall be such as to ensure:
.1 the highest degree of service;

.2 a reasonable lifetime;

* One method of checking the capacity of an accumulator battery is to fully discharge and recharge the battery, using normal operating current and period (e.g. 10 hours). Assessment of the charge condition can be made at any time, but it should be done without significant discharge of the battery when the ship is at sea.

.3 reasonable safety;

.4 that battery temperatures remain within the manufacturer's specifications whether under charge or idle; and

.5 that when fully charged, the batteries will provide at least the minimum required hours of operation under all weather conditions. 8 If an uninterrupted input of information from the ship's navigational or other equipment to a radio installation required by this chapter is needed to ensure its proper performance, including the navigation receiver referred to in regulation 18, means shall be provided to ensure the continuous supply of such information in the event of failure of the ship's main or emergency source of electrical power.

Regulation 14

Performance standards

All equipment to which this chapter applies shall be of a type approved by the Administration. Such equipment shall conform to appropriate performance standards not inferior to those adopted by the Organization*.

Regulation 15

Maintenance requirements

1 Equipment shall be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment.

2 Where applicable, equipment shall be so constructed and installed that it is readily accessible for inspection and onboard maintenance purposes.

* Refer to the following resolutions adopted by the Organization:

1. Resolution A.525(13): Performance Standards for Narrow-Band Direct-Printing Telegraph Equipment for the Reception of Navigational and Meteorological Warnings and Urgent Information to Ships.

2. Resolution A.694(17): General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids.

3. Resolution A.808(19): Performance Standards for Ship Earth Stations Capable of Two-Way Communications, and resolution A.570(14), Type Approval of Ship Earth Stations.

4. Resolutions A.S03(19) and MSC.68(68): Performance Standards for Shipborne VHF Radio Installations Capable of Voice Communications and Digital Selective Calling.

5. Resolutions A.804(19) and MSC.68(68): Performance Standards for Shipborne MP Radio Installations Capable of Voice Communications and Digital Selective Calling.

6. Resolutions A.806(19) and MSC.68(68): Performance Standards for Shipborne MP/HF Radio Installations Capable of Voice Communication, Narrow-Band Direct-Printing and Digital Selective Calling.
7. Resolutions A.810(19), as amended by MSC.120(74) and MSC.56(66): Performance Standards for. Float-Free Satellite Emergency Position-Indicating Radio Beacons (EPIRBs) Operating on 406 MHz (see also resolution A.696(17): Type Approval of Satellite Emergency Position-Indicating Radio Beacons (EPIRBs) Operating in the COSPAS-SARSAT System).

8. Resolution A.802(19): Performance Standards for Survival Craft Radar Transponder for Use in Search and Rescue Operations.

9. Resolution A.805(19): Performance Standards for Float-Free VHF Emergency Position-Indicating Radio Beacons.

10. Resolutions A.807(19) and MSC.68(68): Performance Standards for Inmarsat Standard-C Ship Earth Stations Capable of Transmitting and Receiving Direct-Printing Communications.

11. Resolution A.664(16): Performance Standards for Enhanced Group Call Equipment.

12. Resolution A.812(19): Performance Standards for Float-Free Satellite Emergency Position-Indicating Radio Beacons Operating through the Geostationary Inmarsat Satellite System on 1.6 GHz.

13. Resolution A.662(16): Performance Standards for Float-Free Release and Activation Arrangements for Emergency Radio Equipment.

14. Resolution A.699(17): System Performance Standard for Promulgation and Co-ordination of Maritime Safety Information Using High-Frequency Narrow-Band Direct Printing.

15. Resolution A.700(17): Performance Standards for Narrow-Band Direct-Printing Telegraph Equipment for the Reception of Navigational and Meteorological Warnings and urgent Information to Ships (MSI) by HF.

16. Resolution MSC.80(70): Recommendation on Performance Standards for On-Scene (Aeronautical) Portable Two-Way VHF Radiotelephone Apparatus.

17. Resolution A.809(19): Performance Standards for Survival Craft Two-Way VHF Radiotelephone Apparatus.

18. Resolution A.811 (19): Performance Standards for a Shipborne Integrated Radio-communication System (IRCS) when used in the GMDSS.

3 Adequate information shall be provided to enable the equipment to be properly operated and maintained, taking into account the recommendations of the Organization*.

4 Adequate tools and spares shall be provided to enable the equipment to be maintained.

5 The Administration shall ensure that equipment required by this chapter is maintained to provide the availability of the functional requirements specified in regulation IV/4 and to meet the recommended performance standards of such equipment.

6 On ships engaged on voyages in sea areas Al and A2, the availability shall be ensured by using such methods as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, or a combination of these, as may be approved by the Administration.

* Reference is made to the Recommendation on Genera] Requirements for Ship borne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and for Electronic Navigational Aids (Assembly resolution A.694(17)).

7 On ships engaged on voyages in sea areas A3 and A4, the availability shall be ensured by using a combination of at least two methods such as duplication of equipment, shore-based

maintenance or at sea electronic maintenance capability, as may be approved by the Administration, taking into account the recommendations of the Organization.

8 While all reasonable steps shall be taken to maintain the equipment in efficient working order to ensure compliance with all the functional requirements specified in regulation TV/4 malfunction of the equipment for providing the general radiocommunications required by regulation IV/4.8 shall not be considered as making a ship unseaworthy or as a reason for delaying the ship in ports where repair facilities are not readily available, provided the ship is capable of performing all distress and safety functions.

9 Satellite EPIRBs shall be tested at intervals not exceeding 12 months for all aspects of operational efficiency with particular emphasis on frequency stability, signal strength and coding. However, in cases where it appears proper and reasonable, the Administration may extend this. period to 17 months*. The test may be conducted on board the ship or at an approved testing or servicing station.

* See MSC/Circ.955.

Regulation 16
Radio personnel

1 Every ship shall carry personnel qualified for distress and safety radiocommunication purposes to the satisfaction of the Administration. The personnel shall be holders of certificates specified in the Radio Regulations as appropriate, any one of whom shall be designated to have primary responsibility for radiocommunications during distress incidents.

2 In passenger ships, at least one person qualified in accordance with paragraph 1 shall be assigned to perform only radiocommunication duties during distress incidents.

Regulation 17
Radio records

A record shall be kept, to the satisfaction of the Administration and as required by the Radio Regulations, of all incidents connected with the radiocommunication service which appear to be of importance to safety of life at sea.

Regulation 18
Position-updating

All two-way communication equipment carried on board a ship to which this chapter applies which is capable of automatically including the ship's position in the distress alert shall be automatically provided with this information from an internal or external navigation receiver, if either is installed. If such a receiver is not installed, the ship's position and the time that position was correct shall be manually updated at intervals not exceeding four hours, while the ship is underway, so that it is always ready for transmission by the equipment.

GLOSSARY OF TERMS

AGC	Automatic Gain Control
AMVER	Automated Mutual assistance Vessel Rescue system
AOR	Atlantic Ocean Region
ARQ A NBPD (telex)	technique for detecting and correcting transmitted data errors. Data is re-transmitted if error is detected by the receiver. The receiver requests repeat transmission.
ASCII	American Standard Code for International Interchange. A universal code for the exchange of information between computer terminals.
ATOR	Automatic Telex over Radio
BDE	Below Deck Equipment
BER	Bit Error Rate
C-Band	4/6 GHz
CCIR	International Radio Consultative Committee (Standards Committee of the ITU).
CCITT	International Telegraph and Telephone Consultative Committee
CES	Coast Earth Station
CFR	Code of Federal Regulation: 33 CFR USCG navigation regulations 47 CFR FCC regulations 46 CFR USCG vessel regulations
COSAT Herat Station (CES)	A land station in the maritime mobile service providing communications to and from ships at sea. Same as Land Earth Station
COMSAT	Communication Satellite Corporation
COSPAS	Space System for Search of Distress Vessels
COSPAS-SARSAT	System A satellite aided search and rescue system based on lowaltitude, polar orbiting satellites and designed to locate Emergency Position Indicating Radio Beacons (EPIRB) transmitting on 121.5 MHz and 406.25 MHz.
CW	Continuous Wave
DSC	Digital Select Calling. Provides automated access to coast stations and ships that have DSC capability. The GMDSS
DSC	system for transmitting distress alerts from ships and for transmitting acknowledgments.
DTE	Data Terminal Equipment
DTMF	Dual Tone Multiple Frequency
DUPLEX	Different frequencies are used for transmission and reception.
EGC	Enhanced Group Call. Programmable radio address controller used in the INMARSAT system.
EPIRB	Emergency Position Indicating Radio Beacon. These beacons transmit on 406 MHz and use the COSPASSARSAT polar orbiting satellites to determine position of ship in distress.

EIRP	Equivalent Isotropically Radiated Power.
FCC	Federal Communications Commission.
FEC	Forward Error Correcting (SITOR broadcast mode). Geo-stationary Satellite A satellite whose period of revolution is equal to the point of rotation of the earth and who's circular and direct applies in the plane of the Earth's Equator. The altitude of the satellite can vary.
GHz	Gigahertz. 1,000,000,000,000 Hertz (Hertz = Cycles pre Second). A measure of radio frequency used in satellites radar bands.
GMDSS	Global Maritime Distress & Safety System.
GPS	Global Positioning System.
GRT	Gross Registered Tons.
HF	High Frequency (3 to 30 MHz).
Hz	Hertz. A measure of radio frequency. Hertz is the same as cycle per second.
Horning Signal	Locating signals transmitted by a ship in distress, or survival craft in order to provide a bearing for searching ships and aircraft EPIRBs and SARTs transmit horning signals for SAR. Horning signals are transmitted on frequency band of 117.975 -136.0 MHz; 156 – 174 MHz; 406 – 406.1 MHz; 9200 – 9500 MHz.
IHO	International Hydrographic Organization
IMO	International Maritime Organization (a U.N. Organization)
INMARSAT	International Maritime Satellite Organization
INMARSAT-A	Mobile FM-voice, data (up to 9.6 kb/s), FAX (up to 9.6 kb/s), Telex with 56/64 kb/s option satellite terminal.
INMARSAT-B	Mobile 16 kb/s digital voice, data (up to 9.6 kb/s), FAX (up to 9.6 kb/s), Telex with 56/64 kb/s option satellite terminals.
INMARSAT-C	Data only; Data (up to 600 kb/s) and Telex (used to receive SafetyNET broadcasts).
INMARSAT-E	INMARSAT EPIRB.
INMARSAT-M	Mobile 6.4 kb/s low quality voice, data (up to 2.4 kb/s), FAX (up to 2.4 kb/s) only, satellite terminal. Mobile .voice/data satellite terminal (not GMDSS compliant).
IOR	Indian Ocean Region.
ISDN	Integrated Services Digital Network.
ISVC	INMARSAT Voice Codec.
ITU	International Telecommunications Union (a U. N. Organization
KHz	Kilo Hertz. A measure of radio frequency. 1000 Hertz
L-Band EPIRB System	The INMARSAT satellite EPIRB system operating in the 1.6 GHz frequency.
LAT	Latitude. Horizontal global bearing circles parallel to the equator.
LES	Land Earth Station. Same as Coast Earth Station.
LESA	Land Earth Station Assignment Channel

Local User Terminal (LUT)	A ground receiving station which receives data from COSPAS-SARSAT satellites, calculates the position of the EPIRB and forwards the resultant information.
Locating Signals	Transmissions intended to assist in the location of ships in distress or survival craft.
LONG	Longitude. Vertical global bearing circles parallel to the North and South Poles.
LSB	Lower Side Band
Maritime Safety Information (MSI)	Distress alerts, navigational warnings, meteorological warnings and forecasts as well as other important safety information for ships.
MAYDAY	Distress Call.
MES	Mobile Earth Station.
MHz	Mega Hertz. 1,000,000 Hertz. A measurement of radio frequency.
MF	Medium Frequency (300 to 3000 KHz).
MID	Maritime Identification Digits (3 digit country identifier preceding an MMSI).
MMSI	Maritime Mobile Service Identity (9 digit DSC identifier).
Modem	Modulator/ Demodulator.
MRCC	Marine Rescue Coordination Center.
MRN	Mobile Registration Number provided by the IMO.
MSI	Maritime Safety Information.
MSSC	Maritime Satellite Switching Center.
NAVAREA	Warning Navigational warning broadcasts issues by an area. Coordinator of the world wide navigationa warning service.
NAVAREA	Navigational Area.
NAVTEX	Narrow Band Direct Printing (Telex over radio).
NBDP	Narrow Band Direct Printing (ITU name for SITOR).
NCS	Network Coordination Station in the INMARSAT system (1 per INMARSAT footprint, total of 4).
NRZ	None Return to Zero data signaling.
NWS	National weather Service.
OCC	Operations Control Center at INMARSAT headquarters.
On Scene Communications	Communications between the ship in distress and the assisting units.
PAN PAN	Urgency Signal.
POR	Pacific Ocean Region.
Rescue CoordinationCenter (RCC)	Responsible for efficient organization of search and rescue services and operation of resources within a specific area.
RTT	Radio Teletype
SafetyNET	INMARSAT's Enhanced Group Calling system for maritime safety broadcasts.

SAR Coordinating Communications	Communication necessary for the coordination of ships and aircraft participating in a Search and Rescue (SAR) operation.
SARSAT	Search and Rescue Satellite-Aided Tracking.
SART	Search and Rescue transponder, for survival craft.
SCC	Satellite Coordination Center.
SECURITE	Safety Signal.
Ship Earth Station	A radio station in the terrestrial radio communications service located aboard a ship.
SILENCE MAY DAY	Imposed silence on distress channel.
SIMPLEX	Frequency The same frequency used for transmission and reception.
SITOR	Simplex Teletype Over Radio (also called radio telex or NBDP).
SOLAS	Safety of Life at Sea.
SOLAS Convention	Safety of Life at Sea Convention adopted by the IMO.
SSB	Single Side Band.
USB	Upper Side Band.
UPS	Un-interruptible power supply. Used as back up power source. If ship AC power is lost, UPS uses internal battery and electronics to generate AC for emergency communications.
UTC	Universal Time Coordinated. Greenwich Mean Time.
VDU	Video Display Unit.
VHF	Very High Frequency (30 – 300 MHz.)
WWNWS	World Wide Navigational Warning Service.