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A proposed GMDSS module course for the Iranian maritime education and training system

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A PROPOSED GMDSS MODULE COURSE FOR THE IRANIAN MARITIME EDUCATION AND TRAINING SYSTEM

By

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I certify that all material in this dissertation which is not my own work has been identified and that no material is included for which a degree has been previously conferred upon me.
The contents of this dissertation reflect my personal views and are not necessarily endorsed by the University.

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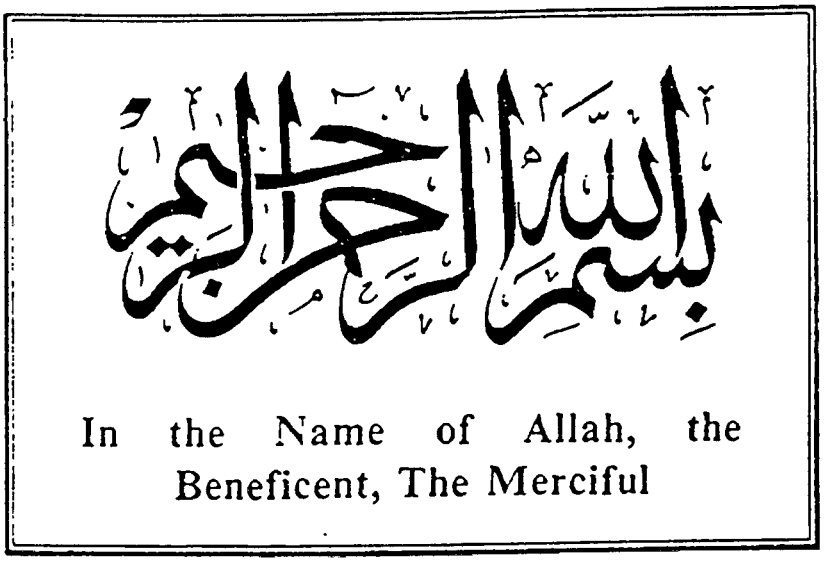

In the Name of Allah, the Beneficent, The Merciful

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ABSTRACT

The Global Maritime Distress and Safety System is in its transition period and will be fully operational by 1999. It is inevitable and time is running by very fast, so it should be smoothly introduced in order to be able to fully implement it before the time comes.

In fulfillment of this task one of the most important aspects is regarding the education and training of new personnel who can work with the new system.

As the curricula of education and training of personnel working with the GMDSS system have been changed, the author proposes a complete set of General Operator's Certificate (GOC) course in this dissertation. The other relevant courses for GMDSS could also be developed from this proposal with slight changes, as the GOC embodies some other courses like Restricted Operator's Certificate (ROC), or upgrading course for those who possess the Radio Telephony (R/T) certificate.

The training institutes should be prepared for conducting such courses.

This dissertation starts with a history of communication, to give the basis to the reader in better understanding the shortcomings of old communication systems to be able to follow the step by step development of the new GMDSS system. Following Chapters introduce the GMDSS and compare the new and old systems in qualification requirements aspect. The core of this dissertation is the proposal for the General Operator's Certificate.

Summing up the dissertation it is the author's proposals to achieve the goal, which is Education and Training of the new personnel for the GMDSS system.

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CHAPTER ONE

INTRODUCTION

1.1 History of Radio

Until the invention and development of radio signals for the transmission of messages, communication between two places was totally based on the telegraphic system, which depended on connection by cables and wires between transmission points and the point of reception of the message. However, this system might have worked only on land. This was not a system to be utilized for mobile objects, e.g. ships.
In the past days once a ship left sight of land, it was totally cut off from all contacts with others at sea and on land except for occasional sighting of other ships. The only way for communication was by voice within a very short distance. Later the alternative was using flags and semaphore, which although gave these a better range of communication, they were still limited to eye sight range and color discrimination.
It is therefore very true to say that the invention of the radio by Guglielmo Marconi in 1895, created a revolution in telecommunications and particularly in maritime communications.
The first at sea life saving use of the new invention by Marconi was recorded in March 1899, when the light ship on the Goodwin Sands near Dover, which was fitted

with Marconi's wireless apparatus, used it to report that the steamer Elbe had ran aground.
The next incident involving use of the radio occurred in Russia in January 1900, when the icebreaker Yanmark received a message to go and rescue some fishermen trapped in an iceflow in the gulf of Finland.
These incidents helped to demonstrate that the radio was to become a recognized international tool for telecommunications.
With the development of the radio, some problems arose gradually. In the first stages the spark transmitters, which had a very wide band-width, were being used. Two operators using these transmitters within a range of about 100 kilometres could interfere with each other's message because of the band-width of transmission. Another problem was uncertainty of the messages being received. Changes in the propagation conditions may have adversely affected the reception and the maximum effective range of telegraphy equipment under normal conditions was not more than a few hundred kilometres.
The need for a specialist such as a radio operator for transmission and reception was another handicap of the telegraphy. So, although Marconi's invention was a revolution in telecommunications, the shortcomings of the system called for a more advanced and reliable system.

1.2 History of Radio-related Conventions

With the spreading of the radio telegraphy technique among nations the need for setting up national and international regulations became necessary.
In 1903 a Radio Conference was held in Berlin to study the international regulations for radio-communications.

In 1906 the first international radio-telegraph conference was held in Berlin. In this conference contracting parties were obliged to connect their coast radio stations to the international telegraph network to give absolute priority to the distress messages. They were also obliged to avoid radio interference as much as possible.

In 1912 the famous disaster took place; the Titanic hit an iceberg and sank within a few hours. More than 1500 people died.

Three months after the Titanic disaster, another international radio conference took place in London. Although during this conference the carriage of radio equipment had not become mandatory, but the idea was brought up. The result was that some ships were being required to maintain a permanent radio watch.

During the same conference (London) the letters SOS were adopted as international distress call. Prior to that the distress call was CQD.

Two years later, in 1914, the first International Convention for the Safety of life at sea (SOLAS) was adopted. The Chapter V of this Convention dealt with radiotelegraphy. Ships carrying more than 50 passengers were required to carry radio equipment with a range of at least 100 nautical miles. This was the first convention which made it obligatory for ships receiving a distress call to go and assist the ship in distress. Due to the first world war this convention did not entered into force.

In 1929 the second SOLAS Conference was held in London. A convention which entered into force in 1935 was adopted. The main points of this conference were firstly due to technological progress; the problem of maintaining radio watch was solved with the invention of auto alarms, some exceptions were allowed regarding

watchkeeping of ships fitted with such a device. Secondly the convention required large ships to equip some of their life boats with radio equipment.
The third version of the SOLAS Convention was adopted during a conference in 1948. This Convention made the carriage of the radio telegraph installation obligatory for all passenger ships and for cargo ships of 1600 Gross Registered Tonnage (GRT) and above.
The other important matters which this convention took into account were Radio Direction Finder (RDF) and Radiotelephone, which was invented with the invention of the Triode Valve.
In 1959 the IMO, the International Maritime Organization, which was then called IMCO, the Intergovernmental Maritime Consultative Organization, came into being.
The fourth version of SOLAS formed in 1960, in which regulations regarding radiocommunications went much more into detail. References at this time were made to Radio Regulations (RR) adopted earlier by the International Telecommunications Union (ITU).
In 1974, the IMO adopted a new SOLAS convention, in which Chapter IV dealing with radiotelegraphy and radiotelephony was further improved. In 1981 some of these regulations were replaced and some amended. These amendments entered into force on 1 September 1984. The subsequent amendments to SOLAS updated the regulations to match with daily developments of technology.

1.3 Development of new technology

Shortcomings of the radiocommuniocations system called for development and new technology.
In 1962, the Telstar, the first communication

satellite, was put into orbit. After this it has been possible to transmit radio messages to a satellite which then is being reflected to the desired position on the earth.

The possibilities which satellite communication offered to maritime communications were appreciated by the IMO.

In 1966 IMO's Maritime Safety Committee decided to study the operational requirements for a satellite communications system devoted to maritime purposes. This idea went under study and consideration by co-operation of the ITU and the IMO.

By 1971 IMO's Submitted outcomes of his studies to the ITU during the ITU Conference on Space Telecommunications.

The IMO decided to form an organization to continue the project. Subsequently in 1976 the IMO Convention on the International Maritime Satellite Organization (INMARSAT) was adopted. The convention entered into force in 1979 and INMARSAT became operational in 1982. This was the first time that shipping had an independent communications system reserved only for its own use and designed only for its own purposes.

The INMARSAT system offered a lot of advantages which could not be provided by terrestrial radiocommunications, but the greatest advantage it has offered to the maritime world is developing a completely new distress and safety system called Global Maritime Distress and Safety System (GMDSS) to provide safer seas.

At all stages of this development, the carrying of the persons to operate the system on board ships as well as shore based personnel has been a necessity. With developments and new technology these personnel should be trained accordingly.

The introduction of the GMDSS calls for a change in training programs of personnel dealing with radiocommunications.
In this dissertation firstly the GMDSS will be introduced and subsequently a module course for training of the new system will be presented, followed by recommendations for guiding the authorities to use the GMDSS system more efficiently.

Chapter TWO

2.1 INTRODUCTION AND CONCEPT OF GMDSS

"Safety of life at sea and assistance to persons in distress are matters of great importance and have been addressed by the International Maritime Organization (IMO) since its foundation. Recognizing the need to continuously develop and improve various elements of the maritime distress and safety system and to establish uniform principles and rules for promoting safety of life at sea , IMO has, since 1959, convened a number of International Conferences which adopted international provisions for the safety of life at sea.

In 1979 the International Conference on Maritime Search and Rescue adopted the International Convention on Maritime Search and Rescue (the 1979 SAR Convention), the ultimate objective of which is to establish a global plan for maritime SAR on a framework of multilateral or bilateral agreements between neighbouring states on the provision of SAR services in coastal and adjacent ocean waters to achieve co-operation and mutual support in responding to distress incidents". (IMO, 1987,GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM,London).

At the same time the SAR Conference encouraged IMO to develop a system to give full global coverage for

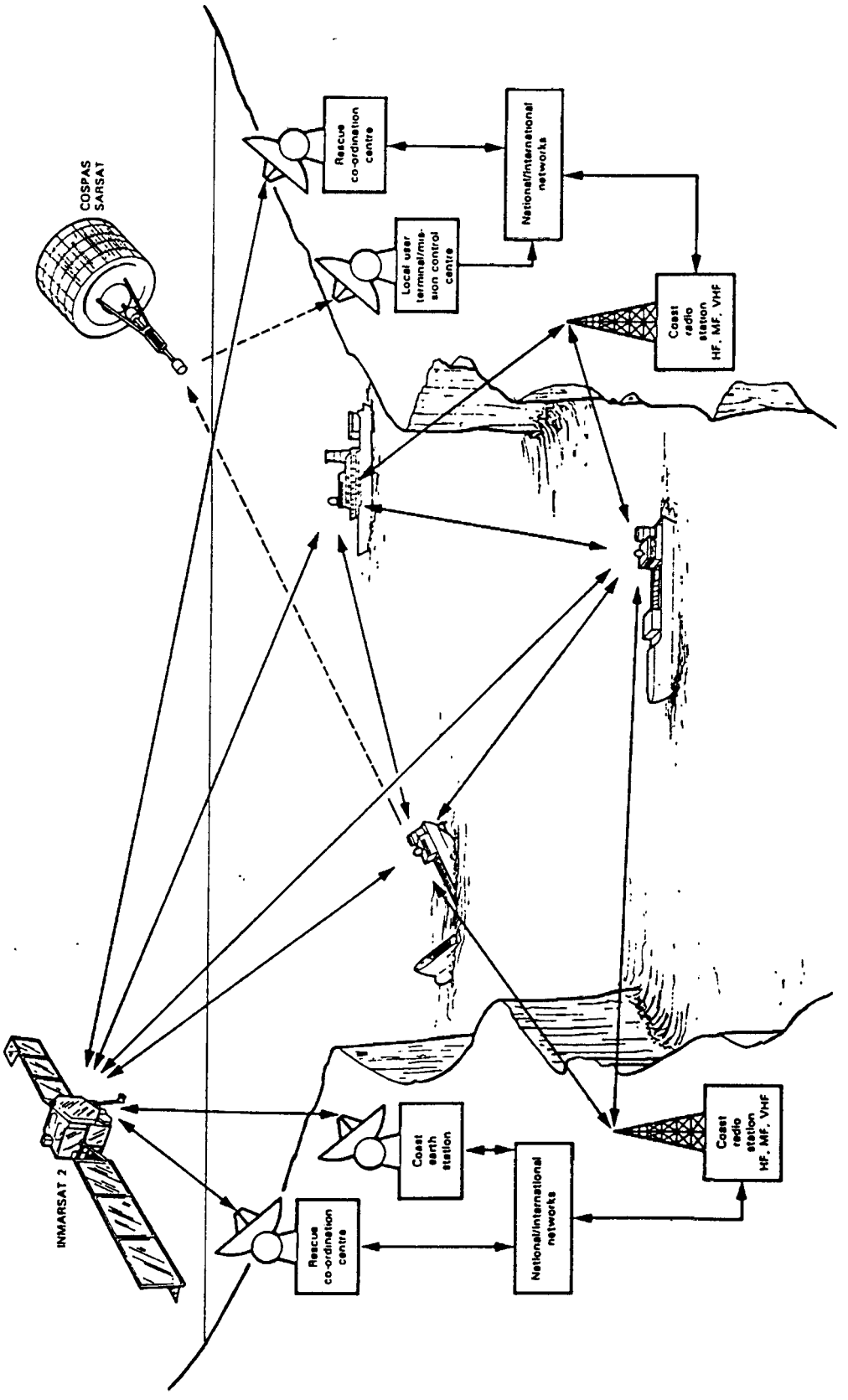


Figure 1 – General concept of the global system

Taken from GMDSS book, page 4, IMO, London, 1987.

maritime distress and safety, later called Global Maritime Distress and Safety System (GMDSS), for the most effective means of search and rescue operations. The outcome was the decision made at the eleventh session of the IMO Assembly in 1979, to establish a Global Maritime Distress and Safety System, which in conjunction with a co-ordinated search and rescue system, would improve the safety of life at sea.

In November 1988 a decade of work reached a successful conclusion when a Conference held at IMO headquarters adopted amendments to the SOLAS convention and its 1978 protocol. The amendments were intended to introduce the Global Maritime Distress and Safety System into the convention.

The basic concept of the system is that search and rescue authorities ashore, as well as shipping in the immediate vicinity of the ship in distress, will be rapidly alerted to a distress incident so they can assist in a co-ordinated search and rescue operation with the minimum of delay.

2.2 Planning the GMDSS

" Work on the new system started with the definition of the operational requirements that it should fulfil, which are as follows :

The new system should be global and the most suitable communication facilities and techniques as well as shore-based facilities should be used so that every ship, using the system, wherever it operates

will be able to fulfil with the essential communication functions for the safety of the ship itself and for other ships in its vicinity.

The detailed work on the system design was carried out by the development of the following five major elements:

.1 Establishment of a communication network for the reception and transmission of distress alerts and distress and safety traffic;

.2 Arrangements for the promulgation of maritime safety information;

.3 Provision of regulations concerning the operation and implementation of the system;

.4 Provision on ships of suitably trained operating personnel;

.5 Provision on ships and at coast stations of suitable equipment". (Cap. John L. Thompson. IMO regional seminar and workshop on the Global Maritime Distress and Safety System, Lecture No. 1, page 3, WMU Dalian, China, 31 August to 4 September 1991).

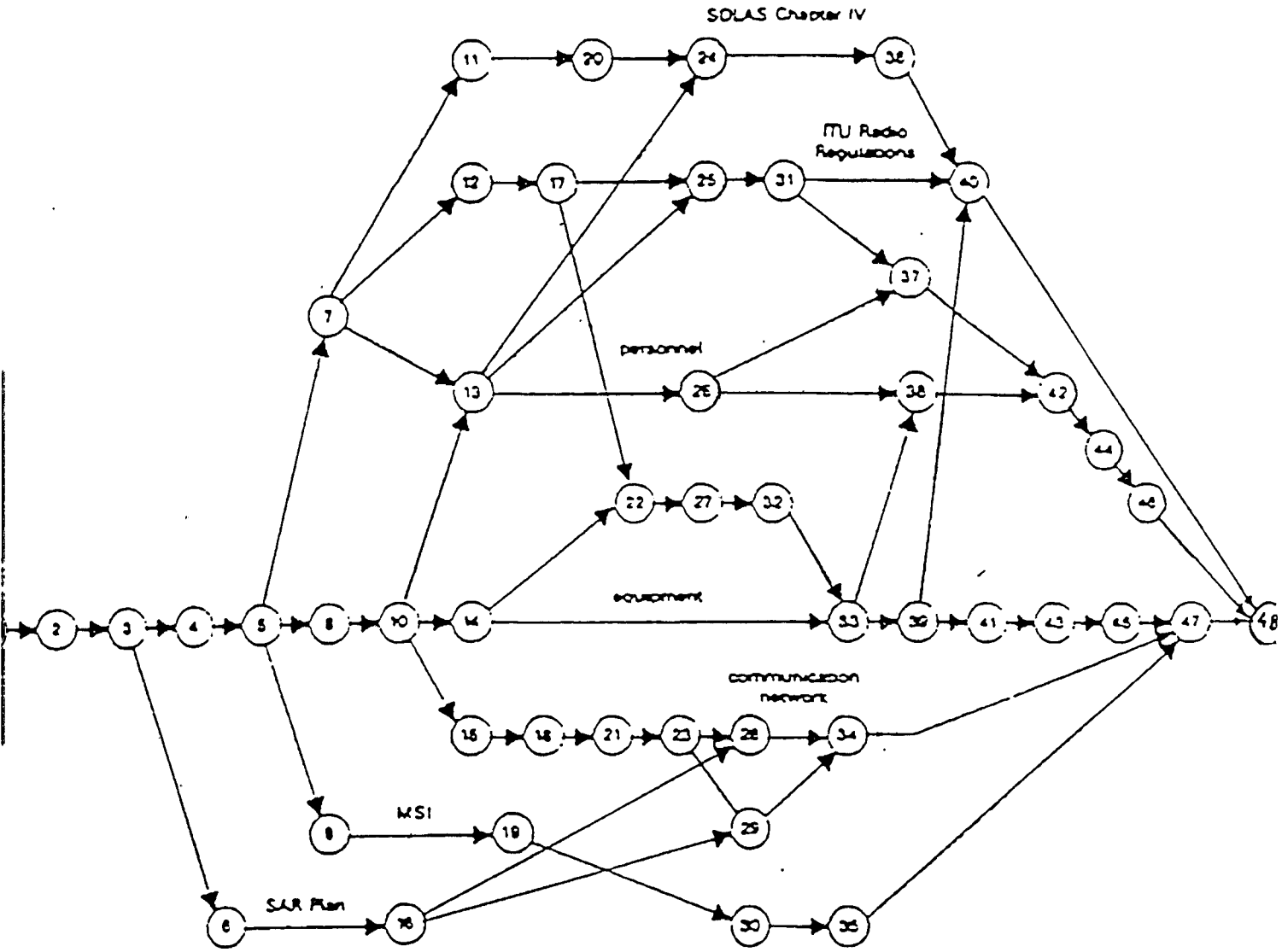
The communication functions include the ability for search and rescue (SAR) authorities ashore, as well as ships in the vicinity of a distressed vessel , to be alerted immediately to a distress incident so the assistance will be provided with minimum delay. The functions also include the provision of facilities for urgency and safety communications and for the promulgation of maritime safety information, including

navigational and meteorological warnings.

To understand the operation of the GMDSS, it is necessary to look in detail at some of these major elements later in this Chapter.

The GMDSS flow diagram (Figure 2) gives a good overview of steps taken from PLANNING to implementation of GMDSS.

GMDSS flow diagram



For understanding the numbers refer to 2.2.1 (masterlist of events), in next page.

(TAKEN FROM ' IMO REGIONAL SEMINAR AND WORKSHOP ON THE GMDSS, WMU DALIAN, CHINA, 31 AUGUST TO 4 SEPTEMBER 1991, LECTURE NUMBER 1 BY CAPTAIN JOHN L. THOMPSON, PAGE 4)

(Figure 2)

2.2.1 Masterlist of events

1 Decision taken by IMO to establish and implement the GMDSS
2 Concept and basic principles established
3 Broad operational requirements defined
4 Communication functions defined
5 Assessment made of sub-system to carry out functions
6 Survey made of current SAR arrangements
7 Future ITU and IMO statutory requirements defined in principle
8 Communication network sub-system decided
9 MSI sub-systems decided
10 Preliminary technical proposals prepared
11 Operational groupings of ships decided
12 Frequency requirements broadly defined
13 Provisional operating techniques and procedures prepared
14 Need for trials on certain sub-systems assessed
15 Provisional plan prepared for coast-based maritime communication network
16 Additional needs for effective SAR co-operation identified and provisional arrangement for such co-operation drafted
17 Frequency provisions made in the radio regulations
18 Survey made of existing facilities at coast and CES
19 Provisional plan prepared for the promulgation of MSI
20 Functions to be performed by each group of ships decided
21 assessment made of additional facilities needed at each station
22 Trials equipment developed for appropriate sub-system
23 Arrangement of participating shore stations adopted
24 Operating requirements defined, except for those under no. 25
25 MOB-87 recommendations finalized
26 Preliminary operator functions drafted
27 Trials on sub-systems completed
28 Effective communications established between coast and Coast Earth Stations and associated SAR
29 Effective communication established between SAR centers
30 Assessment made of most appropriate coast and CESs stations to be used for MSI and of the additional facilities needed
31 Operating provisions made in the ITU radio regulations
32 Sub-system trials results assessed
33 Technical proposals finalized
34 Final plan for the full GMDSS communication adopted
35 Final plan for the promulgation of MSI adopted
36 Preliminary revision of SOLAS chapter IV drafted
37 Operator functions reviewed
38 Methods of equipment availability defined
39 Equipment performance standards adopted by IMO
40 Revised SOLAS chapter IV adopted by IMO
41 National or multinational equipment specifications prepared
42 Guidelines on methods of equipment availability adopted
43 Pre-production equipment designed,manufactured and tested
44 Arrangements for training of personnel complied
45 Quantity production of equipment complied
46 Ships provide with personnel trained for the GMDSS
47 Ships, coasts and CESs fitted with appropriate equipments
48 GMDSS fully implemented

2.3 Communication functions of the GMDSS

The following radiocommunication functions, which each ship subject to the SOLAS Convention shall be capable of performing in the GMDSS, have been identified:

There are nine GMDSS communication function:

.1 Ship-to-shore alerting.
.2 Receiving shore-to-ship alerting.
.3 Transmitting and receiving ship-to-ship alerting.
.4 Transmitting and receiving search and rescue co-ordination communications.
.5 Transmitting and receiving on-scene communications.
.6 Transmitting and receiving signals for locating.
.7 Transmitting and receiving navigational and meteorological warnings and urgent information.
.8 General radiocommunications into shore based communications systems/networks.
.9 Bridge-to-bridge communications.

2.3.1 Communication functions ideally suited to satellite techniques

.1 Communication function 1 - Ship-to-shore alerting:

Initiated at the press of a special button (or a special key sequence) on the Ship Earth Station (SES) terminal, distress alerts are given priority access via the system. If all satellite channels are engaged, one will be pre-emptied so that the distress alert can be routed, usually automatically, to a Rescue Co-ordination Centre (RCC) ashore.

.2 **Communication function 2 - receiving shore-to-ship alerting:**

Initiated by RCCs ashore, ships are alerted through automatic receipt of distress alerts transmitted through the 'safetyNET' service of the Enhanced Group Calling (EGC) system. Ordinary telex group calls to standard-A SESs can also be used to supplement, or until all shops are equipped with EGC, receive facilities.

.3 **Communication function 4 - Transmitting and receiving search and rescue co-ordination communications:**

SESs can be utilized for originating and receiving communications with other ships involved in distress cases and for communications with RCCs. When multiple ships are involved, the EGC system will be advantageous for operational updates and planning actions from RCCs.

.4 **Communication function 7 - Transmitting and receiving navigational/meteorological warnings and urgent information:**

Hydrographic and meteorological danger messages are initiated by ships and transmitted to shoreside authorities through the system, using SESs.
Maritime Safety Information (MSI) is initiated by shoreside authorities in hydrographic, meteorological and search and rescue offices, and messages are entered into the 'safetyNET' service for transmission to ships through the EGC system.

.5 Communication function 8 - general radiocommunicatios into shore-based communications systems/networks:

All of the telecommunications services found in offices ashore are also available to ships which are equipped with SESs. Therefore ships equipped with SESs are capable to have high quality, reliable and automatic communications via telephone, data, facsimile and telex. These capabilities can be used for obtaining advice and assistance from experts ashore in efforts to solve problems before they develop into distress incidents.
In addition, other capabilities, such as 'two-digit service codes', are available. A series of two-digit service codes has been established to make it faster for ships to make connections for a number of common purposes. There are five which are specifically for safety services and provide a quick connection to an RCC, meteorological office, ship reporting center or medical center.

2.4 How does the GMDSS system work ?

The GMDSS will enable a ship in distress to send a message in various ways and be virtually certain that it will be heard and acted upon. The distress or safety message will be picked up by ships in the area and by the shore stations within range (as in the present system), if sent on MF or VHF, or by shore stations if transmitted using HF, INMARSAT or the COSPAS-SARSAT system.

2.5 GMDSS sea areas

The basic principle of the ship always being able to communicate with the shore from wherever it is situated in the world enables an area of operation concept to be established for the application of the GMDSS and for ships to fit, in addition to that necessary for ship-to-ship communication and reception of MSI, equipment necessary for communication with those coast stations or coast earth stations, established by administration to meet GMDSS needs, which will be within range during the ship's voyages.

A principal philosophy of the GMDSS is to equate the equipment carried on board a ship with what is needed to perform nine essential communications functions. All SOLAS cargo ships over 300 tons GRT and all passenger ships on international voyages, regardless of size, must be able to perform all of these functions. So GMDSS carriage requirements are based NOT on the size of a ship but on the sea area in which she operates.
The GMDSS master plan divides the navigable waters of the world into four sea areas, namely:

.1 Sea area A1 :

An area within the radiotelephone coverage of at least one VHF coast station in which continuous DSC alerting is available.

.2 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.

.3 Sea area A3 :

An area , excluding sea areas A1 an A2, within the coverage of an INMARSAT geostationary satellite in which continuous alerting is available.

.4 Sea area A4 :

An area outside areas A1, A2 and A3.

It follows that, in some parts of the world where there is extensive coastal shipping, VHF and MF coast station networks will be established. In other parts, where establishment of VHF and MF networks is unnecessary or uneconomic, on leaving port ships will immediately enter a sea area A3 or, in a few cases, A4.

2.6 The introduction of satellite communications

As a matter of fact some radio waves travel in straight lines, so due to the spherical shape of the earth these radio waves do not follow the earth's curvature and head off into space. Some of those which are reflected from the ionosphere could be affected adversely by climatic and other unsuitable conditions.
To overcome this problem, satellites which are situated above the earth's surface are being used.
The messages are sent from earth to the satellite and from there reflected to the desired location back on

earth. In this way not only the range of the radio wave travelling is extended but the quality of reception improved.

In February 1966, IMO's Maritime Safety Committee (MSC) decided to study the operational requirements of satellite communications for maritime purposes.
By 1971, when IMO had studied important aspects of satellite communications sufficiently, two recommendations to the International Telecommunication Union (ITU) conference on the space telecommunications were submitted. They specified among other things, that maritime satellite communications could be used for the exchange of information by telephony and telegraphy, including data transmission, facsimile and direct printing.

Satellite communications offered great advantages in alerting and locating ships in case of distress or emergency, enhancement of search and rescue operations, transmitting safety and urgency messages and a number of other functions such as automatic reporting of ships' positions, position determination, traffic guidance, automatic navigation warnings and weather routing.
In addition, maritime satellite communications promised to be of great use in the operation and administration of ships.

CHAPTER THREE

Radio communication systems being used in the GMDSS

3.1. Satellite Communications

The use of satellite communications to improve maritime safety is particularly important for the introduction of a global system and for establishing a reliable communications network.
Satellite communications will be used in both ship-to-shore and shore-to-ship directions. The INMARSAT satellite system which employs geostationary satellites will provide a means of alerting from ships by using ship earth stations or satellite EPIRBs and a capability for two-way communications using radiotelex and optionally radiotelephone. Broadcasts of marine safety information to ships using radiotelex will also be provided through the INMARSAT system using either a standard ship earth station and associated equipment or dedicated facilities.

A near-polar orbiting satellite EPIRB service (COSPAS-SARSAT system), does provide a means of distress alerting and determine the location of float-free satellite EPIRBs operating through the system.
Two types of shipborne equipment will be used for satellite communications :

- Ship earth stations, approved by INMARSAT ; and
- Satellite EPIRBs capable of being activated manually or automatically when floating free from a sinking ship.

3.1.1 INMARSAT SYSTEM

INMARSAT grew out of an idea that originated within IMO in 1966. Following extensive study by IMO experts an international conference was convened which, in 1979, unanimously adopted the convention and operating agreement of the International Maritime Satellite Organization.
The INMARSAT system using:

- Automatic calling;
- Radiotelephone;
- Direct-printing telegraphy (Telex);
- Satellite EPIRBs;
- SafetyNET MSI service

The maritime satellite system has four major components:

.1 The satellite capacity provided by INMARSAT (space segment) :

INMARSAT satellites are in geostationary orbit, 36000 kilometres above the equator. There are at present four operational and four fully ready back-up satellites located over the Atlantic (AOR), Indian (IOR) and Pacific Ocean regions (POR). In order to further improve its coverage, at the end of 1990 INMARSAT created a fourth ocean region by splitting

the Atlantic Ocean region (AOR) into two new regions, the AOR-East and AOR-West, each one to be served by a separate satellite.

INMARSAT's first generation satellite system consisted of leased capacity on eight satellites. These first-generation satellites have been replaced by higher capacity, second generation series satellites, but continue to act as spares.
Even as INMARSAT-2 (second generation) satellites began going into service, the organization was well advanced in its plans for a powerful third-generation (INMARSAT-3), with launches targeted for 1994-95. The third-generation satellites will include an L-band to L-band link which will allow direct mobile-to-mobile communications via the satellite, without requiring the signal to be routed through an earth station.

.2 The Network Operation Centre (NOC) :

The nerve center of the system is the Network operation centre (NOC) located at INMARSAT's London headquarters. The NOC is located next to the Satellite Control Centre (SCC) that controls the second-generation satellites and is connected directly by leased lines to the SCC of the organization, from which satellite capacity is currently leased, by its own ship earth stations to the Atlantic, Indian and Pacific Ocean satellites, and to all coast earth stations around the world. Operating 24 hours a day, it co-ordinates a wide range of activities.

.3 The Coast Earth Stations (CES) :

Coast earth stations in the case of maritime services provide the link between the space segment and the terrestrial telecommunications networks. They are owned and operated by individual signatories to the INMARSAT operating agreement.
A typical CES includes a parabolic antenna 11-14 metres in diameter, which is used for transmission of signals to the satellite at 6 GHz and for reception from the satellite at 4 GHz. The same antenna or another antenna is used for L-band transmission (at 1.6 GHz) and reception (at 1.5 GHz) of network control signals.
Each coast earth station provides at least telex and telephone services.

.4 Ship earth stations (SES) :

For the user on board a vessel, the key to the maritime satellite system is an INMARSAT Ship Earth Station, or SES, which puts him in contact with the rest of the world.
Its primary task is to provide the space segment through which the national CES operators can provide services to the mobile users.
The following is a brief description of INMARSAT's current terminals, or SES's, for use by the maritime community :

.4.1 INMARSAT-A ship earth stations :

INMARSAT-A ship earth stations provide two-way direct dial telephone, telex, facsimile, data communications and instantaneous distress alerting, from the mobile,

via satellite and coast earth stations, to the international telecommunications networks.
INMARSAT-A ship earth stations can be separated into two main parts,namely, above-deck equipment and below-deck equipment.
The above deck equipment includes a parabolic antenna, about 0.85 to 1.2 metres in diameter, mounted on a platform, stabilized and steerable, so that the antenna remains pointed at the satellite regardless of ship's motion.
The below-deck equipment consists of an antenna control unit, communication electronics used for transmission, reception, access control and signalling, and telephone and telex equipment. It may also include options such as facsimile or data equipment.
Some ships may add computers and visual display units to the system.

.4.2 INMARSAT-C ship earth stations :

INMARSAT-C is a new terminal type currently being used by mobile services.
INMARSAT-C provides two-way store and forward telex or data massaging communications via satellite to and from anywhere in the globe. The user terminals are small and simple. Because of its flexibility, the INMARSAT-C system can support a wide range of receive-only and transmit-only services, as well as two-way massaging on a store and forward basis.
Two other services which take advantage of INMARSAT-C's Enhanced group call (EGC) facilities are safetyNET and fleetNET.
SafetyNET provides a reliable method for the distribution of marine safety information.

.4.3 INMARSAT-M ship earth stations :

INMARSAT-M system is based on low-cost, lightweight mobile earth stations offering voice (telephone) services, with low-speed facsimile and data capabilities. INMARSAT-M uses modern digital technology to achieve more efficient utilization of satellite power, making it possible to reduce the cost of communications to users.

.4.4 INMARSAT-B ship earth stations :

INMARSAT-B is a digital successor to INMARSAT-A which in operation is very similar to INMARSAT-A terminal but more economical in terms of lower charges resulting from more efficient use of the satellite system.

3.1.1.1 INMARSAT services :

.1 Ship-to-shore distress alerting
.2 Shore-to-ship distress alerting
.3 Search and rescue (SAR) co-ordinating communication
.4 On-scene SAR communications
.5 EGC service for receipt of marine safety information (MSI)
.6 General radiocommunications

3.1.1.2 Emergency Position-Indicating Radio Beacons (EPIRBs) , INMARSAT L-band EPIRBs :

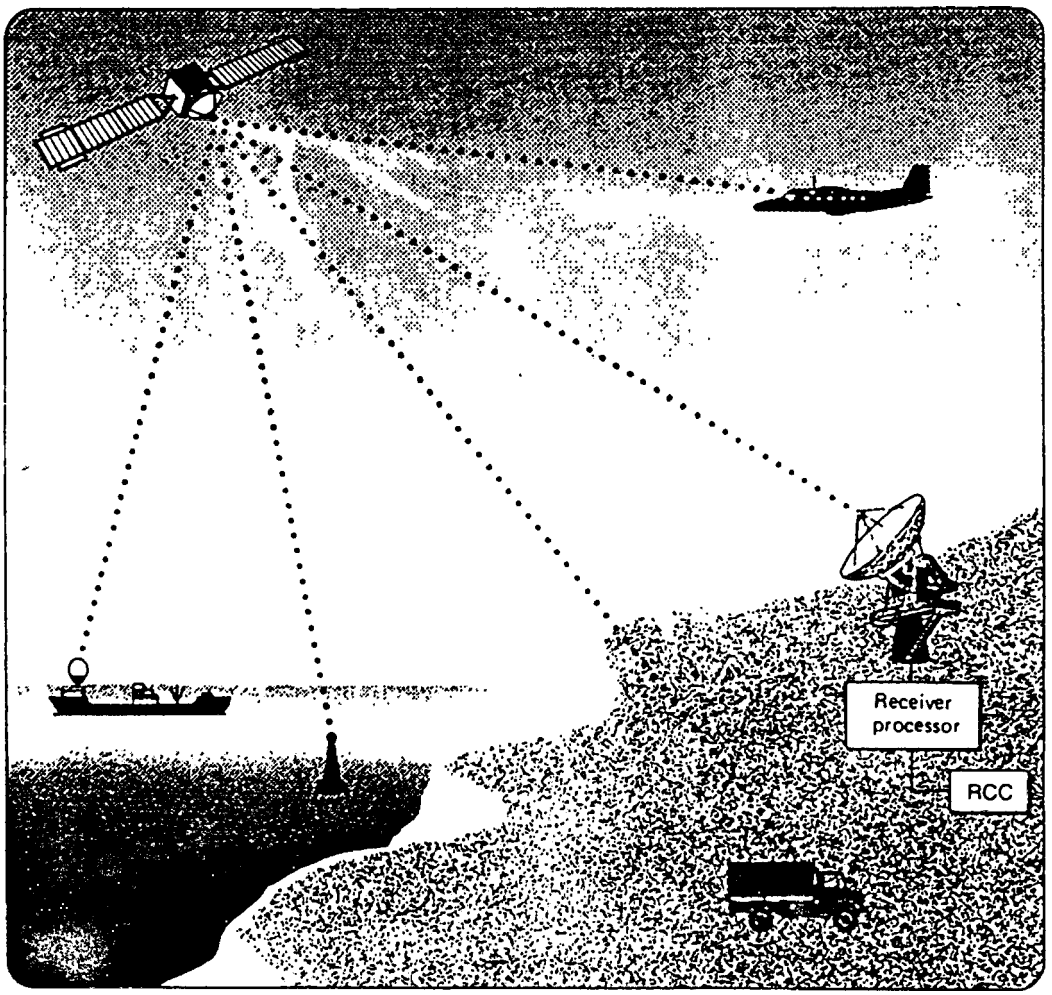
Emergency Position-Indicating Radio Beacons (EPIRBs) are designed to provide an alert in the event of a sudden disaster. They can be fully automated,so that if a ship sinks the EPIRB will float free and automatically transmit a distress message. They will continue to transmit a signal for at least 48 hours after an accident to enable search and rescue units to home in on the signal.
Under the GMDSS, INMARSAT satellite EPIRBs will operate on 1.6 GHz.

The basic concept of the L-band EPIRB satellite system is shown in figure 3. The INMARSAT system employs float-free satellite EPIRBs, INMARSAT satellite and INMARSAT coast earth stations with additional receiver and processor equipment. The system provides for rapid distress alerting coverage (in the order of 2 minutes with 1 watt output power radiated by an EPIRB), up to 70° N and 70° S latitude, 20 simultaneous alerts within a 10 minute time frame and the possibility of manual or automatic entry and update of navigational data to the EPIRB.
After activation, the satellite EPIRB transmits the distress message containing the ship station identity, position information and additional information which could be used to facilitate the rescue. Additionally, a 9 GHz radar transponder is activated.

3.1.1.3 Enhanced Group Calling (EGC) :

EGC is another important feature of the INMARSAT service. The dedicated message processor and printer

Basic concept of L-band satellite EPIRB



Taken from GMDSS book, page 28, IMO, 1987.

(Figure 3)

can be added to an INMARSAT-A or INMARSAT-C receiver or can stand alone, with a separate antenna.
The main point about EGC is that it enables messages to be sent to a group of ships, rather than to all ships within range. Messages can be sent, for example, to ships flying a particular flag, or ships in a given geographical area. They may be sent to one ship or all ships.
The ability of EGC to be selective has considerable advantages as far as safety is concerned. For instance, it enables messages to be sent to ships in the area nearest to a ship in distress, or it would enable the RCC to select the fastest or nearest ships to respond to a distress call. No other ships would have to be inconvenienced.
SafetyNET and FleetNET services are available with the use of the EGC system.

3.1.2 COSPAS-SARSAT system

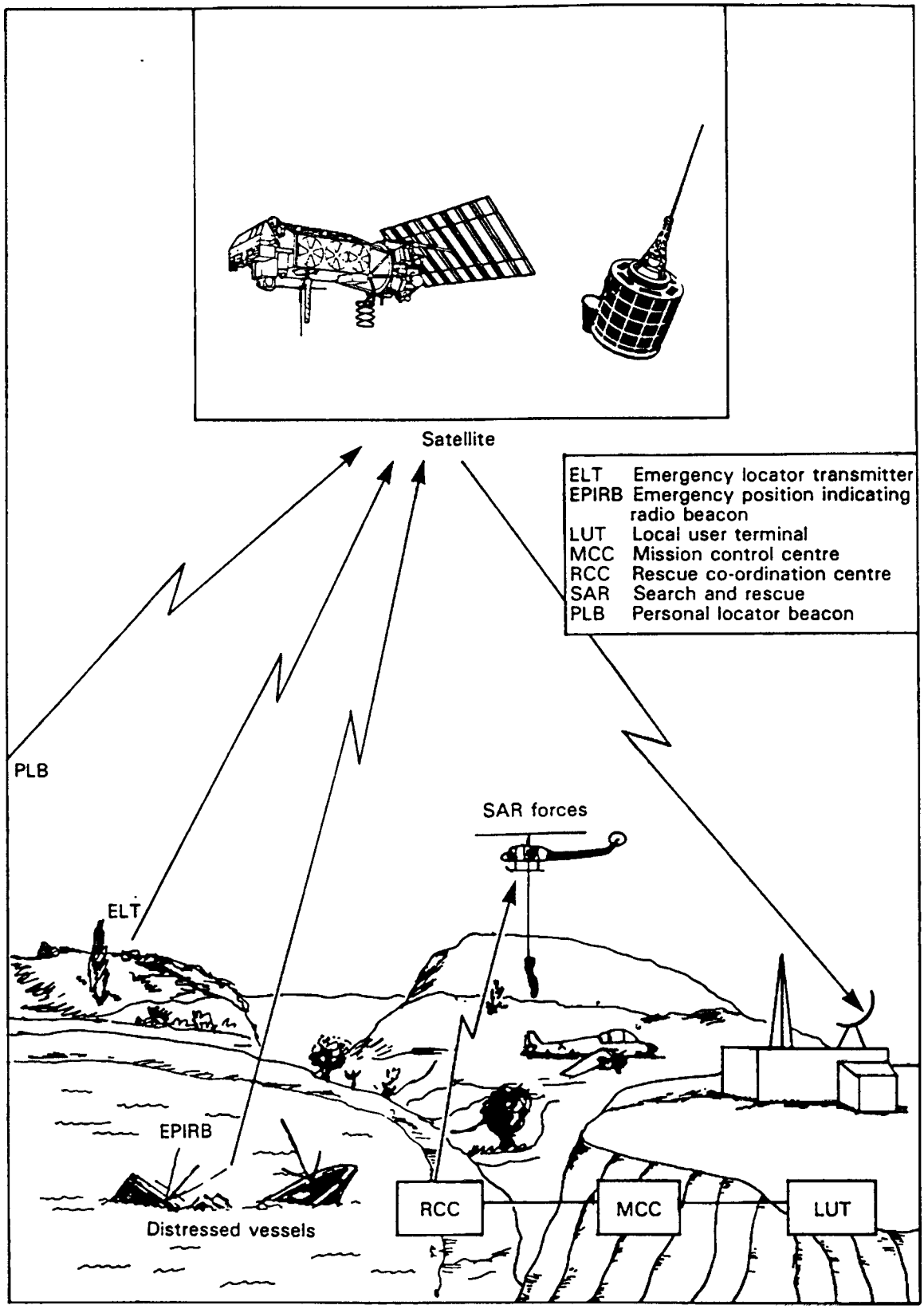
COSPAS- SARSAT is a satellite-aided distress alerting system which plays an important role in the GMDSS.
The idea was raised by Canada in the 1970s, when they required the aircraft operating in their airspace to be fitted with an instrument called Emergency Locator Transmitter (ELT). It was designed to be activated automatically in the event of a distress and emit distress signal for reception by passing aircraft.
This system was not so successful because the distress signals could be picked up only by receivers passing comparatively close to the distress event site. The system was considered to be very efficient if the whole area was being scanned at short, uninterrupted intervals.

With the introduction of satellite technology the goal was achieved. With the aid of satellite the distress signal could be received by a spacecraft and transmitted back to an appropriate centre.

In 1979 a joint venture consisting of Canada, The United States and France was formed to carry out tests of the Search And Rescue Satellite- Aided Tracking system (SARSAT). Later the Soviet Union joined the project with its complementary COSPAS system.
The system works on the basis of doppler shift to locate the distress position.
In 1982 the project's first spacecraft was launched, called COSPAS-1. The first SARSAT spacecraft entered into orbit in 1983. It is called NOAA-8 and its primary task was for weather forecasting and as a secondary task it fulfilled search and rescue requirements.

COSPAS-SARSAT spacecrafts are all near-polar orbiting satellites.

The basic concept of the COSPAS-SARSAT system is shown in figure 4.
The system is designed to locate distress beacons transmitting in the frequencies 121.5 MHz and 406 MHz. Distress transmission is received by the spacecraft, processed and transmitted to the centres on earth, the so-called Local User Terminal (LUT).
The LUT uses the doppler shift principle to calculate the position of the casualty and passes it to a Rescue Co-ordinating Centre.



Taken from GMDSS book, page 34, IMO, London, 1987

Figure 4 - Basic concept of COSPAS-SARSAT system

3.1.2.1 COSPAS-SARSAT sub systems:

This system consists of four basic sub systems as follows:

.1 BEACONS :

Beacons have different names depending upon where they are being used; on land , at sea or on the air.
The Emergency Locator Transmitter (ELT) beacon is used in aircraft, Emergency Position Indicating Radio Beacon (EPIRB) on board ships and Personal Locator Beacon (PLB) on land.
Beacons transmit their signals on two different frequencies, 121.5 MHz and/or 406 MHz. The 121.5 MHz frequency was the original distress frequency in this system, before satellites were introduced. This frequency has number of disadvantages, e.g. a tendency towards saturation by continuous radiation from emergency beacons, but it is still retained because at present a lot of these beacons are being used and carried by aircraft world wide.

Later the second frequency, 406 MHz, was introduced to take advantage of the improved spacecraft based system using this frequency. Using 406 MHz frequency, location is better, at 5 km compared with 20 km for 121.5 MHz. The 121.5 MHz system operates only in real time, but the 406 MHz beacon operates in both real time and stored-data mode.

The beacons are waterproof and can float. They can be activated automatically (float-free for ships and high gravity forces or on crash landing for aircraft).
These beacons can transmit distress frequencies for at

least 24 hours at -20°c.

.2 SPACE SEGMENT :

COSPAS-SARSAT space segment comprises of the Russian COSPAS 2 and 3 and SARSAT 2 and 3 and 4.

The SARSAT task is being done by spacecraft which are primarily weather satellites, but COSPAS tasks are being done by devoted satellites only for Search And Rescue (SAR) purposes.
The SARSAT satellites, or rather the NOAA satellites, follow a path of 99° inclined to the equator at an altitude of 850 km. One complete revolution takes 102 minutes whereas COSPAS satellites are inclined at 83° to the equator at an altitude of 1000 km and one revolution is about 106 minutes.
The 121.5 MHz frequency received by COSPAS-SARSAT spacecraft is immediately being transmitted in 1544.5 MHz to any LUT in the covered area. 406 MHz signals are processed to extract the identity of the transmitter. Their doppler frequency and time of reception are also measured. This data is then transmitted in real time, in the same way as the 121.5 MHz signals, but it is also stored in a memory in the spacecraft for transmission at a time when reception by an earth station is definite.

.3 LOCAL USER TERMINALS (LUTs) :

These are earth stations, ready to receive data from satellites and by using the doppler shift method, process it to find the location of the distress call.

There are two types of LUTs. First those that process the 121.5 MHz signals and 406 MHz processed system and the second types which are those terminals process only 406 MHz signals.
The information from LUT is then passed to the Mission Control Centres (MCCs) which are connected by networks to Rescue Co-ordination Centres.
Almost 15 LUTs are operational worldwide and the number is increased rapidly.

.4 Mission Control Centres (MCCs) :

These are the centres which have as their main function to collect and store the data from LUTs and other MCCs they also provide Rescue Co-ordination Centres with such information for rescue operations. MCCs are normally linked by communication networks to the other MCCs and RCCs to exchange information without any delay.

3.2. Terrestrial Communications

This is the system which is more familiar to seafarers. The major part of terrestrial communications is the conventional radiocommunication system. It can be divided into the following three categories :

.1 Long range services, using High Frequency (HF),
.2 Medium range services, using Medium Frequency (MF),
.3 Short range services, Using Very High Frequency (VHF).

In the terrestrial communication system ships send

their messages directly to a coast station from where they can be relayed to the desired destination. In this system there are only ship stations and coast (shore) stations.

During recent years new techniques such as Digital Selective Call (DSC), direct printing and NAVTEX have been introduced and are being used by the terrestrial communication system.

3.2.1 Long range service

Long range communications could be provided between ship-to-shore and shore-to-ship, using High Frequency (HF) radio waves.

At present HF is the only long-range communication system that can be used in Latitudes further North of 80°N and further South of 80°S, areas which INMARSAT satellites do not provide coverage.
HF can be used as an alternative to satellite communications in areas covered by the INMARSAT system. Frequencies have been assigned in the 4, 6, 8, 12, and 16 MHz HF bands (4207.5, 6312, 8414.5, 12557 and 16804.5 KHz), for distress and safety purposes. The reason for the large number of frequencies in the HF band is that propagation characteristics vary according to the geographical position and time of the day, therefore the choice of a frequency will depend upon where and when ships use HF if an incident occurs. All ships using HF will keep watch on at least 8414.5 KHz and one other HF frequency which is most suited to the area in which they are sailing.
In long range communication, Digital Selective Call (DSC) will form the basis for distress alerting and

safety calling. Coast stations should also be provided with the same frequencies if they are participating in the HF distress and safety watchkeeping network.

3.2.2 Medium Range Service

This is a service using Medium Frequency (MF) radio waves.
A MF service is provided, using 2187.5 KHz frequency for DSC and 2182 KHz frequency for radiotelephony (conventional radiotelephony distress frequency).
In the medium range service, the 2174.5 KHz frequency is used for distress and safety traffic by Narrow Band Direct Printing (radiotelex)(NBDP). The 518 KHz frequency is used for NAVTEX messages.

3.2.3 Short-Range Service

Very High Frequency (VHF) can provide a short-range service. Ships operating within the VHF range can use the Digital Selective Call (DSC) frequency of 156.525 MHz, which is channel 70 in VHF, for distress and safety calls and 156.8 MHz, channel 16 of VHF, for radiotelephone distress and safety traffic.

3.2.4 Digital Selective Call (DSC)

DSC fulfills an important task in the GMDSS. The system operates using a digital code. The equipment contains a modem for the coding and decoding of Digital Selective Calls. Using this system messages can be sent to specific ships or group of ships, etc. Messages sent by the Digital Selective Call system can be received in the form of a print-out or can be

displayed on a screen. By linking DSC equipment to other appropriate equipment, the ship's position and the time of the message can be sent just by pressing a button. This will automatically send out a distress message giving the ship's name and should be received by all vessels and stations equipped with DSC equipment.

Distress calls sent out by the DSC contain the ship's name, position, nature of distress and time. it may contain additional appropriate information.
Distress signals are repeated automatically at intervals of about four minutes until they are acknowledged.

In the GMDSS system, VHF, MF and HF installations are required to be equipped with the DSC system. All ships will be required to carry VHF radios capable of transmitting and receiving DSC on the 156.25 MHz frequency (channel 70), and of keeping a continuous watch on that channel.

3.2.5 World-Wide Navigational Warning Service (WWNWS)

This service has been established by the IMO and IHO for co-ordinated radio navigational warning transmission in geographical areas. These geographical areas are called NAVAREAs. Coastal transmissions are called NAVTEX warnings and long range warnings are called NAVAREA warnings.
The broadcasting arrangements of NAVAREA warnings and NAVTEX services are different, however the subject matter of navigational warnings is identical for each,

and includes failure or changes to navigational aids, newly discovered wrecks, distress alerts, etc.

3.2.5.1 NAVAREA Warnings :

Hazards to navigation are being transmitted with NAVAREA warning services on HF radiotelegraphy bands at precise time schedules. The range of coverage is about 700 miles. In addition, other modes of emission at HF, for instance direct printing, (Telex over radio), are also used.
As NAVAREA warning broadcasts are required to use morse radiotelegraphy at HF and carrying it under the GMDSS is an option, therefore it is important that an adequate alternative broadcast service be arranged. Thus, at present, those ships complying with the INMARSAT equipment for GMDSS, through their INMARSAT-A, equipped with add-on EGC receiver and INMARSAT-C SESs can receive this information through Enhanced Group Call (EGC) transmission.

3.2.5.2 NAVTEX SERVICE :

Another system of promulgation of navigational warnings is NAVTEX, which is a direct printing service with a coverage of about 400 miles offshore.
At present the NAVTEX service utilizes the same geographical divisions of NAVAREAs.

3.2.6 NAVTEX receiver

According to new Chapter IV of SOLAS, all ships over 300 GRT and above are required to carry a receiver capable of receiving NAVTEX broadcasts in areas where these warnings are being promulgated.

A NAVTEX receiver operates on the 518 KHz frequency. The NAVTEX receiver uses the Narrow-Band Direct Printing (NBDP) technique which prints out the received information on board ship. NAVTEX messages are mainly transmitted in English, Within some areas also in other languages. It is an advantage for recipients to study the print out messages at their leisure, to avoid errors or misunderstandings.

3.2.7 Enhanced Group Calling (EGC)

This system is primarily a means of providing Maritime Safety Information (MSI) through the INMARSAT satellite communication where there is no NAVTEX service. Ships are required to carry equipment to receive EGC in any area of INMARSAT coverage, where the NAVTEX service is not provided.
INMARSAT-A with add-on EGC and INMARSAT-C SESs receive EGCs.
EGC can also operate through a separate receiver which is connected to a printer.
FleetNet and SafetyNet are two EGC services which have been developed by INMARSAT.

3.2.8 Search And Rescue Transponder (SART)

This is a device which helps the search and rescue units to locate the ships in distress or the survival craft in any weather condition.
It operates in the 9 GHz frequency band and when being triggered by any ordinary 9 GHz radar, emits a series of response signals which could be visible on a radar screen as dashed lines extending 2-5 nautical miles outward from the SART's position along its line of

bearing. This clearly identifies the transponder's position, making it much easier for search and rescue units to find the vessel in distress.

Under the GMDSS, carriage of SART is mandatory. SART provides a visual or audible indication of its correct operation and also informs survivors when it is triggered by radar.

CHAPTER FOUR

RADIO EQUIPMENT REQUIREMENTS

4.1. Radio Equipment Requirements Relating to Existing Ships Under the old System

Under the old Chapter IV of the SOLAS and Radio Regulations relating to the radio equipment of existing ships, the ships depending on their size, should carry the specific number and type of radio equipment on board.

Regulations 3 and 4 of Chapter IV specify the radiotelegraph and radiotelephone stations. Passenger ships irrespective of size, and cargo ships of 1600 gross tonnage and over, shall be fitted with a radiotelegraph station and comply with regulation 9 and 10 of Chapter IV. Cargo ships of 300 GRT and upwards but less than 1600 GRT, unless already fitted with a radiotelegraph station, shall be fitted with a radiotelephone station in compliance with regulations 15 and 16 of Chapter IV. Cargo ships of 300 GRT and more, as well as all passenger ships, under regulation 4-1 of part A of Chapter IV and specifications of regulation 17 of Chapter IV, shall be fitted with a VHF radiotelephone installation.
Radiotelegraph auto alarm requirements have been

mentioned in regulation 11 of Chapter IV.

Ships of 1600 GRT and upwards, engaged on International voyages and constructed after 25 May 1980, shall be fitted with radio equipment for homing on the radiotelephone distress frequency, and a radio Direction Finder (DF), complying with regulation 12 of Chapter IV. Depending upon special circumstances, ships on less than 5000 GRT may be exempted from carrying direction finding equipment.

Under regulation 6 of Chapter III, a portable radio apparatus for survival craft should be provided, in compliance with regulation IV/14. Some exemptions may apply to this regulation.

Passenger ships engaged on international voyages when the number of passengers on board is more than 199 but less than 1500, shall be fitted with radiotelegraph installations, compliance with regulation IV/13, in at least one life boat. When the number of passengers is 1500 or more, at least one life boat on each side should be so equipped.

An Emergency Position-Indicating Radio Beacon (EPIRB) complying with regulation IV/14-1 shall be carried on each side of the ship.

Two-way radiotelephone apparatus complying with requirements of regulation IV/14-3 shall be provided for communication between survival craft, between survival craft and ship and between ship and rescue boat. At least three such shall be provided on each ship.

The radiotelephone auto alarms shall comply with the minimum requirements of regulation IV/18.

4.2. Ship Equipment Carriage Requirements Under GMDSS

Referring to the final text of amendments to the International Convention for the Safety Of Life At Sea (SOLAS 1974), concerning radiocommunications for the Global Maritime Distress And Safety System (GMDSS), ship equipment carriage requirements have been changed under the new Chapters III and IV regulations. The equipment carried on board should comply with operational areas definition and should also guarantee the specified communications functions under the GMDSS.

.1 General Requirements For Every ship :

All SOLAS Convention ships of 300 tons GRT and above are required to carry, as a minimum set of communications equipment, the following:

.1.1 VHF equipment capable of transmission and reception of DSC on channel 70 and radiotelephony on channels 6, 13 and 16.

.1.2 Equipment able to maintain continuous watch on VHF, DSC channel 70.

.1.3 9 GHz radar transponder.

.1.4 NAVTEX receiver, if the ship operates in any area where NAVTEX broadcast is provided.

.1.5 EGC receiver and receiver using INMARST's SafetyNet, if on voyages where NAVTEX broadcast is not provided, for reception of MSI.

.1.6 Satellite EPIRB operating in the 406 MHz band or when ship is engaged only on voyages within INMARSAT's coverage, 1.6 GHz EPIRB, capable of being activated either manually or automatically.

.2 Additional Requirements For Ships Operating Exclusively In Sea Area A1 :

Ships operating only in sea area A1 should in addition to the general requirements mentioned earlier, carry the following :

.2.1 A radio installation capable of initiating ship-to-shore distress alerts from the navigation bridge, operating either :

.2.1.1 on VHF using DSC. This requirement may be fulfilled by the EPIRB capable of transmitting a distress alert using DSC on VHF channel 70 and providing the means for locating via a radar transponder operating in the 9 GHz band; installed in an easily accessible position; ready to be manually released and capable of being carried by one person into a survival craft; capable of floating free if the ship sinks and being automatically activated when afloat; and capable of being activated manually.
This requirement might be optionally replaced by a satellite EPIRB; or

.2.1.2 Through the polar orbiting satellite service on 406 MHz.
This might be fulfilled by the satellite EPIRB close to, or by remote activation from, the navigational bridge; or

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

.2.1.4 On HF using DSC; or

.2.1.5 Through an INMARSAT Ship-Earth Station; or

.2.1.6 The satellite EPIRB, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the ship is normally navigated.

.2.2 The VHF radio installation which in addition to it's normal task is able to transmit and receive general radiocommunications using radiotelephony.

4.3. Additional Requirements For Ships Operating In Sea Areas A1 and A2

Ships operating in sea areas A1 and A2 should in addition to the general requirements (NO.1), carry the following :

4.3.1 An MF radiotelephony installation working on 2182 KHz and DSC on 2187.5 KHz ;

4.3.2 Radio equipment maintaining continuous DSC watch on 2187.5 KHz ;

4.3.3 Radio equipment for transmission of ship-to-shore distress alerts other than MF, either by:

4.3.3.1 HF using DSC, or;

4.3.3.2 An INMARSAT Ship-Earth Station, or;

4.3.3.3 Manual operation of a satellite EPIRB.

4.3.4 Radio equipment capable of general radiocommunications on working frequencies in the MF band 1605-4000 KHz, or an INMARSAT SES.

4.4. Additional Requirements For Ships Operating In Sea Areas A1 and A2 and A3

Every ship operating beyond sea areas A1 and A2 but remaining within sea area A3, in addition to the general requirements (in no.1) choose one set of the following options 4.4.1 or 4.4.2 to comply with :

4.4.1.1 A standard INMARSAT Ship-Earth Station (INMARSAT-A or INMARSAT-C) ;

4.4.1.2 A MF radio installation for distress and safety purposes on frequencies 2187.5 KHz using DSC and 2182 KHz using radiotelephony ;

4.4.1.3 A radio installation capable of maintaining continuous DSC watch on frequency 2187.5 KHz,

4.4.1.4 Means of transmission of ship-to-shore distress alerts by a radio service, operating either :

- 406 MHz satellite EPIRB, or;
- HF using DSC, or;
- Through the INMARSAT satellite, by an additional SES or by satellite EPIRB.

4.4.2.1 An MF/HF radio equipment for the purpose of distress and safety communications on all distress and safety frequencies in the bands between 4000-27500 KHz, using DSC, radiotelephony and direct-printing telegraphy;

4.4.2.2 Radio equipment capable of maintaining continuous DSC watch on 2187.5 KHZ, 8414.5 KHz and at least one of the distress and safety frequencies : 4207.5 KHz, 6312 KHz, 12577 KHz or 16804.5 KHz.

4.4.2.3 Means of transmission of ship-to-shore distress alerts by a radiocommunication

service other than HF operating either through satellite EPIRB on 406 MHz frequency or through INMARSAT service either by an INMARSAT SES or the satellite EPIRB.

4.4.2.4 In addition, ships shall be able of general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on bands between 1605-4000 KHz and 4000-27500 KHz.

4.5. Additional Requirements For Ships Operating In Sea Area A4

Ships operating in sea area A4 in addition to complying with the general requirements in part 1 should carry the following:

4.5.1 MF/HF radio equipment operating on all distress and safety frequencies in the band 1605-27500 KHz using DSC telephony and direct-printing. This equipment shall also be able of general communication using telephony of direct-printing in band 1605-27500 KHz.

4.5.2 Radio equipment capable of selecting any of the DSC distress and safety frequencies in band 4000-27500 KHz and maintaining DSC watch on 2187.5, 8414.5 KHz and at least on additional distress and safety frequencies 4207.5, 6312, 12577 or 16804 KHz using DSC.

4.5.3 Manual activation 406 MHz satellite EPIRB.

4.6. Radiocommunication Availability

Regarding the radiocommunication on board ships there are three factors. One is the radio equipment which should be carried by the ship, the second factor is the operational availability of the equipment,and the third is the operator.

The first factor is discussed in other Chapters.
The second factor is the availability of the equipment that has been defined under the GMDSS regulations.
During the preparatory work for GMDSS there was a lot of discussion about the relationship between the availability of the equipment and a relevant system to guarantee this availability. In the conventional system, the availability of radio equipment was fulfilled by carrying the radio officers/operators on board, who were adequately trained to carry out both tasks, operation and availability, at the same time.
In convening the new system disputes commenced with one of the issues during the WARC, MOB-87, proposing the following :

"Personnel of ship stations for which a radio installation is made compulsory under international agreement (i.e.SOLAS ships) and which carry GMDSS equipment shall include :

- For ships in A3 and A4 areas : A holder of a first or second class radio electronic certificate;
- For ships in A2 areas : A holder of a first or second class radio electronic certificate or a General Operator's Certificate (GOC);
- For ships in A1 areas : A holder of a first or second class radio electronic certificate or a General Operator's Certificate(GOC) or a Restricted

Operator's Certificate (ROC)".

This decision led to a strict and non-flexible method as desired. A large number of countries were displeased because they felt that the new requirements would give their ships higher costs.
In other proposals the availability of equipment was totally ignored with the elimination of radio officers/operators with a new set of GMDSS equipment on board.

During the GMDSS Conference in London in October/November 1988 the following compromise solution was proposed and adopted :

The Global Maritime Distress and Safety System requires all ships, depending upon the sea area of operation, to ensure the availability of their radio equipment by choice of the following systems:

1. Duplication of certain radio installations;
2. On-board maintenance;
3. Shore-based maintenance.

In sea areas A1 and A2, availability shall be ensured by at least one of the above mentioned options or a combination of these options as approved by the national Administration.

In sea areas A3 and A4, availability shall be ensured by a combination of at least two of the above mentioned methods.

The maintenance at sea option requires a qualified person on board, holding a first or second-class radio

electronics certificate or equivalent qualification. Under the new Chapter IV of the SOLAS Convention, irrespective of the option selected for availability of equipment a ship should not depart from any port, unless and until she complies with and performs all distress and safety functions for all sea areas in which the ship will sail to its next port of call.

CHAPTER FIVE

QUALIFICATIONS REQUIRED IN THE OLD SYSTEM, FOR RADIO OFFICERS, AND IN NEW SYSTEM, FOR THE GMDSS OPERATORS

Introduction to requirements and qualifications for radio personnel

Chapter IV of the International Convention for Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 and articles 55 and 56 of the Radio Regulations (RR) of the International Telecommunication Union (ITU), contain the requirements for the training of radio personnel to serve on board ships. Part B, regulations 6 and 7 of the old Chapter IV of the International Convention for the Safety of Life at Sea (SOLAS), 1974, also contains requirements for ships to carry radio officers and radio telephone operators.

With the entry into force of the revised Chapter IV of the 1974 SOLAS Convention on 1st of February 1992, the Global Maritime Distress and Safety System (GMDSS)

will totally replace the existing maritime radiocommunication system by 1st of February 1999 .

These fundamental changes in maritime radiocommunications have called for adjustments in the training and certification of radio personnel, resulting in Resolution MSC.21(59) by which amendments to the International Convention for Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, were adopted on 22nd of May 1991.

Hereunder the requirements of the old and new system are outlined :

5.1 OLD SYSTEM

5.1.1 SAFETY OF LIFE AT SEA 1974 (SOLAS 1974)

REQUIRES

5.1.1.1 Chapter IV, part B, regulation 6 requires :

"(a) Each ship which in accordance with regulation 3 or 4 of this chapter is fitted with a radiotelegraph station shall, while at sea, carry at least ONE RADIO OFFICER and, if not fitted with a radiotelegraph auto alarm, shall subject to the provisions of paragraph (d) of this regulation, listen continuously on the radiotelegraph distress frequency by means of a RADIO OFFICER using headphones or a loudspeaker.

b) Each passenger ship which in accordance with regulation 3 of this chapter is fitted with a

radiotelegraph station, if fitted with a radiotelegraph auto alarm, shall, subject to provisions of paragraph (d) of this regulation, and while at sea, listen on the radiotelegraph distress frequency by means of a RADIO OFFICER using headphones or a loud speaker, as follows:

(I) if carrying or certificated to carry 250 passengers or less, at least 8 hours' listening a day in the aggregate;

(II) if carrying or certificated to carry more than 250 passengers and engaged on a voyage exceeding 16 hours' duration between two consecutive ports, at least 16 hours' listening a day in aggregate. In this case the ship shall carry at least TWO RADIO OFFICERS;
...".

5.1.1.2 Regulation 7 , part B, Chapter IV of SOLAS 1974 requires :

"(a) Each ship which is fitted with a radiotelephone station in accordance with regulation 4 shall, for the safety purpose while at sea, maintain continuous watch on the radiotelephone distress frequency in the place on board from which the ship is usually navigated, using a loudspeaker, a filtered loudspeaker or radiotelephone auto alarm.

(b) Each ship referred to in paragraph (a) shall carry QUALIFIED RADIOTELEPHONE OPERATORS (who may be the master, an officer or a member of crew) as follows:

(I) if of 300 tons gross tonnage and upwards but less

than 500 tons gross tonnage, AT LEAST ONE OPERATOR;

(II) if of 500 tons gross tonnage and upwards but less than 1600 tons gross tonnage, AT LEAST TWO OPERATORS. If such a ship carries one radiotelephone operator exclusively employed for duties related to radiotelephone, a second operator is not obligatory. ...".

5.1.2 The articles 55 and 56 OF Radio Regulations of the ITU require:

Regulation 3860 :
" The service of every ship radiotelegraph station shall be performed by an operator holding a certificate issued or recognized by the government to which the station is subject.

Regulation 3861 :
" The service of every ship radiotelephone station shall be controlled by an operator holding a certificate issued or recognized by the government to which the station is subject. Provided the station is so controlled, other persons besides the holder of the certificate may use the radiotelephone equipment."

The certificates for ship station operators are categorized by the radio regulations of ITU into the following :

There are four categories of certificates for radiotelegraph operators, namely ;

a) The radiocommunication operator's general certificate;

b) The first-class radiotelegraph operator's certificate;
c) The second class radiotelegraph operator's certificate;
d) The radiotelegraph operator's special certificate.

There are two categories of radiotelephone operators' certificates, general and restricted.

5.1.2.1 Conditions for the issue of operators' certificates :

Section III of article 55 of radio regulations of ITU (regulations 3891 - 3944), deals with the minimum knowledge and qualifications required from candidates to comply with to be competent in getting any of the above mentioned certificates.

(REFER TO APPENDIX ONE FOR DETAILS).

5.1.2.2) Class and minimum number of operators for stations on board ships (BY RR OF ITU) :

Section II of article 56 of the Radio Regulations of ITU deals with class and minimum number of operators for radio stations on board ships.
For the purpose of these regulations ;

Ship station of the **FIRST CATEGORY** means : Station maintains a continuous service,
Ship station of the **SECOND CATEGORY** means : Station maintains a service for 16 hours a day,

Ship station of the **THIRD CATEGORY** means : Station maintains a service for 8 hours a day,
Ship station of the **FOURTH CATEGORY** means : station maintains a service the duration of which is either shorter than that of station of the third category, or is not fixed by radio regulations of the ITU.

By radio regulations of ITU, regulations 3981 - 3986, the personnel of ship stations in the public correspondence service shall, having regard to the provisions of Article 55 of RR, include at least:

RR 3982 a) Ship stations of the first category, except in the case provided for in 3986 : a chief operator holding a radiocommunication operator's general certificate or a first-class radiotelegraph operator's certificate;

RR 3983 b) Ship stations of the second and third categories, except in the case provided for in 3986 : a chief operator holding a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate.

RR 3984 c) Ship stations of the fourth category, except in the cases provided for in 3985 and 3986 : one operator holding a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate;

RR 3985 d) Ship stations in which a radiotelegraph installation provided but not prescribed by international agreements : one operator holding a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's

special certificate ;

RR 3986 e) Ship stations equipped with a radiotelephone installation only : one operator holding either a radiotelephone operator's certificate or a radiotelegraph operator's certificate.

5.1.3 Standards of Training, Certification and Watchkeeping for seafarers, 1978 (STCW)

The mandatory provisions regarding radio watchkeepers are specified in the Radio Regulations RR. The safety matters of radio watchkeeping, as well as maintenance provisions, are set forth in the SOLAS Convention. Another reference related to radio watchkeepers is Chapter IV of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW),1978.

The following are regulations of STCW, relevant to certification of radio watchkeepers :

5.1.3.1 Mandatory Minimum Requirements for Certification of Radio Officers (Regulation IV/1 of the STCW):

" 1) Every radio officer in charge of, or performing, radio duties in a ship shall hold an appropriate certificate or certificates issued or recognized by the Administration under the provisions of the Radio Regulations, and have adequate qualifying service.

2) In addition, a radio officer shall :

(a) be not less than 18 years of age ;

(b) satisfy the Administration as to medical fitness,
particularly regarding eyesight, hearing and speech;

(c) meet the" minimum additional knowledge and training requirements for radio officers".

3) Every candidate for a certificate shall be required to pass an examination or examinations to the satisfaction of the Administration concerned.

4) The level of the knowledge required for certification shall be sufficient for the radio officer to carry out his radio duties safely and efficiently. In determining the appropriate level of knowledge and the training necessary to achieve that knowledge and practical ability, the Administration shall take into account the requirements of Radio Regulations and the minimum additional knowledge and training requirements for radio officers."

5.1.3.2 Minimum Additional Knowledge and Training requirements for Radio Officers :

In addition to satisfying the requirements for the issue of a certificate in compliance with the Radio Regulations, radio officers shall gain knowledge and training, including practical training, as specified in the appendix of Regulation IV/1 of the STCW Convention.

(For details see Appendix 2)

5.1.3.3 Mandatory Minimum Requirements for the certification of Radiotelephone Operators (Regulation IV/3 of STCW) :

" 1) Every radiotelephone operator in charge of, or performing, radio duties in a ship shall hold an appropriate certificate or certificates issued or recognized by the Administration under the provision of the radio regulations.

2) In addition, such radiotelephone operators of a ship which is required to have a radio telephone station by the International Convention for the Safety of Life At Sea, shall :

(a) be not less than 18 years of age ;

(b) satisfy the Administration as to medical fitness, particularly regarding eyesight, hearing and speech;

(c) meet the" Minimum additional knowledge and training requirements for radiotelephone operators".

3) Every candidate for a certificate shall be required to pass an examination or examinations to the satisfaction of the Administration concerned.

4) The level of knowledge required for certification shall be sufficient for the radiotelephone operator to carry out his radio duties safely and efficiently. In determining the appropriate level of knowledge and the training necessary to achieve that knowledge and practical ability, the Administration shall take into account the requirements of the Radio Regulations and the appendix to regulation IV/3 of the STCW Convention."

(For details see Appendix 3)

5.1.3.4) Mandatory Minimum Communication and Radiotelephony Knowledge Required for Deck Department :

Number 10 of appendix to regulation II/4 of the STCW Convention specifies the minimum "RADIOTELEPHONY AND VISUAL SIGNALLING" knowledge required for certification of officers in charge of a navigational watch on ships of 200 gross registered tons or more as follows :

" RADIOTELEPHONY AND VISUAL SIGNALLING :

(a) Ability to transmit and receive messages by morse light.
(b) Ability to use the international code of signals.
(c) Knowledge of procedures used in radiotelephone communications and ability to use radiotelephones, in particular with respect to distress, urgency, safety and navigational messages".

Number 16 of appendix to regulation II/2 of the STCW Convention deals with the minimum "communications" knowledge required for the certification of masters and chief mates of ships of 200 gross tons or more as follows:

" COMMUNICATIONS :

(a) Ability to transmit and receive messages by morse light and to use the international code of signals.
(b) Knowledge of procedures used in radiotelephone communications and ability to use radiotelephones, in particular with respect distress, urgency, safety and navigational messages.

(c) A knowledge of the procedures for emergency distress signals by radiotelephony as prescribed in the Radio Regulations".

Training requirements for radio telegraph operators and radiotelephone operators have a considerable difference in syllabus content, learning objectives and particularly in the time taken to train.
The training for the radiotelephone operator's general certificate takes between one and two weeks and for the restricted radiotelephone operator's certificate about five days.
The duration of training of radiotelegraph operators, depending on maintenance ability, level of electronics and the types and number of equipment for which maintenance skills are needed, takes between one to two years.

5.2 New System

One of the crucial matters while developing a new system, was the discussion concerning the role of radio officer under the GMDSS.
By phasing out radiotelegraphy with the introduction of new equipment and a new system, the role of the radio officer has in fact been changed under the GMDSS.
Taking into consideration the fact that although a new generation of equipment could be easily operated by an operator, but any equipment may fail in its operation at once, at any time. So availability of the radiocommunication equipment should also be noticed.
The availability of radio equipment can be guaranteed

by three means :

1) Duplication of equipment
2) Shore-Based maintenance
3) On-Board maintenance

It is obvious that with the changing of equipment, requirements and new sets of regulations, the training and certification should be changed to match the new system.

Regarding the training and certification for the new GMDSS system, the IMO Sub-Committee on Radiocommunications prepared, to begin with six, different GMDSS certificates and proposed these to the ITU. These consisted of two purely operational, two purely technical and two combined, technical and operational, certificates as follows:

1) The General Operator's Certificate
2) The Restricted Operator's Certificate
3) The first-class technical certificate
4) The second-class technical certificate
5) The first-class Radio electronic certificate
6) The second class Radio electronic certificate.

During the WARC MOB-87 only four certificates were adopted, namely :

1) The General Operator's Certificate
2) The Restricted Operators's Certificate
3) The first-class Radio electronic certificate
4) The second-class Radio electronic certificate

Thus, the two purely technical certificates proposed by IMO were not accepted by the conference.

Revised Chapter IV of the 1974 SOLAS Convention replaced totally the old Chapter IV and with this replacement the requirements for qualification of radio personnel were brought up to date.
Regulation 16 of the new Chapter IV of SOLAS requires all ships to carry radio personnel holding an appropriate certificate which has been specified in the radio regulations of the ITU.
The certificate holders should, as well, comply with requirements of 1991 amendments to the STCW Convention.

In the 17th session of the General Assembly of the IMO, resolution A.703 was adopted, 6th November 1991, from which five categories of training and certificates for Radio personnel in the Global Maritime Distress And Safety System have been annexed as follows:

1) First-class Radio Electronic Certificate
2) Second-class Radio Electronic Certificate
3) General Operator's Certificate
4) Restricted Operator's Certificate
5) Training and certification of personnel performing maintenance of the GMDSS installations aboard ships.

One of the difficult matters of the GMDSS Conference was the decision making regarding the regulations involving maintenance requirements of the radio installations. Finally the regulation regarding "Radio Personnel" was adopted as follows:

" Every ship shall carry radio personnel qualified for distress and safety radiocommunication purpose to the satisfaction of the administration.the personnel shall

be holder 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".

The type of certificate in the new system which the personnel who are responsible for the radiocommunications aboard ships should carry, depends upon the operation area of the ship and the choice of equipment and its availability, designated for that particular ship.

5.3 The GMDSS courses

At present the GMDSS courses are being conducted in some countries. Among these courses the most popular one is the training of radio operators related to the General Operator's Certificate.
Unfortunately there is no standard syllabus and examination to be followed by those institutions conducting the GMDSS courses. Each institute has its own syllabus and training system. This leads to a confusion and nonuniformity in training and qualifications, which some times ends up with poorly qualified certificate holders.

In the near future the IMO, with help from CEPT, is going to present a uniform course content and examination syllabus for the GMDSS qualifications.

CHAPTER SIX

AN OVERVIEW TO THE PRESENT GMDSS MODULE COURSES BEING CONDUCTED IN DIFFERENT COUNTRIES

Introduction

The GMDSS course is being conducted in most European countries, the U.S.A and some developing countries.
Up to now, no harmonization has been achieved in the training of GMDSS personnel. Each country, depending upon its own requirements, has developed a curriculum for its own purposes.
Syllabus contents and duration of courses in different countries are not always the same.
This Chapter presents an overview of the GMDSS courses being conducted in some developed and developing countries.

6.1 The GMDSS Course In HONG KONG

The Department of Nautical Studies of Hong Kong polytechnic conducts the course leading to an award of GMDSS Operator's Certificate.
This certificate, issued by the Department of Nautical Studies of the polytechnic, is recognized by the Hong Kong Telecommunications Authority for the purpose of

issuance of their General Operator's Certificate (GOC).
This course is especially designed for seagoing watchkeeping officers to comply with the training requirements of the GMDSS certification.
Candidates completing the course are supposed to have sufficient knowledge in :

- The operation of all GMDSS sub-systems and equipment;
- The communication procedures using radiotelephone and direct-printing telegraphy
- Radio Regulations
- SOLAS
- International MF/HF/VHF operation services.

The General Operator's Certificate syllabus is issued by the Hong Kong Telecommunications Authority.
The course is divided into two parts, part A and part B, each of one week (5 days) duration. Students intending to obtain the GOC have to complete both parts A and B. Holders of radiotelephony and radiotelegraphy are required to attend part B only. For the purpose of Restricted Operator's Certificate (GOC), attending only part A is sufficient.
The course is open to all seagoing watchkeepers and any others holding the equivalent or appropriate qualifications.

6.2 The GMDSS course in the NETHERLANDS

The Netherlands, like most of the other developed countries, due to the tendency towards a reduction in the manning scale of its fleet, started to cope with

new radiocommunications technology a few years ago.

With the introduction of the GMDSS, the Netherlands started to conduct appropriate courses which results in the award of two types of certificates for maritime communication purposes. One is the so-called general maritime communication certificate or MARCOM-A and the other one is the restricted maritime communication certificate or MARCOM-B.
All bridge watchkeepers of ships operating in GMDSS sea areas A2, A3, and A4 are required to have MARCOM-A Certificate. For sea area A1 the restricted certificate (MARCOM-B) is enough and at least one bridge watchkeeper must be a holder of MARCOM-B certificate for this sea area.
The syllabus content of the GMDSS courses conducted in the Netherlands is almost the same as those in others mentioned in this Chapter.

For maintenance and equipment availability the Netherlands follows the shore-based maintenance strategy, due to the facilities which they posses for this purpose.
The Netherlands offers services such as Radio Holland Maintenance Group to other countries who are intending to follow shore-based maintenance as their option for radio equipment availability on board their ships.

6.3 The GMDSS course in DENMARK

At present there are four different courses being conducted in Denmark, namely :

.1 The General Operator's Certificate (GOC);

.2 The Restricted Operator's Certificate (ROC);

.3 The Radiotelephone general certificate;
.4 The Restricted radiotelephone operator's certificate.

Course duration for the GOC is 14 days. In addition one day is allocated for examination purposes. The total teaching and practical time during the course is 56 hours for those who possess the RadioTelephony (R/T) Certificate and 95 hours for those who do not possess the R/T.
Due to their intake limitations the number of candidates should be between 5-8 persons for each course. The number of lecturers for the GOC are three qualified persons.

The following is the syllabus outline of the Danish GMDSS GOC course :

.1 Radio technic
.1.1 Radiotelephony
.1.2 Radiotelex
.1.3 DSC for VHF/MF/HF
.1.4 INMARSAT A/C
.1.5 EPIRB
.1.6 SART

.2 Operation :
.2.1 Radiotelephone operational procedures
.2.1.1 DSC
.2.1.2 VHF
.2.1.3 HF
.2.1.4 MF
.2.2 Radiotelex operational procedures
.2.2.1 Telex
.2.2.2 NAVTEX

.2.3 INMARSAT A/C
.2.4 EPIRB
.2.5 SART

.3 Fault finding
.3.1 Built-in measure apparatus
.3.2 Fuses
.3.3 Indicator lamps
.3.4 Emergency power

.4 Practice and execution
.4.1 Distress, urgency and safety (MAYDAY; PAN PAN; SECURITY)
.4.2 Radiotelex
.4.3 Radiotelegraph
.4.4 Telephone calls

.5 Radio regulations

.6 Miscellaneous
.6.1 Structure of the GMDSS
.6.2 Trade routes
.6.3 Position of CESs
.6.4 List of coast stations
.6.5 Radio log books
.6.6 Special services

At present "Sea Speak" is the text book used for these courses.

A special government agency through The Telecommunication Union is the Authority who conducts the examinations and issues the certificates for different radiocommunication courses. The validity of the certificates are unlimited.

With the new proposal for harmonization of training and certification of the GMDSS, Denmark is, like other countries, upgrading its course syllabuses to cope with the required standards.

6.4 The GMDSS Course in CHINA

At present there are several maritime training institutions in China. Among these there are three maritime institutions of higher education (university level) of which two offer GMDSS courses. One is Dalian Maritime University and the other Jimei Navigation Institute.
There is also a specialized maritime institute of higher education, the Qingdao Ocean Shipping Mariner's College, which offers a GMDSS course.

China's approach for the training of personnel for GMDSS differs from that used in most developed countries. The reason is that due to cheap labour in China, it still seems to be economical to employ radio officers or radio electronic officers on board. For the availability of radio equipment, China selected on board maintenance instead of duplication of equipment.

There are two approaches in the GMDSS training in China. One is conducting short and intensive courses for different certificates and the other is spreading the teaching syllabus of GMDSS into the certificate of competency course (during the four years of college studies) resulting in the required GMDSS knowledge by the time of graduation.

The following are the proposed courses for the

training of radio personnel in China. Some of these courses are already being practiced :

" .1 The GMDSS training plan for on-the-job radio personnel;
.2 The training course for the radio technician ashore, (those whose professional posts are higher than engineers);
.3 The training course for the radio technician ashore, (those whose professional posts are lower than engineers);
.4 The GMDSS training plan for ship surveyors;
.5 The GMDSS training plan for the on-the-job Deck Officers." (Ye Yue Qian, WMU, 1992)

The GMDSS training syllabus for the Deck Officers at Qingdao College is outlined to give a general over view of the Chinese system :

" .1 Introduction to GMDSS
.2 INMARSAT geostationary maritime satellite communication system
.2.1 Introduction to INMARSAT
.2.2 The fundamental principles of satellite communications
.2.3 INMARSAT-A ship earth station
.2.4 INMARSAT-C ship earth station
.3 NBDP terminal
.4 DSC
.5 Weather FAX." (Ye Yue Qian, WMU, 1992)

The Chinese training categorization for training of the GMDSS personnel is most likely to be followed by the Iranian training system.

6.5. The GMDSS course in the United Kingdom

Some countries may issue a restricted operator's certificate for those operators who sail only in sea area A1, but since THE U.K. is in sea area A2,there is only THE GMDSS General Operator's Certificate being issued at present.
The GMDSS course is a one-week course before taking the examination , but from January 1994 it is being extended to 2 weeks to update their standards with the CEPT syllabus .
Examinations are conducted at a number of regional examination centres. The authority conducting the examination is AMERC, the Association of Marine Electronics and Radio Colleges, who does this on behalf of the Radiocommunications Agency, a section of the Department of trade and Industry (DOT).
Certificates are issued from the national administration centres.
A specimen certificate is annexed to this dissertation.(Appendix 4)

For examination purposes each training centre keeps a bank of examination papers that are used in rotation. New examination papers are made up every year at the annual examiners' meeting.
The exam consists of the following elements :

1. A 10 minutes written SOLAS paper with pass mark of 75% ;
2. A 20 minutes regulations paper in multiple choice format with a pass mark of 60%, covering Radio Regulations and charging ;
3. A radiotelephony practical examination of simulated operating procedures with a pass mark of 60% ;

4. An equipment operation test on a range of GMDSS equipment with a pass mark of 60%, to include main transceiver, DSC encoder, VHF, NAVTEX Rx, and telex/keyboard skills.

GMDSS General Operator's Certificate examination syllabus in the U.K., at present, is being introduced here under :

" **Examination syllabus :**

1. Detailed practical Knowledge of the operation of GMDSS sub-systems and equipment :
Candidates will be required to demonstrate ability to operate and/or describe the function as appropriate of the following equipment which may be used in the GMDSS: (note 1)

MF/HF/VHF transmitters and receivers using telephony and NBDP;
DSC encoder/decoder;
INMARSAT ship earth stations (note 2);
COSPAS SARSAT EPIRBs (note 3);
radar transponders;
NAVTEX receivers.

2. Ability to send and receive by radiotelephony and direct-printing telegraphy.
Candidates will be required to demonstrate :

Communication procedures for passing information by means of telephony using , where appropriate, the phonetic alphabet and the standard marine navigation vocabulary;
ability to use a QWERTY keyboard to communicate over a

direct-printing telegraphy circuit using, where appropriate, recognized standard abbreviations and commonly used service codes (note 4).

3. Detailed knowledge of regulations, procedures and charges.
Candidates will be required to :
have a sound understanding of the general provisions for the Global Maritime Distress and Safety System;
specify the distress and safety frequencies/channels allocated in the MF and VHF bands, their purpose and permissible class(es) of emission;
describe the band plan, modes of operation and use of frequencies allocated for distress, safety and public correspondence in the HF bands and for public correspondence in the MF and VHF bands;
explain how distress and safety frequencies are protected against harmful interference and the means of avoiding harmful interference;
explain the operational procedures for distress, urgency and safety communications in the GMDSS;
describe the general procedures to be followed when setting up, conducting and terminating communication links using; a) NBDP b) Radiotelephone
calculate charges for commercial correspondence services using terrestrial and satellite services.

4. Knowledge of the English language
Candidates will be required to demonstrate their ability to effectively communicate in the English language, both orally and in writing, by satisfactory completion of all written tests and communications

exercises leading to the issue of a certificate.

Notes and references :

1. Includes Knowledge necessary to choose the most appropriate system or frequency band for a given communications link.
2. Specific equipment knowledge will not be required and questions will be confined to system Knowledge and procedures contained in the INMARSAT users Handbook.
3. Basic Knowledge of purpose and system will be required. Ref: IMO publications "Global Maritime Distress and Safety System".
4. Familiarity with the QWERTY keyboard should be sufficient to allow an operating speed of not less than 50 characters per minute.". (Global Maritime Distress and Safety System Information for users, Wray Castle, U.K., NO.4-11/09/92-/CK)

6.6. The GMDSS Course in Germany

There are two different procedures with respect to the GMDSS courses in Germany , at present. These two could be called TYPE A and TYPE B procedures.

TYPE A : Courses to extend the General Radio Telephony Certificate (GRTC) to the new General Operator's Certificate (GOC).
These are short 7-day-seminars, which can only be attended by holders of the GRTC.

TYPE B : Courses for students within their regular studies for the Nautical Certificate of Competency. It is necessary to hold the GOC to be eligible of

obtaining a Nautical License, but in this case acquisition of the GOC is contained in the syllabus of regular studies.
GMDSS courses type A and type B are being conducted by almost all nautical institutes in Germany.
Due to enormous demands for the type A course, this course is being offered by some "Further Education Institutions" at present.
Until now the duration of the GOC has been only 5 days, but to comply with the new examination syllabus proposed by the CEPT, they have increased the course duration to 7 days (about 60 hours duration).
Shorter courses are being conducted for those who have already obtained the conventional Radiotelephony (R/T) Certificate.

Although the official authority for examination and issuance of any radio operator certificate is the Federal Post and Telecommunications Ministry (Bundesministerium für Post und Telekommunikation, BMPT), the examinations are being held by the same institutions, where courses are conducted, but under the supervision of the regional Telecommunications Office (Bundesamt für Post Und Telekommunikation, BAPT), i.e., a member of the authority may be present at the examination as observer.
The official certificate is issued by the BAPT on the behalf of the BMPT.
"At present there are no courses for "Radio Electronic" in Germany, may be Warnemunde school would offer such course on demand". (A letter from professor C. Marcus, Head of the Nautical Department, Bremen Polytechnic, 27 september 1993).

Germany is assigned for sea areas A1 (North Sea) and

A2 (Baltic).
The various radio operator's syllabus content and a copy of the Bremen polytechnic, Department of Nautical Studies GOC is Annexed. (Appendix 5).
Hereunder for more familiarization with the German system "The proposed syllabus for education and training of General Radio(Officers) Certificate" (JHM 517/t1 25 March 1991) is outlined :

Learning Objectives and Lecture Contents :

1. GMDSS : Procedure, Equipment, Distress and safety communication.

1.1. Knowledge about the requirements/regulations for Radio Equipment in GMDSS, consist of :
A1-A4 areas; DSC and Satcom-equipment; Standard A and C; Distress Radio Beacon; SART; EGC; Navtex.
1.2. Links for Distress and Safety Communications, consist of :
Frequency allocations in the GMDSS; Protection of Distress frequencies; Transmission methods; Transmission priorities; Priority 3.
1.3. Procedures in Maritime Distress and Safety Communications, consist of :
Distress alarm; Transmissions; Procedures for relay and confirmation of distress calls; Reception and confirmation by CRS, CES or RCC; Preparation for the handling , further transport, coordination and finalization of Distress traffic.
1.4. Urgency and Safety messages, including Maritime Safety Information, consist of :
NAVTEX receiver, Worldwide Maritime Safety transmissions, NAVAREAs, Priorities 2 and 1,

Limitation of Information quantity.

2. Exercise with Equipment for Data Input

2.1. The operational aspects of Telex- and Satcom-terminals and the DSC-receiver, consist of :

Special codes, Message identification, US and German Keyboards, Flawless operation, Changing and mixing of texts, Buffering of messages, DSC messages.

3. Operational procedures of SATCOM, DSC and Telex

3.1. Sufficient skill in procedures with SATCOM-installations, consist of :

Transmitter engagement, Choice of CES and signalling methods (Telex, Telephone, Fax), Priority zero, Country identification, Abbreviations used in Telex traffic.

3.2. DSC-transmission, reception and confirmation, consist of :

Choice of appropriate frequencies, procedures for making a connection, Repeating messages.

3.3. Providing for a Telex-communication link, consist of :

Choice of appropriate frequencies, Handling of a Telex terminal.

4. Laws and Regulations

4.1. Knowledge of relevant national and international regulations as far as concerned with GMDSS, consist of:

Telecommunication regulations, Ship Safety regulations, INMARSAT regulations.

5. Technical Aspects of Telecommunications

5.1. The assessment of the technical reliability of

equipment, consist of :
A Technical Manual of the installation, Block diagrams, Control of indicators, Antenna, Gyroscopes, Earth connection, Status alarms, Status reports, Printer tests, Paper transport.
5.2. The performance of test-sequences, Fault identification, Correction for simple faults as far as is possible on board, consist of :
Fuses, Measurements at test-points, Power failures, Communication with service/maintenance companies.

(For more information about German system see Appendix 5)

6.7. The GMDSS Course in Australia

Currently two of the four types of GMDSS courses are being conducted in Australian Maritime College (AMC), namely :

a) GMDSS General, Operator's Certificate (GOC),
b) GMDSS First-Class Radio-Electronic Certificate.

Duration of the GOC is two weeks and for First-Class Radio-Electronic Certificate it is two years.
Entry to the GOC course is open to anyone, but entry to the First-Class Radio-Electronic course is open only to those who hold acceptable education for entry into Australian Associate Diploma of Engineering (Maritime Electronics) course.

Examination syllabus of the GMDSS course in the AMC is as follows :

" A candidate will be required to :

1. Demonstrate ability to handle traffic by Radiotelephone and direct printing telegraphy (NBDP);
2. Demonstrate general knowledge of relevant regulations and associated documents;
3. Demonstrate practical knowledge by performing an appropriate test, supported by appropriate explanations, on the following GMDSS equipment :
a) INMARSAT-A and related equipment, together with antenna safety precautions, blind spots and interface;
b) INMARSAT-C (transmit, receive and EGC capabilities), together with antenna as for INMARSAT-A;
c) EGC receiver;
d) MF/HF transceiver with DSC and NBDP capabilities, together with antenna;
e) NAVTEX receiver;
f) Radiotelephony distress frequency (2182 kHz) watchkeeping receiver;
g) Radiotelephony two-tone alarm signal generator (2182);
h) EPIRB on 406 MHz and homing capabilities in 121.5 MHz;
i) Radar transponder (SART);
j) Portable radio equipment for survival craft;
k) VHF and VHF transceiver;
l) Batteries and emergency power supplies."

(Examination syllabus of AMC, page 3).

Complete and detailed course syllabus and assessment information and time table of the GOC of the AMC is annexed (Appendix 6).
The maximum number of students being enrolled for each

course is 10. The text book being used in the AMC is "The General Operator's Certificate handbook" published by Australian Maritime College.
The AMC has a laboratory with a full set of GMDSS equipment.
The 40-hour GMDSS GOC course is being conducted in several ways at the AMC. The main aim is that each student receives 40 hours of instruction.

The following alternatives are used in conducting their courses :

1. From 9 AM to 6 PM, Monday to Friday for one week with a maximum of 10 students;
2. A one-hour lecture a week for ten weeks and two hours per week in the GMDSS practical laboratory for up to 10 students at a time;
3. A one-hour lecture a week for ten weeks and four hours per week in the GMDSS practical laboratory for up to 10 students at a time.

The authority issuing the certificates in Australia is currently the Radiocommunications Division, Department of Transport and Communications.

Amendments to the Radiocommunications (Certificates of Competency) regulations made by the Governor- General of the Commonwealth of Australia, (Statutory rules 1990 No.344), stating the objectives and the examination purposes for different Radio Certificates is annexed. (Appendix 7).

CHAPTER SEVEN

A proposed GMDSS module course for the Iranian MET system

Introduction

Sooner or later all ships should comply with the GMDSS requirements. This chapter presents a module course which could be used in Iranian maritime training centres for the education and training of required personnel for the Iranian merchant fleet.
This module presents a flexible content which could be adjusted depending upon the entrance level of trainees or any other reason.
The course advisor should make sure that if any change is being made, the minimum requirements of the course for training the qualified personnel are being maintained.

7.1. References and sources

In preparing this module course to be acceptable within the present standards of GMDSS training the following documents have been used and found very useful :

1. The German module course for General Operator's Certificate (GOC);

2. The Australian module course for GOC;
3. The European Conference of Postal and Telecommunications Administrations (CEPT) proposed examination syllabus for GOC and ROC.

7.2. Course framework

7.2.1 Aim

The course is designed for those persons who will operate radio equipment on board ships within the Global Maritime Distress and Safety System (GMDSS).

7.2.2. Objectives

The teaching objectives are designed so as to enable students to :

1. gain knowledge about the organization and procedures of international radiotelephony, telex and data services;
2. know and be able to decide on the appropriate devices and systems depending upon the situation in distress and other urgent cases;
3. know how to establish and perform radiocommunications ship-to-shore, shore-to-ship and ship-to-ship in daily routines;
4. be able to competently operate and maintain radio installations and to secure permanent operability.

7.2.3. Entry standards

This course is open to all persons who are watchkeeping officers or at least are being trained for certificates of competency. Present radio

operators may also attend the course, upgrading their knowledge to be able to fulfil the GMDSS tasks.
Ability to use the English language, both written and spoken for the exchange of communications is essential.

7.2.4. Course certificate

With the approval of the Administration, candidates who pass the course successfully will be awarded the General Operator's Certificate (GOC).

7.2.5. Course intake limitations

The course intake is limited, depending upon the teaching facilities, equipment and the GMDSS radio simulator capacity for practical work. However, the number of candidates for a course should not be more than double that of the radio simulator's capacity.
As far as possible these intake limitations should be observed and not exceeded otherwise the quality of the course will be diluted.

7.2.6. Staff requirements

1. A course director with sufficient experience in course and curriculum development is required for implementing the course and overall charge.
2. Subject to the number of trainees, one instructor should be sufficient for the theoretical sessions, but at least two instructors are required, if the number of trainees is maximum.
Instructors should be experienced radio personnel, qualified for training such a course, with sufficient teaching experience,

3. A laboratory technician with sufficient experience for maintenance of simulator and laboratory, assisting instructors in practice sessions.

7.2.7. Teaching aids, facilities and equipment

1. A classroom to accommodate all students, including black board, chairs and benches.
2. An overhead projector with extra lamp.
3. Relevant posters, cards and sketches, illustrating different radio instruments should be posted in the class room.
4. One set of video-cassette player and a television set for demonstration of various radio communication procedures. e.g. INMARSAT video cassette or "Alive via satellite", product of Department Of Transport and communications, Camberra, January 1990.
5. Relevant overhead projector transparencies.
6. Handouts, to be prepared by instructors prior to course commencement.
7. A laboratory with a complete set of instruments and radio simulation equipment with sufficient cubicles to accommodate the maximum number of intake trainees.

7.2.8. IMO and ITU references

1. A SOLAS 1974 and amendments (new Chapter IV). (R1)
2. STCW Convention (new Chapter IV). (R2)
3. Radio Regulations of ITU, articles 55 and 56 (Radio Regulations 3869 through to 3876). (R3)
4. IMO resolution A.703 (17). (R4)

7.2.9. Text book

Handbook for marine radio communication is one of the

best text books that could be used, although the textbook might be changed by the instructor. (T1)
The GMDSS Handbook, newly published by the IMO, could also be used for making handouts for students. (T2)

7.2.10. References and Bibliography

1. Global Maritime Distress and Safety System.
IMO, London, 1987. ISBN 92-801-1216-3. (B1)
2. INMARSAT users hand book. INMARSAT, London. (B2)
3. NAVTEX manual.
IMO, London, 1988. ISBN 92- 801- 1238-4. (B3)
4. International Convention on Safety of life at sea (SOLAS 1974) and amendment to the 1974 SOLAS Convention And 1978 protocol, concerning Radiocommunications for the Global Maritime Distress and Safety System.
IMO, London, 1989. ISBN 92-801-1249-X and 92-802-1250-3. (B4)
5. Manual for use by the maritime mobile and maritime mobile satellite services.
ITU, Geneva, 1982. ISBN 92-61-01261-2. (B5)
6. Admiralty list of radio signals (UK), volumes 1-6. (B6)
7. Merchant ship search and rescue manual.
IMO, London, 1986. ISBN 92-801-1205-2. (B7)
8. Ocean voice.
INMARSAT's quarterly journal, ISSN 0261-6777. (B8)
9. Safety at sea.
International trade publications, Redhill, UK, monthly journal. ISSN 0142-06666. (B9)
10. International code of signals.
IMO, London, 1985, 1987 (with supplement 1989).
ISBN 92-801-1184-1. (B10)

11. G.M.D.S.S HANDBOOK. 1st edition, IMO, London, 1992. (B11)

7.2.11. Teaching methods

1. Explanatory lectures on the GMDSS and related subjects as being outlined in syllabus contents.
2. Practice in correct operation of type-approved equipment and exchange of messages, using the GMDSS communication laboratory.
3. The use of computer aided learning tutorials and exercises.
4. Keyboard skills.

7.2.12. Assessment methods

1. A one and half hours written examination, consisting of multiple-choice and short-answer questions. (Approved by national administration).
2. Practical and oral examinations, as specified by the GMDSS General Operator's Certificate (GOC) examination syllabus approved by national administration.

NOTE : The abbreviations being used in reference column of syllabus content table (7.3 and 7.3.1), refers to acronyms used in sub-paragraphs 7.2.8, 7.2.9 and 7.2.10.

7.3 Syllabus Content (Outline)

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
1. Basic knowledge			
1.1. Principles of maritime mobile service.	4		T1,B5,B6
1.2. principles of maritime mobile-satellite service.	3		T1,T2,B2, B5
2. Practical knowledge and ability in using the basic radio equipment in a ship station.			T1,T2,B1, B2,B5,B11
2.1. Understanding the functions of the basic equipment of a ship station and ability to use those in practice.	4		T1,T2,B5
2.2. Digital Selective Call (DSC).	2	5	T1,T2,B1, B5,B11
2.3. General principles and practical ability to use maritime Narrow Band Direct Printing (NBDP) and telex systems.	2	6	T1,T2
2.4. General knowledge and ability to use INMARSAT systems and equipment.	2	1	T1,B2
3. GMDSS system and sub-systems and practical operation.			T1,T2,B1, B2,B3,B11

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
3.1. GMDSS concept.	2		T1,B1,B11
3.2. INMARSAT usage in the GMDSS.	2	6	T1,B1
3.3. NAVTEX system.	1	1	B3,T1
3.4. Emergency Position Indicating Radio Beacon (EPİRB).		1	T1,B1,B11
3.5. Search And Rescue Transponder.		1	B7,T1
3.6. Communication procedures in the GMDSS.	1	14	T1,B1,B11
4. Search And Rescue operation (SAR).	2		B5
5. General communications and operation.	4	8	T1,R1,R2, R3
6. Operational regulations.	2		T1,B5
7. Maintenance and fault locating.	1	2	T1
TOTAL	32	45	

7.3.1 Syllabus Content (Details)

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
1. BASIC KNOWLEDGE :	7	-	
1.1. Principles of maritime mobile service. 1.1.1. Definition of communication. 1.1.2. Intership communication 1.1.3. On-board communication 1.1.4. Distress, urgency and safety communications. 1.1.5. Ship stations, coast stations,port and pilot stations. 1.1.6. Rescue Coordination Centre(RCC). 1.1.7. Definition and concept of : Volt, Amper, Ohm, Watt, Transformers, Rectifiers, Carrier, Oscillator, Accumulator, Fuses, Acid density, Ground connection, Short circuit, Frequency and it's units(Hz, KHz, MHz,GHz), Wave length, Radio frequency bands (MF, HF, VHF, UHF), Wave propagation mechanism, Ground and sky waves. 1.1.8. Knowledge of the various communication modes consisting of: morse telegraphy, radiotelephony,	4		T1,B5,B6

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
Digital selective call (DSC), Narrow band direct printing (NBDP). 1.1.9. Frequency channelling systems. 1.1.10. Calling frequencies and working frequencies. 1.1.11. Distress and safety frequencies. 1.1.12. Alarm signals, SOS, MAYDAY, PANPAN, SECURITE, SILONCE MAYDAY, SILONCE FINI.			
1.2. Principles of maritime mobile-satellite service. 1.2.1 Satellite communications ,INMARSAT and COSPAS-SARSAT. 1.2.2. Communication services such as : telex, telephone, data and facsimile, store and forward operation. 1.2.3. INMARSAT mobile-satellite stations, namely : Coast-earth station (CES), Ship-earth station (SES), Network co-ordination station (NCS). 1.2.4. Satellite communication equipment standards: INMARSAT-A, INMARSAT-C, INMARSAT-B & INMARSAT-M SESs.	3		T1,T2,B2, B5

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
2. Practical knowledge and ability in using the basic radio equipment in a ship station :	10	12	T1,T2,B1, B2,B5,B11
2.1. Understanding the functions of the basic equipment of a ship station and ability to use those in practice. 2.1.1. Receivers - 2182 KHz watch receiver - VHF Digital Selective Call receiver - MF/HF watch receiver 2.1.2. VHF channels, controls, DSC and usage. 2.1.3. MF/HF frequencies, transmission and reception selections, connecting the power, tuning, volume control, squelch, Gain control, fine tuning, alarm testing and usage. 2.1.4. Antenna types, isolators, maintenance, emergency antenna. 2.1.5. Different types of batteries, maintenance and charging. 2.1.6. Emergency Radio	4		T1,T2,B5

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
equipment for survival craft, Search And Rescue Transponders (SART), Emergency Position Indicating Radio Beacon (EPIRBs).			
2.2. Digital Selective Call (DSC) : 2.2.1. Calling format : distress call, all ships call, individual station call, specific geographic area call, group call. 2.2.2. Calling categories : Priority 3 (Distress), urgency, safety, routine, ship business. 2.2.3. Call address selection: nationality identification, group calling numbers, coast station numbers.	2	5	T1,T2,B1, B5,B11
2.3. General principles and practical ability to use maritime Narrow Band Direct Printing (NBDP) and Telex systems. 2.3.1. NBDP systems : Automatic, manual, different modes (ARQ,FEC). 2.3.2. Telex	2	6	T1,T2

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
keyboard, controls and indicators.			
2.4. General knowledge and ability to use INMARSAT systems and equipment. 2.4.1. INMARSAT-A SES : components of INMARSAT-A terminal, telex, telephone, data and facsimile services, usage of INMARSAT-A station. 2.4.2. INMARSAT-C station : Components of INMARSAT-C terminal, loading and updating data, usage of INMARSAT-C station, sending and receiving messages.	2	1	T1,B2
3. GMDSS system and sub-systems and practical operation :	4	23	T1,T2,B1, B2,B3,B11
3.1. GMDSS concept 3.1.1. Sea areas A1,A2,A3,A4. 3.1.2. Distress frequencies. 3.1.3. Carriage and functional requirements and sources of energy of ship stations.	2		T1,B1,B11
3.2. INMARSAT usage in the GMDSS. 3.2.1. INMARSAT-A SES	2	6	T1,B2

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
procedures for distress and safety calls, satellite acquisition and use of the distress facility. 3.2.2. INMARSAT-C SES distress and safety services, sending a distress alert and distress priority message. 3.2.3. INMARSAT EGC including purpose of the EGC and different group messages.			
3.3. NAVTEX system 3.3.1 Purpose and frequencies. 3.3.2. transmitter selection and operational procedures. 3.3.3. Worldwide maritime safety transmission, NAVAREAs, priorities 2 and 1.	1	1	B3,T1
3.4. Emergency Position Indicating Radio Beacons (EPIRBs). 3.4.1. Characteristics of operation and frequencies of EPIRBs, manual usage and maintenance. 3.4.2 Technical characteristics of VHF-DSC-EPIRB, Manual operation and maintenance.		1	T1,B1,B11

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
3.5. Search And Rescue Transponders (SART). 3.5.1 Technical characteristics operation and range. 3.5.2. Maintenance.		1	B7,T1
3.6. Communication procedures in the GMDSS. 3.6.1 Distress communications, definition of distress alert, DSC distress alert, direct and relayed transmission of distress alert, reception of DSC alert, acknowledgement procedures of alert by radiotelephony and NBDP through coast station or ship station. 3.6.2. Search And Rescue operation and on-scene communications in GMDSS 3.6.3. Urgency and safety communications, definition of urgency and safety, procedures for DSC urgency and safety calls 3.6.4. Radiotelephony communication with conventional system including alarm signal, distress signal, distress call, acknowledgement	1	14	T1,B1,B11

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
of a distress message, medical advice. 3.6.5. Maritime Safety Information (MSI) reception including navigational warnings transmitted by radiotelephony, NAVTEX, INMARSAT EGC and HF NBDP reception.			
4. Search And Rescue operation (SAR). 4.1. Aims of SAR, MERSAR. 4.2. SAR organizations 4.3. Role of RCCs	2		B5
5. General communication procedures and operation.	4	8	T1,B5
5.1. Radiotelephone call including method of calling a coast station, calling by radiotelephone using DSC, automatic radiotelephone call, traffic lists, selection of appropriate communication methods in different situations and ending the call.			T1,B5
5.2. Radiotelegram message, format, counting the words, transmission by radiotelephony			T1,B5

SYLLABUS CONTENT AND LEARNING OBJECTIVES	HOURS		REFERENCE
	LECTURE	PRACTICE	
and transmission by radiotelex. 5.3. Traffic charges including international and INMARSAT charging system.			T1,B5
6. Operational regulations : 6.1. Knowledge of relevant National and International regulations as far as concerned with GMDSS including: telecommunication regulations, ship safety regulations, INMARSAT regulation, right of usage, misuse of distress, urgency and safety codes and avoiding harmful interference.	2		T1,R1,R2, R3
7. Maintenance and fault location : 7.1. On board maintenance procedures of various radio installations. 7.2. Elementary fault location using equipment manuals and elementary failure repair.	1	2	T1 T1 T1

Total time required for this course, mentioned in the outline, is the minimum time required for lectures and practice. However, the time allocated for subjects might need adjustment by approval of the course advisor and instructors.

7.4. GMDSS Course for Deck Cadets

The full course introduced in this Chapter should be conducted for deck cadets. In the Iranian maritime training centres where the semestrial system is applied, usually a full course can not be allocated within an intensive time frame. So the syllabus for such a course should be spread out through one or two semesters.

In the Chah-Bahar Nautical college, one of the Iranian maritime institutes, the best time for this course seems to be the seventh semester of the four year program, when cadets are being prepared for their certificate of competency. The reason is that cadets have acquired a sound background during the first three years of study to understand the course thoroughly.

It should be noticed that the GOC course syllabus, proposed in this chapter should be completely followed making sure that teaching objectives have been achieved. The course advisor can allocate the time and syllabus within a long-term (semestrial) course.

7.5. Radio Officers' new role in shipping

With the introduction of the GMDSS during its transition period, the phasing out of the radio officers from the manning scale of ships seems to be inevitable. In some European countries switching courses for present radio officers to change to deck or engine officers or especially shore-based maintenance officers has already been introduced and even started.

To comply with the requirements of the GMDSS there is a need for expertise for shore-based maintenance. The best personnel which are available could be present radio officers. These personnel with their specialized background could be easily trained through special courses to switch to Maintenance Officers or Radio Electronic Officers.

One of the best courses has been proposed by the CEPT, the European Conference of Postal and Telecommunications Administration, for Radio Electronic Certificate.

The system of training radio officers in China seems to be very suitable for Iran.
The Chinese GMDSS training course (GOC) proposed by Ye Yue Qian, WMU graduate in 1992, is being annexed to this dissertation. (Appendix 9)
On board Iranian ships, with the present system there is a need to have electrical officers. The radio officers can be trained through a special course to switch to radio electronic officers. The electrical officers can also be trained to do both tasks, radio

and electric.

A suitable course should be constructed for this purpose. In the meantime new personnel could be trained as electronic officers for on-board ships career and electronic officers with higher level for shore-based duties and maintenance. These courses need to be developed under special studies and consideration by a board of experts.

CHAPTER EIGHT

Radiocommunication Simulators

8.1. Simulators in the maritime world

Over the past few decades , there has been a steady increase in the use of simulators for training purposes in various industries. During these years it has been proved that the simulator is a very efficient tool for training.
By dictionary definition, the simulator is a device which is designed to reproduce actual conditions.

"There are two main factors which caused the wide maritime application of simulators. The first is an over all recognition of the role of the human factor in marine casualties. By the human factor is meant the errors resulted from poor practical skills. Acquiring such skills onboard ships is rather lengthy, costly and not always a successful thing since an artificial creation of a distress is impossible in real life, and if the actual distress does occur it could be the last one for the ship and for the trainee. The second factor deals with the fitting of ships more and more advanced aids which can only be properly used after extensive preliminary training on-shore under the supervision of experienced instructors." (A. Yakushenkov, the Present and Future Use of Computers in Maritime Education and Training. A

paper presented during the third international conference on maritime education and training, 17-19 September 1984, Malmö, Sweden).

There are various types of simulators in the maritime industry, e.g., radar, shiphandling and cargo handling simulators.

8.2. Radiocommunications Simulator

In recent years another simulator, which is called the Maritime communication simulator, has been introduced to the maritime world. It is a complete training system which is totally independent and operating within its own environment. Although it is possible to do the radiocommunication practice on the real-life equipment, the safety and emergency message communication is not allowed to be practiced on real-life equipment because it may cause problems for stations and ships operating in the vicinity. Another point is that NAVTEX transmissions are not available in all countries where GMDSS courses are being conducted but these transmissions could be simulated on simulators for practical purposes.

Radicommunication simulators presently available in the market can be divided into two categories. The first type is the PC based simulator, which consists of a communication software and a personal computer. It can be a network consisting of several personal computers and an instructor station, all connected to the central computer and software. This type of simulator is normally very cheap but its efficiency is not as good as the others which work with a consul and

real instruments.
The second category is the radiocommunication simulators consisting of real-format instruments being fed by software through a central computer. The first category is normally cheaper than the second category simulators, but in terms of efficiency the second category simulators give a better understanding because it gives the impression of real-instrument, hands-on simulation to the trainee.

8.3. Maritime Communication Simulator Market

At present there are several communication simulator manufacturers in the world. The main ones are Radio Holland Group, NORCONTROL and Poseidon Simulation Systems A.S (PSS A.S).

Following is a short introduction to the latest GMDSS simulators which are available.

8.3.1. Radio Holland Group's SATCOM simulator

This is a complete training system for the INMARSAT global communication system. The system consists of a instructor station and up to thirty student positions located along on a common network.
The simulator system operates within its own environment and can be used for both telex and speech communications.
The complete system runs from the instructor's position. A colour graphic display screen is used to show how the system is operating at any time. Each student position comprises a self contained terminal which simulates either:

INMARSAT-A SES equipment (telex and telephony) or INMARSAT-C terminal (telex only).

The instructors position automatically simulates the following functions simultaneously :

1. All Coast Earth Stations (CES);
2. All, satellite positions;
3. Any terrestrial telex/telephone number or SES number;
4. Short code selection;
5. Diversion procedures under distress priority;
6. INMARSAT-C
7. Enhanced Group Call EGC);
8. System management, consist of queueing and de-queueing;
9. System log keeping , showing all network activity in real-time.

(For more details see Appendix 8)

8.3.2. Poseidon GMDSS Simulator (PGS)

This is a PC-based simulator. The front panels of the instruments are presented on the PC monitor and requires students to learn their proper procedures in order to successfully perform a transmission.

Student (ship) station in PGS includes

Hardware :

- VHF/MF/HF Telephone (headset)
- SATCOM Telephone (headset)

Software for simulation of

- VHF Radiotelephone
- VHF DSC controller/receiver
- MF/ HF Radiotelephone
- MF/HF DSC controller/receiver
- NAVTEX Receiver
- 2182 KHz Watch Receiver
- INMARSAT-A
- INMARSAT-C
- EGC Receiver (SafetyNET and FleetNET)
- Ship maneouvering control panel

The students are required to conduct the same procedures on the PGS as with the real instruments.

Instructor (coast) Station in PGS includes :

Hardware :

- Audio Multiplexer Central cables
- VHF/MF/HF/SATCOM Telephone headset

Software for simulating following instruments :

- VHF Radiotelephone
- VHF DSC controller/receiver
- MF/HF Radiotelephone
- MF/HF DSC controller/receiver
- NAVTEX Receiver
- 2182 KHz Watch Receiver
- INMARSAT-A
- INMARSAT-C
- EGC Receiver (SafetyNET and FleetNET)

Additional software for making exercises and maintenance and extension of system-data.

The instructor can make up and store exercises on the harddisk or on a disket for later use

Minimum required hardware configurations :

Instructor station :

- IB/DOS 5.0 compatible PC, 386 (16 MHz)
- 1 Mb RAM
- 20 Mb HDD
- One 3.5" floppy disk drive, 1.44 Mb or one 5.25" Floppy disk drive, 1.2 MB
- VGA color monitor
- Keyboard (English)
- Microsoft compatible mouse
- Two serial ports
- One parallel port
- One 10 MBit/sec. Ethernet-comp. netcard W/NetBios Comp. software, cableand connectors
- One IBM proprinter comp. needle printer

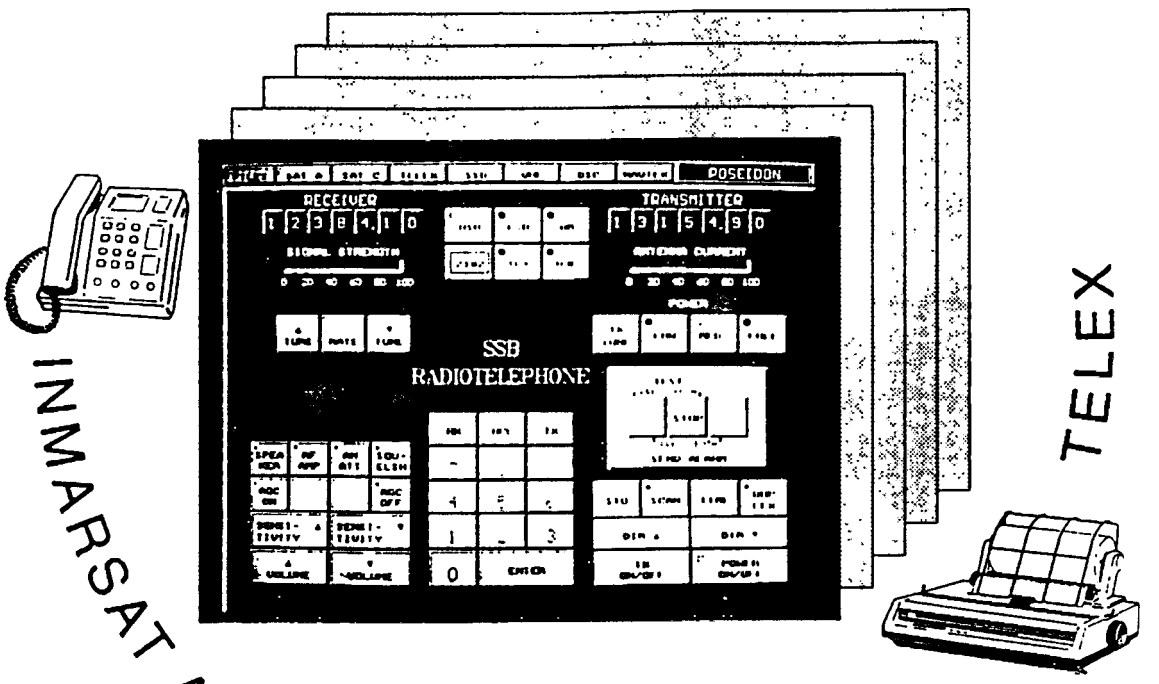
Student stations (each) :

- IBM/DOS 5.0 compatible PC, 286 (12 MHz)
- 1 Mb RAM
- 20 Mb HDD
- One 3.5" floppy disk drive, 1.44 Mb or one 5.25" floppy disk drive, 1.2 Mb
- VGA color monitor
- Keyboard (English)
- Microsoft compatible mouse
- Two serial ports

- One parallel port
- One 10 MBit/sec. Net-comp. Ethernetcard W/NetBios Comp. software, cable and connectors
- One Mb proprinter comp. needle printer

GMDSS

Poseidon GMDSS Simulator (PGS)



FIRST GMDSS SIMULATOR WITH UP TO 16 NETWORKED PCs

Inmarsat A/B with Voice, Telex and Fax
Inmarsat C with Telex and Fax
Radio: VHF, HF, MF with Voice, Telex, Fax and DSC

Global Coverage According to System Limitations

POSEIDON
POSEIDON SIMULATION SYSTEMS AS
P.O. Box 89, N-8370 Leknes, NORWAY
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From 28. Oct. 1993; Phone: +47 76 08 26 22 - Fax: +47 76 08 20 06

Figure 5 - Poseidon GMDSS Simulator (PGS)

8.3.3. NORCONTROL GMDSS Trainer :

The NORCONTROL GMDSS Trainer contains all equipment which is found on board a vessel for communication purposes. The system consists of a computer network connecting an instructor station with up to 16 student stations which include a computer and a simulated radiocommunications station. From the instructor station communication with up to 16 trainees can be monitored. The trainee stations can also communicate between one another, acting as ships or shore stations.The instructor can set up the exercises in advance, prior to the commencement of the exercise. As all positional and communication data is recorded, the instructor can de-brief an exercise on real or fast time with the students. At the instructor a console with keyboard, monitor, printers and telephone are available. The student stations are equipped similarly except with those instruments needed for creating the exercise and recording instruments.

The GMDSS trainer is software based, the operator panels and stations are either real or designed in the real format as it is found on board ships.

The minimum configuration of the GMDSS Trainer for supply consist of :

Student Radio Consoles :

Name	Numbers
DF panel	4
SART panel	4
NAVTEX Receiver	4

INMARSAT-C Terminal	4
MF/HF NBDP	4
VHF with DSC	4
HF with DSC	4
GPS Instrument	4
Clock	4
Console	4

Instructor station :

Name	Numbers
System console	1
INMARSAT-C console	1
MF/HF NBDP	1
VHF with DSC	1
HF with DSC	1
System Software	1

Chapter NINE

Conclusion and Recommendations

One of the most recent changes and requirements of the SOLAS Convention is regarding the radiocommunications. The new system of Global Maritime Distress and Safety System provides the shipping world with the best standards of safety ever known.

It is inevitable that the GMDSS should be implemented by all nations within a few years.

The timetable of introducing the GMDSS is as follows:

1. Between 1 February 1992 and 1 February 1999 existing ships can comply either with the GMDSS or with the requirements of the existing chapter IV of the SOLAS 1974.

2. All ships when operating in NAVTEX areas must carry NAVTEX receivers by 1 August 1993.

3. All ships must carry satellite EPIRBs by 1 August 1993.

4. All ships must comply fully with the GMDSS not later than 1 February 1999.

5. All new-built ships must comply with the GMDSS by 1 February 1995.

Organisation	1989	1990	1991	1992
IMO ITU			1 July 1991 new HF Band Plan Com-mences	GMDSS com-mences internation-ally 1 February 1992

1993	1994	1995	1996 -1998	1999
Mandatory carriage of satellite EPIRBs 1 August 1993 (all ships) mandatory carriage of NAVTEX (all ships operating within NAVTEX coverage area - see note below)		GMDSS mandatory for all ships constructed after 1 February 1995		GMDSS mandatory for all ships from 1 February 1999

Table - 1 (GMDSS timetable)

It is very clear and obvious that many communication facilities, which are being used on board ships at present, are common with the requirements of the GMDSS and only some changes should be made to comply with the new requirements.
In this way the renewal of the contents of the latest developments of radio technology in the training courses and reformation in the teaching methods should be noted.

With the knowledge of the above mentioned timetable, each shipping company has to instal NAVTEX and Satellite EPIRBs working on 406 MHz or L-Band EPIRB for all ships on international voyages. New constructed vessels should be equipped for GMDSS by 1 February 1995.

From now on all radio personnel on board ships or ashore and all personnel performing the maintenance of the GMDSS facilities, should be trained according to the training requirements of the GMDSS.

One of the main tasks is to define the sea area which Iran is going to be assigned for as soon as possible.
Related to the decided sea area within the GMDSS transitional period, Iran should gradually be prepared for full implementation of the new system. For achieving this goal ,the implementation of the other important conventions, specially those related to safety, e.g., SOLAS, should be of great importance.

Education and training of the personnel to be able to work with the new system is one of the main steps in complying with new GMDSS requirements.

The following list shows some of the tools for grasping the new system :

1. Defining the sea areas

2. Implementing the related Conventions

3. Supplying the on-board equipment

4. Education and training
4.1. Education and training the qualified instructors
4.2. Facilitate the training institutes, to give them ability to conduct relevant courses
4.3. Conduct proper courses
4.4. Up date and evaluate the system as it is running,frequently

Regarding the education and training the followings is being recommended :

1. Availability of qualified teaching staff seems to be the first necessity in order to conduct the GMDSS courses. For this purpose, some experienced personnel with relevant qualifications should be selected and be sent to GMDSS instructor's training courses.

2. Nautical institutes should be provided with facilities for training of such courses and financial measures should be taken for maintenance of these facilities.

The following shows some of the requirements needed :

.1 Classrooms

.2 Laboratories
.3 Teaching aids,
.3.1 Overhead projector, video, television, etc.
.3.2 Relevant wall charts,
.3.3 Simulator

As it has been mentioned in dissertation in earlier chapters, simulators are very efficient aids for training so it is being recommended here that a GMDSS simulator should be purchased in order to enable the institute to conduct a very efficient course.

3. The course which should be given the first priority, in the first step, is the GOC course which should be conducted as soon as possible.
This course can be offered to three different groups :
a) Deck Cadets
b) Deck Officers
c) Radio Officers

The background of each above mentioned group is different, so relevant course syllabus contents should be developed for each. (The proposed module course in chapter 6 of this dissertation is a complete course for the GOC, relevant for deck cadets and those who do not possess R/T, but it can easily be adjusted for others with better backgrounds, with slight changes.)

4. The courses such as First-Class Radio-Electronic or Second-Class Radio-Electronic should be developed as soon as possible because if the on-board or shore-based maintenance option is chosen as "Equipment Availability", personnel with such a qualifications are needed.

5. Electrical officers have to be kept in the manning scale of the ships. Therefore with a special course these personnel can be trained to be switched to Electronic Officers, who can do both electrical and radiocommunications duties. Such special courses could be developed for radio officers to do both communications and electrical tasks at the same time. In this way one person can do both tasks (electrical and communications), as well as on-board radio equipment maintenance as a choice of equipment availability.

ABBREVIATIONS

AOR	- Atlantic Ocean Region
AMC	- Australian Maritime College
AMEREC	- the Association of Marine Electronics and Radio Colleges
BAPT	- Bundesamt Für Post und Telekommunication (Regional Telecommunication Office)
BMPT	- Bundesministerium Für Post und Telecommunikation (Federal Post and telecommunication Ministry)
CEPT	- European Conference of Postal and Telecommunications Administration
CES	- Coast Earth Station
COSPAS	- Space System for the Search of Vessels in distress
CRS	- Coast Radio Station
DF	- Direction Finder

DOT - Department Of Trade

DSC - Digital Selective Calling

ELT - Emergency Locator Transmitter

EGC - Enhanced Group Calling

EPIRB - Emergency Position Indicating Radio Beacon

GMDSS - Global Maritime Distress and Safety System

GHz - Gega Hertz

GOC - General Operator's Certificate

GRT - Gross Registered Tonnage

GRTC - General Radio Telephony Certificate

HF - High Frequency

IHO - International Hydrographic Organization

IMO - International Maritime Organization

INMARSAT - International Maritime Satellite Organization

IOR - Indian Ocean Region

ITU - International Telecommunication Union

KHz - Kilo Hertz

LUT - Local User Terminal (in the COSPAS-

SARSAT system)

MCC - Mission Control Centre (in the COSPAS-SARSAT system)

MF - Medium Frequency

MHz - Mega Hertz

MRCC - Maritime Rescue Co-ordination Centre

MSC - Maritime Safety Committee

MSI - Maritime Safety Information

NBDP - Narrow Band Direct Printing

NOAA - National Oceanic and Atmospheric Administration

NOC - Network Operation Centre

OCC - Operations Control Centre

POR - Pacific Ocean Region

RCC - Rescue Co-ordination Centre

RRs - Radio Regulations

R/T - Radio Telephony

ROC - Restricted Operator's Certificate

SARSAT - Search And Rescue Satellite Aided Tracking

SAR - Search And Rescue

SART	- Search And Rescue Transponder
SCC	- Satellite Control Centre
SES	- Ship Earth Station
SOLAS	- Safety Of Life At Sea
STCW	- Standards of Training, Certification and Watchkeeping
VHF	- Very High Frequency
WARC	- World Administrative Radio Conference
WWNWS	- World Wide Navigational Warning System

THIS DOES NOT FOLLOW THE HARVARD SYSTEM AS PER GUIDELINES.

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ARTICLE 55

Operators' Certificates for Ship Stations and Ship Earth Stations

Section I. General Provisions

3860 § 1. (1) The service of every ship radiotelegraph station shall be performed by an operator holding a certificate issued or recognized by the government to which the station is subject.

3861 (2) The service of every ship radiotelephone station shall be controlled by an operator holding a certificate issued or recognized by the government to which the station is subject. Provided the station is so controlled, other persons besides the holder of the certificate may use the radiotelephone equipment.

3862 (3) The service of every ship earth station shall be controlled by a person holding a certificate issued or recognized by the government to which the station is subject. Provided the station is so controlled, other persons besides the holder of the certificate may use the equipment.

3863 (4) The service of automatic communication devices [1] installed in a ship station shall be controlled by an operator holding a certificate issued or recognized by the government to which the station is subject. Provided the devices are so controlled, they may be used by other persons. If such devices require for their basic function the use of Morse code signals specified in the Instructions for the Operation of the International Public Telegram Service, the service shall be performed by an operator holding a radiotelegraph operator's certificate. However, this latter requirement does not apply to automatic devices which may use Morse code signals solely for identification purposes.

3863.1 [1] The term "automatic communication devices" is intended to include such equipment as teleprinters, data transfer systems, etc.

3864 (5) Nevertheless, in the service of radiotelephone stations operating solely on frequencies above 30 MHz, each government shall decide for itself whether a certificate is necessary and, if so, shall define the conditions for obtaining it.

3865 (6) The provisions of No. **3864** shall not, however, apply to any ship station working on frequencies assigned for international use.

3866 § 2. (1) In the case of complete unavailability of the operator in the course of a sea passage and solely as a temporary measure, the master or the person responsible for the station may authorize an operator holding a certificate issued by the government of another Member to perform the radiocommunication service.

3867 (2) When it is necessary to employ a person without a certificate or an operator not holding an adequate certificate as a temporary operator, his performance as such must be limited solely to signals of distress, urgency and safety, messages relating thereto, messages relating directly to the safety of life and urgent messages relating to the movement of the ship. Persons employed in these cases are bound by the provisions of No. **3877** regarding the secrecy of correspondence.

3868 (3) In all cases, such temporary operators must be replaced as soon as possible by operators holding the certificate prescribed in paragraph 1 of this Article.

3869 § 3. (1) Each administration shall take the necessary steps to prevent, to the maximum extent possible, the fraudulent use of certificates. For this purpose, such certificates shall bear the holder's signature and shall be authenticated by the issuing administration. Administrations may employ, if they wish, other means of identification such as photographs, fingerprints, etc.

3870 (2) In the maritime mobile service the certificates issued after 1 January 1978 shall bear the photograph of the holder and the holder's date of birth.

3871 (3) To facilitate verification of certificates, these may carry, if necessary, in addition to the text in the national language, a translation of this text in a working language of the Union.

3872 (4) In the maritime mobile service all certificates not in one of the working languages of the Union and issued after 1 January 1978 shall carry at least the following information in one of these working languages:

3873 *a)* the name and date of birth of the holder;

3874 *b)* the title of the certificate and its date of issue;

3875 *c)* if applicable, the number and period of validity of the certificate;

3876 *d)* the issuing administration.

3877 § 4. Each administration shall take the necessary steps to place operators under the obligation to preserve the secrecy of correspondence as provided for in No. **2023**.

Section II. Categories of Certificates for Ship Station Operators

3878 § 5. (1) There are four categories of certificates for radiotelegraph operators [1], namely:

3879 *a)* the radiocommunication operator's general certificate;

3880 *b)* the first-class radiotelegraph operator's certificate;

3881 *c)* the second-class radiotelegraph operator's certificate;

3882 *d)* the radiotelegraph operator's special certificate.

3883 (2) There are two categories of radiotelephone operators' [1] certificates, general and restricted.

3884 § 6. (1) The holder of a radiocommunication operator's general certificate, or of a first-class or second-class radiotelegraph operator's certificate, may carry out the radiotelegraph or radiotelephone service of any ship station.

3878.1 } 3883.1 } [1] As regards the employment of operators holding the different certificates, see Article **56**.

3885 (2) The holder of a radiotelephone operator's general certificate may carry out the radiotelephone service of any ship station.

3886 (3) The holder of a radiotelephone operator's restricted certificate may carry out the radiotelephone service of any ship station, provided that the operation of the transmitter requires only the use of simple external controls, and excludes all manual adjustment of frequency determining elements, with the stability of the frequencies maintained by the transmitter itself within the limits of tolerance specified by Appendix 7, and the peak envelope power of the transmitter does not exceed 1.5 kW.

3887 (4) The radiotelephone operator's restricted certificate may be limited exclusively to one or more of the maritime mobile frequency bands. In such cases the certificate shall be suitably endorsed.

3888 Mob-83 (5) The radiotelegraph service of ships for which a radiotelegraph installation is not made compulsory by international agreements, as well as the radiotelephone service of ship stations for which only a radiotelephone operator's restricted certificate is required, may be carried out by the holder of a radiotelegraph operator's special certificate [1].

3889 Mob-83 (6) However, where the conditions specified in No. 3934 are satisfied, the radiotelegraph service of ships for which a radiotelegraph installation is not made compulsory by international agreements, as well as the radiotelephone service of any ship station, may be carried out by the holder of a radiotelegraph operator's special certificate [1].

3890 § 7. Exceptionally, the second-class radiotelegraph operator's certificate as well as the radiotelegraph operator's special certificate may be limited exclusively to the radiotelegraph service. In such cases the certificate shall be suitably endorsed.

3888.1 } 3889.1 } Mob-83 [1] The radiotelegraph service of ships equipped with a radiotelegraph installation in accordance with Regulation 131 (2) (a) of the Torremolinos International Convention for the Safety of Fishing Vessels, 1977, may be carried out by the holder of a radiotelegraph operator's special certificate.

Section III. Conditions for the Issue of Operators' Certificates

3891 *A. General*

3892 § 8. (1) The conditions to be imposed for obtaining the various certificates are contained in the following paragraphs and represent the minimum requirements.

3893 (2) Each administration is free to fix the number of examinations necessary to obtain each certificate.

3894 § 9. (1) The administration which issues a certificate may, before authorizing an operator to carry out the service on board a ship, require the fulfilment of other conditions (for example: experience with automatic communication devices; further technical and professional knowledge relating particularly to navigation; physical fitness; etc.).

3895 (2) Administrations should take whatever steps they consider necessary to ensure the continued proficiency of operators after prolonged absences from operational duties.

3896 (3) However, with respect to the maritime mobile service, administrations should also take whatever steps they consider necessary to ensure the continued proficiency of operators while in service.

3897 *B. Radiocommunication Operator's General Certificate for the Maritime Mobile Service*

3898 § 10. The radiocommunication operator's general certificate for the maritime mobile service is issued to candidates who have given proof of the technical and professional knowledge and qualifications enumerated below:

3899 *a)* knowledge of the principles of electricity and the theory of radio and of electronics sufficient to meet the requirements specified in Nos. **3900**, **3901** and **3902**;

3900 *b)* theoretical knowledge of modern radiocommunication equipment, including marine radiotelegraph and radiotelephone transmitters and receivers, marine antenna systems, automatic alarm devices, radio equipment for lifeboats and other survival craft, direction-finding equipment, together with all auxiliary items including power supply (such as motors, alternators, generators, inverters, rectifiers and accumulators), as well as a general knowledge of the principles of other apparatus generally used for radionavigation, with particular reference to maintaining the equipment in service;

3901 *c)* practical knowledge of the operation, adjustment and maintenance of the apparatus mentioned in No. **3900**, including the taking of direction-finding bearings and knowledge of the principles of the calibration of radio direction-finding apparatus;

3902 *d)* practical knowledge necessary for the location and remedying (using appropriate testing equipment and tools) of faults in the apparatus mentioned in No. **3900** which may occur during a voyage;

3903 *e)* ability to send correctly by hand and to receive correctly by ear, in the Morse code, code groups (mixed letters, figures and punctuation marks) at a speed of sixteen groups a minute, and a plain language text at a speed of twenty words a minute. Each code group shall comprise five characters, each figure or punctuation mark counting as two characters. The average word of the text in plain language shall contain five characters. The duration of each test of sending and receiving shall be, as a rule, five minutes;

3904 *f)* ability to send correctly and to receive correctly by radiotelephone;

3905 *g)* knowledge of the Regulations applying to radiocommunications, knowledge of the documents relating to charges for radiocommunications and knowledge of the provisions of the Convention for the Safety of Life at Sea which relate to radio;

3906 *h)* a sufficient knowledge of world geography, especially the principal shipping routes and the most important telecommunication routes;

3907 *i)* knowledge of one of the working languages of the Union. Candidates should be able to express themselves satisfactorily in that language, both orally and in writing. Each administration shall decide for itself the language or languages required.

3908 *C. First-Class Radiotelegraph Operator's Certificate*

3909 § 11. The first-class certificate is issued to candidates who have given proof of the technical and professional knowledge and qualifications enumerated below:

3910 *a)* knowledge both of the general principles of electricity and of the theory of radio, knowledge of the adjustment and practical working of various types of radiotelegraph and radiotelephone apparatus used in the mobile service, including apparatus used for radio direction-finding and the taking of direction-finding bearings, as well as a general knowledge of the principles of operation of other apparatus generally used for radionavigation;

3911 *b)* theoretical and practical knowledge of the operation and maintenance of apparatus, such as motor-generators, storage batteries, etc., used in the operation and adjustment of the radiotelegraph, radiotelephone and radio direction-finding apparatus mentioned in No. **3910**;

3912 *c)* practical knowledge necessary to repair, with the means available on board, damage which may occur to the radiotelegraph, radiotelephone and radio direction-finding apparatus during a voyage;

3913 *d)* ability to send correctly by hand and to receive correctly by ear, in the Morse code, code groups (mixed letters, figures and punctuation marks), at a speed of twenty groups a minute, and a plain language text at a speed of twenty-five words a minute. Each code group shall comprise five characters, each figure or punctuation mark counting as two characters. The average word of the text in plain language shall contain five characters. The duration of each test of sending and of receiving shall be, as a rule, five minutes;

3914 *e)* ability to send correctly and to receive correctly by radiotelephone;

3915 *f)* detailed knowledge of the Regulations applying to radiocommunications, knowledge of the documents relating to charges for radiocommunications and knowledge of the provisions of the Convention for the Safety of Life at Sea which relate to radio;

3916 *g)* a sufficient knowledge of world geography, especially the principal shipping and air routes and the most important telecommunication routes;

3917 *h)* sufficient knowledge of one of the working languages of the Union. Candidates should be able to express themselves satisfactorily in that language, both orally and in writing. Each administration shall decide for itself the language or languages required.

3918 *D. Second-Class Radiotelegraph Operator's Certificate*

3919 § 12. The second-class certificate is issued to candidates who have given proof of the technical and professional knowledge and qualifications enumerated below:

3920 *a)* elementary theoretical and practical knowledge of electricity and of radio, knowledge of the adjustment and practical working of the various types of radiotelegraph and radiotelephone apparatus used in the mobile service, including apparatus used for radio direction-finding and the taking of direction-finding bearings, as well as elementary knowledge of the principles of operation of other apparatus in general use for radionavigation;

3921 *b)* elementary theoretical and practical knowledge of the operation and maintenance of apparatus, such as motor-generators, storage batteries, etc., used in the operation and adjustment of the radiotelegraph, radiotelephone and radio direction-finding apparatus mentioned in No. **3920**;

3922 *c)* practical knowledge sufficient for effecting repairs in the case of minor damage which may occur to the radiotelegraph, radiotelephone and radio direction-finding apparatus during a voyage;

3923 *d)* ability to send correctly by hand and to receive correctly by ear, in the Morse code, code groups (mixed letters, figures and punctuation marks) at a speed of sixteen groups a minute, and a plain language text at a speed of twenty words a minute. Each code group shall comprise five characters, each figure or punctuation mark counting as two characters. The average word of the text in plain language shall contain five characters. The duration of each test of sending and of receiving shall, as a rule, be five minutes;

3924 *e)* ability to send correctly and to receive correctly by radiotelephone, except in the case provided for in No. **3890**;

3925 *f)* knowledge of the Regulations applying to radiocommunications, knowledge of the documents relating to charges for radiocommunications and knowledge of the provisions of the Convention for the Safety of Life at Sea which relate to radio;

3926 *g)* a sufficient knowledge of world geography, especially the principal shipping and air routes and the most important telecommunication routes;

3927 *h)* if necessary, an elementary knowledge of one of the working languages of the Union. Candidates should be able to express themselves satisfactorily in that language, both orally and in writing. Each administration shall decide for itself the language or languages required.

3928 *E. Radiotelegraph Operator's Special Certificate*

3929 § 13. (1) The radiotelegraph operator's special certificate is issued to candidates who have given proof of the knowledge and professional qualifications enumerated below:

3930 *a)* ability to send correctly by hand and receive correctly by ear, in the Morse code, code groups (mixed letters, figures, and punctuation marks) at a speed of sixteen groups a minute, and a plain language text at a speed of twenty words a minute. Each code group shall comprise five characters, each figure or punctuation mark counting as two characters. The average word of the text in plain language shall contain five characters;

3931 *b)* knowledge of the practical operation and adjustment of radiotelegraph apparatus;

3932 *c)* knowledge of the Regulations applying to radiotelegraph communications and specifically of that part of those Regulations relating to safety of life at sea.

3933 (2) Each administration concerned shall fix the other conditions for obtaining this certificate. However, the conditions specified in Nos. **3941**, **3942**, **3943** and **3944** or **3945**, as the case may be, shall be satisfied.

3934 (3) In the maritime mobile service each administration concerned shall fix the other conditions for obtaining this certificate. However, except as provided for in No. **3890**, the conditions specified in Nos. **3936**, **3937**, **3938**, **3939** and **3940** shall be satisfied for such a certificate issued to ship station operators after 1 January 1976.

3935 *F. Radiotelephone Operators' Certificates*

3936 § 14. The radiotelephone operator's general certificate is issued to candidates who have given proof of the knowledge and professional qualifications enumerated below (see also Nos. **3884**, **3885**, **3888** and **3889**):

3937 *a)* a knowledge of the elementary principles of radiotelephony;

3938 *b)* detailed knowledge of the practical operation and adjustment of radiotelephone apparatus;

3939 *c)* ability to send correctly and to receive correctly by radiotelephone;

3940 *d)* detailed knowledge of the Regulations applying to radiotelephone communications and specifically of that part of those Regulations relating to the safety of life.

3941 § 15. (1) The restricted radiotelephone operator's certificate is issued to candidates who have given proof of the knowledge and professional qualifications enumerated below:

3942 *a)* practical knowledge of radiotelephone operation and procedure;

3943 *b)* ability to send correctly and to receive correctly by telephone;

3944 *c)* general knowledge of the Regulations applying to radiotelephone communications and specifically of that part of those Regulations relating to the safety of life.

3945 (2) For ship radiotelephone stations where the peak envelope power of the transmitter does not exceed 400 watts, each administration may itself fix these conditions for obtaining a restricted radiotelephone operator's certificate, provided that the operation of the transmitter requires only the use of simple external switching devices, excluding all manual adjustment of frequency determining elements, and that the stability of the frequencies is maintained by the transmitter itself within the limits of tolerance specified in Appendix 7. However, in fixing the conditions, administrations shall ensure that the operator has an adequate knowledge of radiotelephone operation and procedure particularly as far as distress, urgency and safety are concerned. This in no way contravenes the provisions of No. **3949**.

3946 (3) Administrations in Region 1 do not issue certificates under No. **3945**.

3947 § 16. A radiotelephone operator's certificate shall show whether it is a general certificate or a restricted certificate and, in the latter case, if it has been issued in conformity with the provisions of No. **3945**.

3948 § 17. In the maritime mobile service a radiotelephone operator's restricted certificate shall show whether it is also limited as provided for in No. **3887**.

3949 § 18. In order to meet special needs, special agreements between administrations may fix the conditions to be fulfilled in order to obtain a radiotelephone operator's certificate, intended to be used in radiotelephone stations complying with certain technical conditions and certain operating conditions. These agreements, if made, shall be on the condition that harmful interference to international services shall not result therefrom. These conditions and agreements shall be mentioned in the certificates issued to such operators.

Section IV. Qualifying Service

3950 § 19. (1) The holder of a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate is authorized to embark as chief operator of a ship station of the fourth category (see No. **4056**).

3951 (2) However, before becoming chief or sole operator of a ship station of the fourth category (see No. **4056**) which is required by international agreements to carry a radiotelegraph operator, the holder of a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate shall have had adequate experience as operator on board ship at sea.

3952 (3) Before becoming chief operator of a ship station of the second or third category (see Nos. **4054** and **4055**), the holder of a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate shall have had, as operator on board ship or in a coast station, at least six months' experience of which at least three months shall have been on board ship.

3953 (4) Before becoming chief operator of a ship station of the first category (see No. **4053**), the holder of a radiocommunication operator's general certificate or a first-class radiotelegraph operator's certificate shall have had, as operator on board ship or in a coast station, at least one year's experience of which at least six months shall have been on board ship.

3954
to
3978 NOT allocated.

ARTICLE 56

Personnel of Stations in the Maritime Mobile Service

Section I. Personnel of Coast Stations

3979 § 1. Administrations shall ensure that the staff on duty in coast stations shall be adequately qualified to operate the stations efficiently.

Section II. Class and Minimum Number of Operators for Stations on board Ships

3980 § 2. In the public correspondence service, each government shall take the necessary steps to ensure that stations on board ships of its own nationality have personnel adequate to perform efficient service.

3981 § 3. The personnel of ship stations in the public correspondence service shall, having regard to the provisions of Article **55**, include at least:

3982 *a)* ship stations of the first category, except in the case provided for in No. **3986**: a chief operator holding a radiocommunication operator's general certificate or a first-class radiotelegraph operator's certificate;

3983 *b)* ship stations of the second and third categories, except in the case provided for in No. **3986**: a chief operator holding a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate;

3984 *c)* ship stations of the fourth category, except in the cases provided for in Nos. **3985** and **3986**: one operator holding a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate;

3985 *d)* ship stations in which a radiotelegraph installation is provided but not prescribed by international agreements:

one operator holding a radiocommunication operator's general certificate or a first- or second-class radiotelegraph operator's certificate, or a radiotelegraph operator's special certificate;

3986 *e)* ship stations equipped with a radiotelephone installation only: one operator holding either a radiotelephone operator's certificate or a radiotelegraph operator's certificate.

3987
to NOT allocated.
4011

APPENDIX TWO

APPENDIX TO REGULATION IV/1

Minimum additional knowledge and training requirements for radio officers

In addition to satisfying the requirements for the issue of a certificate in compliance with the Radio Regulations, radio officers shall have knowledge and training, including practical training, in the following:

(a) the provision of radio services in emergencies, including:

(i) abandon ship;

(ii) fire aboard ship;

(iii) partial or full breakdown of the radio station;

(b) the operation of lifeboats, liferafts, buoyant apparatus and their equipment, with special reference to portable and fixed lifeboat radio apparatus and emergency position-indicating radio beacons;

(c) survival at sea;

(d) first aid;

(e) fire prevention and fire-fighting with particular reference to the radio installation;

(f) preventive measures for the safety of ship and personnel in connexion with hazards related to radio equipment, including electrical, radiation, chemical and mechanical hazards;

(g) the use of the IMCO Merchant Ship Search and Rescue Manual (MERSAR) with particular reference to radiocommunications;

(h) ship position-reporting systems and procedures;

(i) the use of the International Code of Signals and the IMCO Standard Marine Navigational Vocabulary;

(j) radio medical systems and procedures.

APPENDIX THREE

APPENDIX TO REGULATION IV/3

Minimum additional knowledge and training requirements for radiotelephone operators

In addition to satisfying the requirements for the issue of a certificate in compliance with the Radio Regulations, radiotelephone operators shall have knowledge and training, including practical training, in the following:

(a) the provision of radio services in emergencies, including:

  (i) abandon ship;

  (ii) fire aboard ship;

  (iii) partial or full breakdown of the radio station;

(b) the operation of lifeboats, liferafts, buoyant apparatus and their equipment, with special reference to portable and fixed lifeboat radio apparatus and emergency position-indicating radio beacons;

(c) survival at sea;

(d) first aid;

(e) fire prevention and fire-fighting with particular reference to the radio installation;

(f) preventive measures for the safety of ship and personnel in connexion with hazards related to radio equipment, including electrical, radiation, chemical and mechanical hazards;

(g) the use of the IMCO Merchant Ship Search and Rescue Manual (MERSAR) with particular reference to radiocommunications;

(h) ship position-reporting systems and procedures;

(i) the use of the International Code of Signals and the IMCO Standard Marine Navigational Vocabulary;

(j) radio medical systems and procedures.

This is to certify that, under the provisions of Section 7(1) of the Wireless Telegraphy Act, 1949, and the Radio Regulations annexed to the International Telecommunication Convention

SPECIMEN

was qualified for the award of a GMDSS General Operator's Certificate

It is also certified hereby that the holder has made a declaration that he will preserve the secrecy of correspondence

Signature of examining officer

Date

This Certificate should be carefully preserved. In case of loss through avoidable causes, a duplicate will be issued only on payment of such charge as may be determined by the Secretary of State for Trade and Industry

Any person other than the owner thereof becoming possessed of this Certificate should send it to the Department of Trade and Industry, Radiocommunications Agency, London, SE1 8UA

Description of holder

specimen

Date of birth

Place of birth

Height

Distinguishing marks

Signature of holder

AUTHORITY TO OPERATE GRANTED BY THE SECRETARY OF STATE FOR TRADE AND INDUSTRY

No 02632

The holder of this GMDSS General Certificate is hereby authorised to operate a ship radio station and a ship earth station established in a ship under a licence issued by the Secretary of State for Trade and Industry

Subject to the provisions of Section 7(3) of the Wireless Telegraphy Act, 1949, regarding the suspension of any authority with a view to the revocation thereof, this Authority shall remain valid until further notice

(Signature)

For the Secretary of State for Trade and Industry
London SE1 8UA

(Date)

APPENDIX FOUR

BREMEN POLYTECHNIC, DEPARTMENT OF NAUTICAL STUDIES

SYLLABUS / Course Contents

(*in brackets:* recommended minimum lecture/exercise hours according to German MET legislation)

1. General Ship Radiotelephone Operator's Certificate

I. Minimum equipment requirements for seagoing vessels (6)

Objectives:
- to know national and international legal regulations with respect to telecommunication equipment;
- to know the different kinds of telecommunication equipment;
- to know about installation and operation to be approved by national government.

Contents:
- SOLAS, international and national law, radio and radiotelephony safety certificates;
- radiotelegraphy, radiotelephony, distress radio, EPIRB, radio equipment for survival craft, automatic alarms;
- application and procedures for approval of installation and operation.

II. Operational regulations (8)

Objectives:
- to know the international and national legal regulations with respect to operational procedures in telecommunication;
- to know the equipment requirements according to regulations;
- to know about correct participation in telecommunication;
- to know purpose and limits of use of radio installations;
- to know the contents of the approval certificate;

Contents:
- international and national radio regulations;
- frequencies and services of national and foreign coast radio stations;
- one-way radio communication, AMVER, collective calls, TR-message;
- right of usage, secrecy of correspondence;
- misuse of distress, urgency and safety codes, public and non-public radio stations and services;
- distress and call frequencies, working frequencies, weather reports and warnings, radio medical service.

..... 2

III. Practical telecommunication procedures (14)

Objectives:
- to be able to independently perform practical radio communication;
- to be able to call national and foreign coast and ship radio stations, and to execute communication;
- to be able to receive, forward and calculate fees of radio telegrammes and telephone calls;
- to be competent in sending and receiving of distress, urgency and safety messages;
- to be able to decide on confirming, forwarding and repeating distress, urgency and safety messages, and to decide on priorities of such messages.

Contents:
- morse code spelling for letters and numerals, common abbreviations, nautical warning code, SIMPLEX/ DUPLEX, change of frequencies, radio log book;
- call signs, individual and collective calls, selective calls, on-board communication;
- regulations for radio telegrammes, special handling of telegrammes in transmission and delivery, correct word counting in telegrammes, radio telephony calls, announcing calls etc., types of calls (foreign), calculating fees (national currency, gold francs), use and maintenance/updating of manuals etc.;
- VHF alarm signal, SOS, MAYDAY, PAN PAN, SECURITE, MAYDAY RELAY, SILENCE MAYDAY, SILENCE DETRESSE; SILENCE FINI.

IV. Radio technique - devices (8)

Objectives:
- to know about generation, transmission, propagation and reception of electromagnetic waves;
- to know parts of transmitter and receiver and how to operate them;
- to know modulation modes used (AM, FM, DSB, SSB);
- to know about the power supply;
- to be able to recognize the operability of the equipment and to recognize failures;
- to be able to re-establish operability and execute repairs as far as possible;
- to be able to maintain power supply and antenna to the extent of securing permanent operability at sea.

Contents:
- Volt - Ampere - Ohm - Watt, Hz - kHz, MHz, microphone, ear phones, transformer, rectifier, LF/HF, carrier, oscillator, tuning circuit; quartz, generator, accumulator, fuses, acid density.
- antennas, ground connection, short circuit, accident avoidance.

(Total hours: 36)

SYLLABUS / Course Contents

(*in brackets:* recommended minimum lecture/exercise hours according to **German MET legislation**)

2. Upgrading Course for GMDSS Operator Qualification

(for **Holders** of the **General Radiotelephony Certificate**)

I. Procedures and execution of distress and safety radio communication in GMDSS. (8)

Objectives:
- to know equipment requirements in GMDSS;
- to know the alternative systems of distress alerting;
- to know the operational procedures of distress radio communication;
- to know procedures of announcing and transmitting distress and safety messages as well as messages concerning safety of shipping.

Contents:
- sea areas A1 to A4, DSC- and SATCOM equipment (Standard A / Standard C), distress radio beacons, radar transponders, EGC, Navtex;
- available frequencies, protection of and permanent receptibility on frequencies devoted to distress communication in GMDSS, transmission modes priority 3;
- distress alarm, sending, long distance transmission and confirmation of a distress alarm, reception and confirmation by coast radio stations, CES or RCC, preparation for commencing, performing, co-ordinating and finishing of distress radio communication, communication on scene, codes for radiolocation and homing;
- Navtex receivers, global warning system, Navareas, priority 2 and 1, limiting surplus information.

II. Practical exercises with data input devices (6)

Objectives:
- to gain competency in the use of teletype, satellite terminal and DSC decoder;

Contents:
- special codes, different keyboards, error-free creating, altering and mixing of texts and saving to disk, inputs for DSC calls.

..... 2

- VHF alarm signal, SOS, MAYDAY, PAN PAN, SECURITE, MAYDAY RELAY, SILENCE MAYDAY, SILENCE DETRESSE; SILENCE FINI;
- distress, urgency and safety calls in SATCOM and DSC services.

IV. Radio technique - devices (24)

Objectives:
- to be able to competenly operate all ship radio installations including GMDSS;
- to know about generation, transmission, propagation and reception of electromagnetic waves;
- to know parts of transmitter and receiver and how to operate them;
- to know modulation modes used (AM, FM, DSB, SSB, puls modulation);
- to know about the power supply;
- to be able to recognize the operability of the equipment and to recognize failures;
- to be able to re-establish operability and execute repairs as far as possible;
- to be able to maintain power supply and antenna to the extent of securing permanent operability at sea.

Contents:
- SATCOM (Std A, Std C), medium/short wave appliances with/without DSC, scan receiver, VHF with/without DSC, Sitor TELEX, Navtex and EGC receivers, alarm generator, mobile distress set, EPIRB;
- Volt - Ampere - Ohm - Watt, Hz - kHz, MHz, microphone, ear phones, transformer, rectifier, LF/HF, carrier, oscillator, tuning circuit, quartz, generator, accumulator, fuses, acid density.
- antennas, ground connection, short circuit, avoiding accidents.

(Total hours: 72)

II. Operational regulations (12)

Objectives:
- to know the international and national legal regulations with respect to operational procedures in telecommunication;
- to know the equipment requirements according to regulations;
- to know about correct participation in telecommunication;
- to know purpose and limits of use of radio installations;
- to know the contents of the approval certificate;

Contents:
- international and national radio regulations;
- frequencies and services of national and foreign coast and coast-earth radio stations
- one-way radio communication, AMVER, collective calls, TR-message, group and selective calls in DSC and satellite systems;
- right of usage, secrecy of correspondence;
- misuse of distress, urgency and safety codes, public and non-public radio stations and services;
- distress and call frequencies, working frequencies, weather reports and warnings, radio medical service.

III. Practical telecommunication procedures (24)

Objectives:
- to be able to independently perform practical radio communication;
- to be able to call national and foreign coast and ship radio stations, and to execute communication;
- to be able to receive, forward and calculate fees of radio telegrammes and telephone calls;
- to be competent in sending and receiving distress, urgency and safety messages in the English language, and in translating them into the national language;
- to be able to decide on confirming, forwarding and repeating distress, urgency and safety messages, and to decide on priorities of such messages.

Contents:
- morse code spelling for letters and numerals, common abbreviations in radiotelephony and TELEX services, nautical warning code, SIMPLEX/DUPLEX, change of frequencies, radio log book;
- call signs, MMSI, Sitor and SES numbers, individual and collective calls, multitone call DSC, selective calls, on-board communication;
- establishing TELEX communication and cost calculation;
- regulations for radio telegrammes, special handling of telegrammes in transmission and delivery, correct word counting in telegrammes, radio telephony calls, announcing calls etc., types of calls (foreign), calculating fees (national currency, gold francs), use and maintenance of manuals etc.;

SYLLABUS / Course Contents

(*in brackets:* recommended minimum lecture/exercise hours according to **German MET legislation**)

3. General Operating Certificate

(including Radiotelephony and GMDSS qualifications)

> ***Remark:*** *Most items are identical with respective items in the syllabus for the Radiotelephony Certificate **extended** by GMDSS relevant items.*

General objectives:

- to gain knowledge about organisation and procedures of international maritime radio telephony, TELEX and data services;
- to know and to be able to decide on the appropriate devices and systems depending upon the situation in distress or other urgent cases;
- to know how to establish and perform radio communication SHIP-SHORE and SHIP-SHIP in daily routine;
- to be able to competently operate and maintain radio installations (incl. power supply), and to secure permanent operability.

I. Minimum equipment requirements for seagoing vessels (12)

Objectives:
- to know national and international legal regulations with respect to telecommunication equipment;
- to know the different kinds of telecommunication equipment;
- to know about installation and operation to be approved by national government.

Contents:
- SOLAS including new Chapter 4, INMARSAT regulations, international and national law, radio safety certificate;
- radiotelegraphy, radiotelephony, radiolocation, distress radio installations, EPIRB, radio equipment for survival craft, automatic alarms, DSC, satellite communication, SART, mobile VHF sets, watch receiver, EGC receiver, Navtex;
- application and procedures for approval of installation and operation, INMARSAT license.

..... 2

III. Operational procedures for SATCOM, DSC segment and teletype (8)

Objectives:
- to gain sufficient experience in operating SATCOM installations;
- to send and confirm DSC calls;
- to correctly establish a TELEX connection.

Contents:
- starting the devices, selecting the CES and operation mode (TELEX, Telephony, FAX), Priority 0, country code, abbreviations in TELEX services.
- selecting the correct frequencies (DSC), call procedures, repeating calls;
- selecting the correct frequencies (TELEX), performing TELEX communication.

IV. Legal regulations (2)

Objectives:
- to know relevant national and international regulations concerning GMDSS.

Contents:
- telecommunication and safety regulations, regulations by INMARSAT.

V. Radio technique (GMDSS only) (8)

Objectives:
- to be able to recognize the operability of GMDSS installations,
- to be able to execute test routines, to detect malfunctions, to re-establish operability as far as possible.

Contents:
- manufacturer's manuals, block scheme, visual check, aerial, gyro, ground connection, status alarm, status notices, printer test, paper feed.
- electrical safety, measuring at test points, power supply failure, radio consulting by service firms, exchange of parts.

(Total hours: 32)

Hochschule Bremen
Fachbereich Nautik

Bremen Polytechnic
Department of Nautical Studies

Teilnahmebescheinigung
Certificate

Hiermit wird bescheinigt, daß
This is to certify that _____

geboren am
born _____ in
in _____

Inhaber des Allgemeinen Sprechfunkzeugnisses
für den Seefunkdienst
Holder of General Ship Radiotelephone Operator's Certificate Nr.
No. _____

vom
from _____ bis
to _____ teilgenommen hat an einem
has attended an

Fortbildungs-Seminar GMDSS
zum Erwerb des Allgemeinen Betriebszeugnisses für Funker

Upgrading Course GMDSS
for GMDSS Operator Certificate

und die abschließende Prüfung bestanden hat.
and has passed the final examination.

Bremen, _____

Siegel
Seal

_____
Sprecher des Fachbereichs
Head of Department

APPENDIX SIX

Australian Maritime College

School of Engineering

Global Maritime Distress & Safety System

GENERAL OPERATOR'S CERTIFICATE

COURSE AND ASSESSMENT INFORMATION

School of Engineering
Australian Maritime College
PO Box 986
Launceston
Tasmania 7250

August 1990

GMDSS GENERAL OPERATOR'S CERTIFICATE

SECTION A COURSE DETAILS

1. Introduction

This course is designed to meet the needs of those people who will operate equipment within the Global Maritime Distress and Safety System (GMDSS). The course includes the national and international operational procedures and practices.

2. Course Aims

2.1 To familiarise the student with:

a) the function and purpose of all the communications subsystems within the GMDSS.

b) standard procedures for:

(i) the setting up of radio telephone calls,

(ii) the exchange of messages by radiotelephone,

(iii) narrow-band direct-printing (NBDP) telegraphy, in the MF, HF, and the SHF bands using the international public correspondence service.

2.2 To ensure that the student:

a) is aware of the purpose of all frequencies allocated to the GMDSS,

b) is aware of the correct procedures to be followed in all situations relevant to the GMDSS,

c) understands the legal importance and the correct procedures involved in maintaining an accurate communication log,

d) recognises and understands the commonly used codes appropriate to the international public correspondence service,

e) is proficient in operating type-approved communications equipment by selecting frequencies and modes of transmission and reception appropriate to the GMDSS and the public correspondence service.

3. Teaching Methods

a) Lectures explaining the GMDSS and public correspondence regulations and procedures,

b) practice in the exchange of messages and log keeping using simulation or type approved equipment,

c) practice in the correct operation of type-approved equipment.

4. Teaching Hours

The hours allocated for the teaching of each practical topic assumes a group of 15 students for the practical learning experience sessions.

5. Assessment

A one hour multiple-choice type written examination, together with practical and oral examinations, as specified by the GMDSS General Operator's Certificate Examination Syllabus detailed in Section C.

SECTION B

COURSE SYLLABUS

5. General and Specific Objectives.

In terms of:

a) knowledge to be acquired by the student,

b) resulting abilities to be developed by the student.

5.1 Detailed practical knowledge of the operation of all GMDSS sub-systems and equipment.

a) Demonstrates ability to correctly adjust the controls of an MF transmitter or an MF/HF transmitter to select a medium frequency for:

i) radiotelephone operation on that frequency,

ii) narrow-band direct-printing (NBDP) telegraphy operation on that frequency including the selection of a selcall number and correct adjustment of error correction equipment.

iii) 2182 kHz Alarm Signal Generator operation.

b) Demonstrates ability to correctly adjust the controls of an HF transmitter or an MF/HF transmitter to select a high frequency for:

i) radiotelephone operation on that frequency,

ii) narrow-band direct-printing (NBDP) telegraphy operation on that frequency including the selection of a selcall number and correct adjustment of error correction equipment.

c) Demonstrates ability to correctly adjust the controls of a 2182 kHz Watchkeeping Receiver and, either a general purpose communications receiver or stand alone MF and HF communications receivers which are an integral part of a transceiver which also contains the transmitter in a) and/or b) above, to receive:

i) MF and HF radiotelephone signals,

ii) MF and HF NBDP telegraphy signals.

d) Demonstrates a practical knowledge of antennae.

e) i) Demonstrates ability to correctly adjust the controls of both fixed and portable VHF & UHF transceivers for radiotelephone operation on selected channels.

ii) Demonstrates awareness of Intrinsically Safe Certification requirements.

f) i) Demonstrates ability to input a 2 line distress message into a Digital Selective Calling (DSC) encoder and explains how the message would be transmitted.

ii) Demonstrates ability to correctly operate a DSC decoder and 2187.5 kHz DSC receiver for radiotelephony distress alerting.

g) Describes the functions of INMARSAT-A and INMARSAT-C Ship Earth Station terminals in terms of :

i) services available, including Enhanced Group Calling (EGC),
ii) satellite service areas,
iii) number of channels available for voice and NBDP telegraphy,
iv) Coast Earth Stations
v) Network Control Stations,
vi) selection of ocean area, satellite, CES, priority, message, and compandors,
vii) inputting ship's parameters,
viii) calling channels,
ix) common TDM and Local TDM,
x) distress mode,
xi) Antenna safety precautions and blind spots.

h) Demonstrates practical knowledge of batteries and emergency power supplies.

i) Describes the purpose and the function of the COSPAS/SARSAT system in terms of:

i) type of satellite and orbit used,
ii) the 406/121.5 MHz float free EPIRB,
iii) message type and system response.

j) Describes the purpose and the function of type approved 9 GHz radar transponders (SART).

k) Demonstrates a practical knowledge of portable VHF radio equipment for survival craft.

l) Describes the purpose and function of the NAVTEX system in terms of:

i) service provided,
ii) transmitting stations,
iii) message types transmitted,
iv) mode of transmission,
v) frequency used,
vi) service area.

Correctly adjusts the controls of a NAVTEX receiver to enable reception of selected message types from selected transmitting stations or a simulator.

5.2 Ability to send and receive messages correctly by radiotelephony and NBDP telegraphy and to set up radio telephone calls using correct procedures on either type-approved or simulation equipment.

a) Demonstrates ability to exchange messages by radiotelephony with a coast radio station, using the phonetic alphabet and the Standard Marine Navigational Vocabulary to:

i) make a call on an appropriate frequency and copy the reply,
ii) transmit a ship position report,
iii) set up a radio telephone call to a shore subscriber,
iv) transmit a radio telegram,
v) conclude traffic exchange,
vi) maintain an accurate communications log,
vii) apply correct charges.

b) Demonstrates ability to efficiently exchange messages by NBDP telegraphy. Uses a non-radiating closed loop circuit which includes ARQ mode error correcting equipment and digital teleprinters or simulators having a QWERTY keyboard to:

i) prepare a message off line and store in memory,
ii) select a message for automatic transmission,
iii) make a simulated call,
iv) exchange answerbacks and use standard abbreviations and commonly used codes to establish communication,
v) transmit a selected message,
vi) obtain duration of call and conclude communication,
vii) maintain an accurate communications log.
viii) apply correct charges for the call.

c) States the purpose of floppy disk drives, paper tape readers and punches.

d) Recognises standard abbreviations and commonly used service codes.

.3 Detailed knowledge of the regulations applying to radiocommunications, knowledge of the documents relating to charges for radiocommunications and knowledge of those provisions of the International Convention for the Safety of Life at Sea which relate to radio.

a) States:

i) general provisions for the Global Maritime Distress and Safety System,

ii) distress, urgency, safety and public correspondence frequencies/channels allocated in the MF and VHF bands, their purpose and permissible class(es) of emission,

iii) the band plan, modes of operation and use of frequencies allocated for distress, urgency, safety and public correspondence in the HF bands,

iv) how distress, urgency and safety frequencies are protected against harmful interference.

b) Explains the means of avoiding harmful interference.

c) Explains the operational procedures for distress, urgency and safety communications in the GMDSS.

d) Describes the general procedures to be followed when setting up, conducting and terminating communication, using:

i) NBDP telegraphy,
ii) Radiotelephony.

e) Uses tariffs to calculate charges for commercial correspondence services using terrestrial and satellite services.

GMDSS GENERAL OPERATOR'S CERTIFICATE

SECTION C EXAMINATION SYLLABUS

6. Introduction

The General Operator's Certificate of Competence for use in the GMDSS will be awarded to applicants who have satisfactorily completed a 1 hour multiple-choice type written examination, practical and oral examinations to demonstrate their knowledge and ability in the areas detailed below.

6.1 Detailed practical knowledge of the operation of all GMDSS sub-systems and equipment.

Candidates will be required to demonstrate ability to operate the following equipment which may be used in the GMDSS: (note 1)

i) MF/HF/VHF Transmitters and receivers using telephony and NBDP telegraphy (note 2)
ii) DSC encoder/decoder
iii) INMARSAT-A Ship Earth Station (note 3)
iv) INMARSAT-C Ship Earth Station (note 3)
v) COSPAS/SARSAT EPIRB (note 4)
vi) 9GHz radar transponder (SART)
vii) Enhanced Group Calling receiver
viii) NAVTEX receiver.
ix) 2182 kHz Watchkeeping Receiver
x) 2182 kHz Alarm Signal Generator
xi) VHF & UHF transceivers
xii) Portable VHF radio equipment for survival craft.

6.2 Ability to send and receive correctly by radiotelephony and NBDP telegraphy.

Candidates will be required to demonstrate:

i) Communications procedures for the exchange of information by means of telephony using, where appropriate, the phonetic alphabet and the Standard Marine Navigational Vocabulary (note 5)

ii) ability to efficiently use a QWERTY keyboard to communicate over a NBDP telegraphy circuit using, where appropriate, recognised standard abbreviations and commonly used service codes (notes 6 and 7)

iii) ability to maintain an accurate communications log.

6.3 Detailed knowledge of the regulations applying to radiocommunications, knowledge of the documents relating to charges for radiocommunications and knowledge of those provisions of the International Convention for the Safety of Life at Sea which relate to radio.

Candidates will be required to:

i) have a sound understanding of the general provisions for the Global Maritime Distress and Safety System; (note 8)

ii) specify the distress and safety frequencies/ channels allocated in the MF, HF and VHF bands, their purpose and permissible class(es) of emission; (note 9)

iii) describe the band plan, modes of operation and use of frequencies allocated for distress. (note 10)

iv) describe the band plan, modes of operation and use of frequencies allocated for safety and public correspondence in the HF bands and for public correspondence in the MF and VHF bands; (note 10)

v) explain how distress and safety frequencies are protected against harmful interference and the means of avoiding harmful interference; (note 11)

vi) explain the operational procedures for distress, urgency and safety communications in the GMDSS; (note 12)

vii) describe the general procedures to be followed when setting up, conducting and terminating communication links using:

i) NBDP telegraphy (note 13)
ii) a radio telephone call (note 14)

viii) calculate charges for commercial correspondence services using terrestrial and satellite services.

6.4 Practical knowledge of batteries and emergency power supplies.

6.5 Knowledge of the English Language.

Candidates will be required to demonstrate their ability to effectively communicate in the English language, both orally and in writing, by satisfactory completion of all written tests and communications exercises leading to the issue of the GMDSS General Operator's Certificate.

SECTION D NOTES

1. Includes knowledge necessary to choose the most appropriate system or frequency band for a given communications link.

2. MF refers to 2 MHz Radiotelephony or NBDP telegraphy.

3. Specific equipment knowledge will not be required and questions will be confined to system knowledge and procedures contained in the INMARSAT Users Handbook.

4. Basic knowledge of purpose and systems will be required. Ref: IMO publication - "Global Maritime Distress and Safety System".

5. ITU Radio Regulations Appendix 24.
"Phonetic Alphabet and Figure Code".

6. Familiarity with the QWERTY keyboard should be sufficient to allow an operating speed of not less than 15 words per minute.

7. ITU Radio Regulations, Appendix 14, Section II.
"Miscellaneous Abbreviations and Signals" as appropriate to NBDP telegraphy.

8. ITU Radio Regulations, Article N37.
"Distress and Safety Communications for the GMDSS".

9. ITU Radio Regulations, Article N38, Nos N2969-N2976 and N3034-N3042.
"Availability of frequencies for Distress and Safety Communications for the GMDSS".

10. ITU Radio Regulations, Article N38.
"Frequencies for Distress and Safety Communications for the GMDSS".

11. ITU Radio Regulations, Article 38 Nos 3009-3016B, 3026-3028, 3036; Article N38, Nos N3067-N3069 and Article 59, No. 4103.
"Protection of Distress and Safety Frequencies".

12. ITU Radio Regulations, Article N39: "Operational Procedures for Distress and Safety Communications in the GMDSS";
Article N40: "Operational Procedures for Urgency and Safety Communications in the GMDSS";
Article N41: "Alerting Signals";
Article 41, Nos 3270, 3271, 3275-3280 "Alarm and Warning Signals".

13 ITU Radio Regulations, Article 64
"General Procedures for Narrow-Band Direct-Printing Telegraphy in the Maritime Mobile Service".

14 ITU Radio Regulations, Article 65.
"General Radiotelephone Procedures in the Maritime Mobile Service".

APPENDIX SEVEN

AUSTRALIA

Statutory Rules 1990 No. 344[1]

Radiocommunications (Certificates of Proficiency) Regulations[2] (Amendment)

I, THE GOVERNOR-GENERAL of the Commonwealth of Australia, acting with the advice of the Federal Executive Council, hereby make the following Regulations under the *Radiocommunications Act 1983*.

Dated 25 October 1990.

BILL HAYDEN
Governor-General

By His Excellency's Command,

KIM C. BEAZLEY
Minister of State for Transport
and Communications

Principal Regulations

1. In these Regulations, **"Principal Regulations"** means the Radiocommunications (Certificates of Proficiency) Regulations.

Interpretation

2. Regulation 2 of the Principal Regulations is amended by inserting the following definition:

" 'SOLAS' means the Safety of Life at Sea Convention, 1974 done at London on 1 November 1974 and its Protocol of 1978, both as in force on the day on which this definition takes effect;".

3. After regulation 6 of the Principal Regulations the following regulations are inserted:

First-Class Radio Electronic Operator's Examination

"6A. For the purposes of these Regulations, a First-Class Radio Electronic Operator's Examination is an examination conducted by an authorised person in relation to the following matters:

(a) a knowledge of the principles of electricity and of the theory of radio and electronics;

15121/90 (S.R. 120/90)—Cat. No. 90 5092 8

(b) a theoretical knowledge of the types of radiocommunication equipment specified in writing by an authorised person;

(c) a general knowledge of the principles of equipment used for radionavigation;

(d) a practical knowledge of the operation, repair and maintenance of the items of equipment referred to in paragraphs (b) and (c);

(e) a detailed practical knowledge of global maritime distress and safety subsystems and associated equipment;

(f) ability to send and receive correctly by radiotelephone and direct-printing radiotelegraph installations;

(g) a detailed knowledge of the regulations applying to radiocommunication for the time being in force under the Telecommunication Convention:

(h) a knowledge of the published recommendations relating to charges for radiocommunication of the International Telegraphic and Telephone Consultative Committee of the International Telecommunications Union:

(i) a knowledge of the provisions of SOLAS that relate to radiocommunication.

Second-Class Radio Electronic Operator's Examination

"6B. For the purposes of these Regulations, a Second-Class Radio Electronic Operator's Examination is an examination conducted by an authorised person in relation to the following matters:

(a) a knowledge of the principles of electricity and of the theory of radio and electronics;

(b) a general theoretical knowledge of the types of radiocommunication equipment specified in writing by an authorised person:

(c) a general knowledge of the principles of equipment used for radionavigation:

(d) a practical knowledge of the operation and maintenance of the items of equipment referred to in paragraphs (b) and (c);

(e) a detailed practical knowledge of global maritime distress and safety subsystems and associated equipment;

(f) ability to send and receive correctly by radiotelephone and direct-printing radiotelegraph installations;

(g) a detailed knowledge of the regulations applying to radiocommunication for the time being in force under the Telecommunication Convention:

(h) a knowledge of the published recommendations relating to charges for radiocommunication of the International Telegraphic and Telephone Consultative Committee of the International Telecommunications Union:

(i) a knowledge of the provisions of SOLAS that relate to radiocommunication.

General Operator's Examination

"6C. For the purposes of these Regulations, a General Operator's Examination is an examination conducted by an authorised person in relation to the following matters:

(a) a detailed practical knowledge of global maritime distress and safety subsystems and associated equipment that are specified in writing by an authorised person;

(b) ability to send and receive correctly by radiotelephone and direct-printing radiotelegraph installations;

(c) a detailed knowledge of the regulations applying to radiocommunication for the time being in force under the Telecommunication Convention;

(d) a knowledge of the published recommendations relating to charges for radiocommunication of the International Telegraphic and Telephone Consultative Committee of the International Telecommunications Union;

(e) a knowledge of the provisions of SOLAS that relate to radiocommunication.".

Schedule 1

4. Schedule 1 to the Principal Regulations is amended by adding at the end the following item:

"5	First-Class Radio Electronic Operator's Examination, Second-Class Radio Electronic Operator's Examination or General Operator's Examination	Coast station, Class A; Coast station, Class B; Limited coast station; Marine rescue station; Mobile station; Ship station, Class B: Ship station, Class C; Earth station, Class A".

Schedule 2

5. Schedule 2 to the Principal Regulations is amended by adding at the end of Part I the following items:

"5	First-Class Radio Electronic Operator's Examination	100
6	Second-Class Radio Electronic Operator's Examination	75
7	General Operator's Examination	50".

NOTES

1. Notified in the *Commonwealth of Australia Gazette* on 31 October 1990.

2. Statutory Rules 1985 No. 196 as amended by 1987 No. 152.

Printed by Authority by the Commonwealth Government Printer

APPENDIX EIGHT

SATCOM SIMULATOR

A complete training system for the INMARSAT global communication system.
The system comprises a master (instructors) position and up to thirty student positions located along on a common network cable up to 1 k.m. in length.

The simulator system operates within its own environment and can be used for both telex and speech communications. Each student position can operate either as a class 1, Imarsat-A terminal (telex and telephony) or as a Imarsat-C INMARSAT terminal (telex message switching only).

Full simulation of the INMARSAT system can be achieved including enhanced group calls, SOS call diversions, short code selection, etc. Antenna control routines are available to nominated student terminals for positioning exercises.

The instructor can control how the complete system functions by changing operational characteristics of the network, e.g. satellite position, queueing limits, coast station facilities, etc.

The complete system is run from the instructors position. A colour graphics display screen is used to show how the system is operating at any time through the use of maps with symbolic overlays. "Pull down" windows are used by the instructor to change any system operations. A second (monochrome) display screen allows the instructor to communicate in telex mode and to show systems messages.

Each student position comprises a self contained "intelligent" terminal to allow for message preparation as well as for normal telex communications.

The complete system allows all INMARSAT facilities requested by any terminal to operate simultaneously.

Student Positions

Each student position simulates either:

Imarsat-A class 1 SES equipment (telex and telephony) or Imarsat-C message terminal (telex only).
(The mode of operation is selected by the student.)

Facilities offered by the terminals are as follows:

1. Off-line message preparation.
Up to ten separate message texts can be prepared. Additionally, provision is made for a distress message texts to be prepared.

2. Distress message generate (DMG)
The distress message can be automatically transmitted at intervals after an "SOS" request by the student.

3. Antenna positioning exercises.
Two modes are available (controlled by the instructor). Mode "manual" requires the student to calculate the azimuth and elevation of the antenna before the satellite TDM signal is detected.

Mode "auto" will position the antenna automatically for the student.

4. Conversation mode.
Once student connection has been established with a selected CES then telex and/or telephony conversation mode is possible (full duplex simulation).

5. Message switching.
Previously prepared messages can be recalled for transmission either as part of a Imarsat-A connection or in Imarsat-C mode.

6. Enhanced group call EGC.
A "listening channel" is maintained for EGC calls which are valid for the SES terminal (fleet and national numbers for each SES terminal are controlled by the instructor position).

7. Options: Fax/data transmission.
If required the simulator can be modified for use with fax/datatransmissions.

Instructor Position

The instructors position automatically simulates the following functions simultaneously;

1. All coast east stations (CES).
   The instructor can configure up to 30 CES stations each with different operational facilities.

2. All satellite positions..
   In addition to the main satellite associated with each ocean area there are also two standby satellites for each ocean area which can be configured by the instructor.

3. Any terrestrial telex/telephone number or SES number.
   Country code routings are incorporated for automatic simulated connections. A current list of approximately 8000 valid SES numbers is also maintained by the system for immediate call-up/verification.

4. Short code selection.
   The current range of short code selections are automatically incorporated for selection if required.

5. Diversion procedures.
   Nominated CES stations can offer diversion routings under "distress" priority.

6. Imarsat-C.
   Message switching facilities are incorporated consistent with Imarsat-C operation.

7. Enhanced Group Calls (EGC).
   Ocean area calls, national calls and fleet calls can be automatically transmitted under the timing control of the instructor. The message texts can also be varied.

8. System Management.
   Connection limits and queueing limits on the network can be imposed with automatic "de-queueing".

9. System log.
   A log file is maintained showing all network activity in real-time. This facility is useful for "billing" simulation.

In addition to the automatic operation, the instructor can anually select the following facilities:

10. Relocation of SES terminals.
Student terminals can be placed at specific latitude and longitude positions

11. Conversation mode.
The instructor can respond to, or initiate, both telex and telephony calls with specific SES terminals.

The instructors position offers all facilities simultaneously and all times. Where a facility is requested by a student that needs a response then "recorded responses" are generated if required.

Brief technical info:

The telex communications operate on a simulated 50 bauds around the network and uses ITA No. 2 character set. The actual (hidden) transmission speed is 4800 bauds using ASCII character set.

The communications protocol is master/slave (with the instructors position as "master"). A reply-after-receipt mechanism is incorporated to ensure that only an addressed SES terminal will respond to a specific message. Buffering facilities at all terminals coupled with the increased transmission speed ensure that the effect is to show real-time communications at the simulated 50 bauds.

Printing facilities are available at all terminals. At the instructors position this can be dedicated either to the real-time system log or to provide a copy of the instructors status/messaging screen; at the student positions the printer can be redirected to display the incoming EGC messages while the terminal is in off-line mode, or for printing out any other recorded or stored texts.

Telephony mode uses simulated tone dialling with the standard INMARSAT response tones for "busy"' "unavailable"' etc.
A slave "SOS" button is incorporated into each SES telephone keypad.

Technical Specification and Equipment (Standard system)

1. General

Number of SES terminals (normal)	1 to 30
Additional SES terminals (extra line driver)	30
Maximum cable length	1000 metres
Simulated message speed (Imarsat-A)	50 bauds
Actual (transparent) message speed	9600 baud
Network protocol (transparent)	RS485
Number of satellites available	9
Number of CES (all separately configurable)	up to 100

Number of simulation "connects" over network Limited only by queueing parameter.
Number of simultaneous speech conversations 8 (16 terminals)

2. Instructor position

IBM PC compatible computer complete with;
a) Satcom network card
b) Second EGA facility
c) Colour display
d) Second monochrome display
e) Data on 8000 valid SES terminals
f) 20 MByte hard disk
g) 80 column dot matrix printer
h) Telephone unit plus handset.
j) Terminal for connection of Fax machine

3. Student position

SES simulator consisting of;
a) Monochrome monitor
b) Keyboard
c) System unit
d) Telephone unit plus handset
e) Printer
f) Terminal for connection of FAX machine.

4. One instruction manual

5. Optional

a) Telephone card for connection of the Instructor-station to PABX networks. This allows telephony routing from student terminals via the instructor-position into "real" networks. (outgoing only)

b) Extentioncard with Onboard modem for data-input. (RS-232) Required for instructor and student position.

R H G Satcomsimulator — Budgetprices

Basic system comprising:

- instructorsposition.
- one studentposition.
- five metres interconnectioncable. D.fl 37.680,-

expansion:

- one studentposition. D.fl 15.265,-
- interconnectioncable, per meter: D.fl 10,25

Prices:

All prices are ex-works Amsterdam, including packing, excluding rights/duties.

Deliverytime:

To be adviséd.

RADIO HOLLAND B.V.,

APPENDIX NINE

5.5 Proposed GMDSS General Operator Certificate Syllabus in the P.R. of China

According to the amendments of RRs, SOLAS Convention and STCW Convention, any one if he/she holds the GMDSS General Operator's Certificate (GOC) may serve at GMDSS sea area A1, A2, A3, and A4 as well. The minimum requirements for GOC are set up in the 1991 amendments to STCW Convention, 1978. The duration for GOC training is very much depended on the background of trainees. Normally, it takes between two and three weeks.

A Proposed GMDSS GOC Syllabus may be as follows:

Learning Objectives
(Lecture Contents)

I. GMDSS: Procedures, equipment, Distress and Safety Communication

1. Knowledge about the requirements/regulations for Radio Equipment in GMDSS

(A1- A4 areas; DSC and Satcom-equipment; INMARSAT A, B, C and M; EPIRB for L-band or COSPASAT; SART; EGC; NAVTEX)

2. Links for Distress and Safety Communications

(Frequency allocations in GMDSS; Protection of Distress frequencies; Transmission methods; Transmission priorities; Priority 3)

3. Procedures in Maritime Distress and Safety Communications

(Distress alarm; Transmissions; Procedures for relay and confirmation of distress calls; Reception and confirmation by LUT,CRS, CES or RCC; Preparation for the handling, further transport, coordination and finalization of distress traffic;)

4. Urgency and Safety message, including Maritime Safety Information

(Navtex receiver, Worldwide Maritime Safety transmissions, Navareas, Priorities 2 and 1, Limitation of Information quantity.)

II. Exercises with Equipment for Data Input

1. The operational aspects of Telex- and Satcom terminals and the DSC-receiver

(Special codes, Message identification, English keyboard, Flawless operation, changing and mixing of texts, buffering of message, DSC message.)

III. Operational Procedures of SATCOM, DSC and Telex

1. Sufficient skill in procedures with SATCOM installations

(Transmitter engagement, Choice of CES and signalling methods (Telex, Telephone, Fax), Priority Zero, Country identificating, Abbreviations used in Telex traffic)

2. DSC-transmission, reception and confirmation

(Choice of appropriate frequencies, Procedures for making a connection, Repeating messages)

3. Providing for a Telex-communication link

(Telecommunication regulations, Ship safety regulations, INMARSAT regulations)

IV. Law and Regulations

Knowledge of relevant national and international regulations as far as concerned with GMDSS

(Telecommunication regulations, Ship safety regulations, INMARSAT regulations)

V. Technical Aspects of Telecommunication

As far as concerns GMDSS, the ability of the operator, related to:

1. The assessment of the technical principles of equipment

(Technical Manual of the installation, Block diagrams, Control of indicators, Antenna, Gyroscopes, Earth connection, status alarms, Status reports, Printer tests, Paper transport)

2. The performance of test-sequences, Fault identification, Correction for simple faults as far as is possible on board.

(Fuses, Measurements at test-points, Power failures, communication with service/maintenance companies, Replacing PCB's.)

APPENDIX TEN

TERNATIONAL MARITIME
ORGANIZATION

IMO

A 17/Res.703
25 November 1991
Original: ENGLISH

ASSEMBLY - 17th session
Agenda item 10

RESOLUTION A.703(17)
adopted on 6 November 1991

TRAINING OF RADIO PERSONNEL IN THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS)

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

CONSIDERING the 1987 amendments to the Radio Regulations, the 1988 amendments to the International Convention for the Safety of Life at Sea, 1974 (SOLAS), and the 1991 amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW), for introduction of the global maritime distress and safety system (GMDSS),

NOTING that the 1991 amendments to regulation IV/2 of the STCW Convention require that, in determining the appropriate level of knowledge and training for certification of GMDSS radio personnel, the Administration shall also take into account the relevant recommendations of the Organization,

NOTING ALSO that resolutions 14 and 15 of the International Conference on Training and Certification of Seafarers, 1978, concerning the training and certification of radio officers and radiotelephone operators do not apply to radio personnel on ships operating in the GMDSS,

NOTING FURTHER that resolution A.702(17) on radio maintenance guidelines for the GMDSS related to sea areas A3 and A4 includes provisions permitting Administrations to approve at-sea electronic maintenance qualifications which are equivalent to those recommended for holders of certificates specified by the Radio Regulations,

RECOGNIZING the need for developing recommendations on training for radio personnel in ships operating in the GMDSS,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its fifty-ninth session,

1. ADOPTS:

(a) the Recommendation on Training of Radio Operators related to the First-Class Radioelectronic Certificate, set out in annex 1;

(b) the Recommendation on Training of Radio Operators related to the Second-Class Radioelectronic Certificate, set out in annex 2;

(c) the Recommendation on Training of Radio Operators related to the General Operator's Certificate, set out in annex 3;

(d) the Recommendation on Training of Radio Operators related to the Restricted Operator's Certificate, set out in annex 4; and

(e) the Recommendation on Training of Personnel Performing Maintenance of the GMDSS Installations Aboard Ships, set out in annex 5;

2. RECOMMENDS Governments to take account of the appropriate recommendation set out in the annexes to the present resolution on the training of radio personnel for ships operating in the GMDSS;

3. INVITES the Maritime Safety Committee to keep the present resolution under review in consultation or association with other international organizations, as appropriate, particularly with the International Labour Organisation and the International Telecommunication Union, and to bring any future amendments to the attention of all Governments concerned;

4. AUTHORIZES the Maritime Safety Committee to keep the annexed recommendations under review and to adopt, when appropriate, amendments thereto.

ANNEX 1

RECOMMENDATION ON TRAINING OF RADIO OPERATORS RELATED TO THE FIRST-CLASS RADIOELECTRONIC CERTIFICATE

1 General

1.1 Before training is commenced, the requirements of medical fitness, especially as to hearing, eyesight and speech, should be met by the candidate.

1.2 The training should be relevant to the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), the provisions of the Radio Regulations annexed to the International Telecommunication Convention (Radio Regulations) and the provisions of the International Convention for the Safety of Life at Sea (SOLAS) then in force, with particular attention to provisions for the global maritime distress and safety system (GMDSS). In developing training requirements, account should be taken of knowledge of the following items, which is not an exhaustive list.

2 Theory

2.1 Knowledge of the general principles and basic factors necessary for safe and efficient use of all the subsystems and equipment required in the GMDSS sufficient to support the training requirements listed in the practical section of this annex.

2.2 Knowledge of the use, operation and service areas of the GMDSS subsystems, including satellite system characteristics, navigational and meteorological warning systems and selection of appropriate communication circuits.

2.3 Knowledge of the principles of electricity and the theory of radio and electronics sufficient to meet the requirements specified in 2.4, 2.5, 2.6, 2.7 and 2.8 below.

2.4 Theoretical knowledge of GMDSS radiocommunication equipment, including narrow-band direct-printing telegraphy and radiotelephone transmitters and receivers, digital selective calling equipment, ship earth stations, emergency position-indicating radiobeacons, marine antenna systems, radio equipment for survival craft together with all auxiliary items, including power supplies, as well as general knowledge of the principles of other equipment generally used for radionavigation, with particular reference to maintaining the equipment in service.

2.5 Knowledge of factors that affect system reliability, availability, maintenance procedures and proper use of test equipment.

2.6 Knowledge of microprocessors and fault diagnosis in systems using microprocessors.

2.7 Knowledge of control systems in the GMDSS radio equipment including testing and analysis.

2.8 Knowledge of the use of computer software for the GMDSS radio equipment and methods for correcting faults caused by loss of software control of the equipment.

3 Regulations and documentation

The operator should have knowledge of:

.1 the SOLAS Convention and the Radio Regulations with particular emphasis on:

.1.1 distress, urgency and safety radiocommunications;

.1.2 avoiding harmful interference, particularly with distress and safety traffic;

.1.3 prevention of unauthorized transmissions;

.2 other documents relating to operational and communication procedures for distress, safety and public correspondence services, including charges, navigational warnings, and weather broadcasts in the Maritime Mobile Service and the Maritime Mobile Satellite Service;

.3 use of the International Code of Signals and the IMO Standard Marine Navigational Vocabulary.

4 Watchkeeping and procedures

Training should be given in:

.1 communication procedures and discipline to prevent harmful interference in the GMDSS subsystems;

.2 procedures for using propagation prediction information to establish optimum frequencies for communications;

.3 radiocommunications watchkeeping relevant to all GMDSS subsystems, exchange of radiocommunications traffic, particularly concerning distress, urgency and safety procedures and radio records;

.4 use of the international phonetic alphabet;

.5 monitoring a distress frequency while simultaneously monitoring or working on at least one other frequency;

.6 ship position-reporting systems and procedures;

.7 communication procedures of the IMO Merchant Ship Search and Rescue Manual (MERSAR), using radiocommunications;

.8 radio medical systems and procedures.

5 Practical

Practical training, supported by appropriate laboratory work, should be given in:

.1 correct and efficient operation of all GMDSS subsystems and equipment under normal propagation conditions and under typical interference conditions;

.2 safe operation of all the GMDSS communication equipment and ancillary devices, including safety precautions;

.3 adequate and accurate keyboard skill for the satisfactory exchange of communications;

.4 operational techniques for:

.4.1 receiver and transmitter adjustment for the appropriate mode of operation, including digital selective calling and direct-printing telegraphy;

.4.2 antenna adjustment and re-alignment, as appropriate;

.4.3 use of radio life-saving appliances;

.4.4 use of emergency position-indicating radio beacons (EPIRBs);

.5 antenna rigging, repair and maintenance, as appropriate;

.6 reading and understanding of pictorial, logic and circuit diagrams;

.7 use and care of those tools and test instruments necessary to carry out at-sea electronic maintenance;

.8 manual soldering and desoldering techniques, including those involving semiconductor devices and modern circuits and the ability to distinguish whether the circuit is suitable to be manually soldered or desoldered;

.9 tracing and repair of faults to component level where practicable, and to board/module level in other cases;

.10 recognition and correction of conditions contributing to the fault occurring;

.11 maintenance procedures, both preventive and corrective for all the GMDSS communication equipment and radionavigation equipment;

.12 methods of alleviating electrical and electromagnetic interference such as bonding, shielding and bypassing.

6 Miscellaneous

The operator should have knowledge of, and/or receive training in:

.1 the English language, both written and spoken, for the satisfactory exchange of communications relevant to the safety of life at sea;

.2 world geography, especially the principal shipping routes, services of rescue co-ordination centres (RCCs) and related communication routes;

.3 survival at sea, the operation of lifeboats, rescue boats, liferafts, buoyant apparatus and their equipment, with special reference to radio life-saving appliances;

.4 fire prevention and fire fighting with particular reference to the radio installation;

.5 preventive measures for the safety of ship and personnel in connection with hazards related to radio equipment, including electrical, radiation, chemical and mechanical hazards;

.6 first aid, including heart-respiration revival technique;

.7 co-ordinated universal time (UTC), global time zones and international date line.

ANNEX 2

RECOMMENDATION ON TRAINING OF RADIO OPERATORS RELATED TO THE SECOND-CLASS RADIOELECTRONIC CERTIFICATE

1 General

1.1 Before training is commenced, the requirements of medical fitness, especially as to hearing, eyesight and speech, should be met by the candidate.

1.2 The training should be relevant to the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), the provisions of the Radio Regulations annexed to the International Telecommunication Convention (Radio Regulations) and the provisions of the International Convention for the Safety of Life at Sea (SOLAS) then in force, with particular attention to provisions for the global maritime distress and safety system (GMDSS). In developing training requirements, account should be taken of knowledge of the following items, which is not an exhaustive list.

2 Theory

2.1 Knowledge of the general principles and basic factors necessary for safe and efficient use of all the subsystems and equipment required in the GMDSS sufficient to support the training requirements listed in the practical section of this annex.

2.2 Knowledge of the use, operation and service areas of the GMDSS subsystems, including satellite system characteristics, navigational and meteorological warning systems and selection of appropriate communication circuits.

2.3 Knowledge of the principles of electricity and the theory of radio and electronics sufficient to meet the requirements specified in 2.4, 2.5, 2.6, 2.7 and 2.8 below.

2.4 General theoretical knowledge of GMDSS radiocommunication equipment, including narrow-band direct-printing telegraph and radiotelephone transmitters and receivers, digital selective calling equipment, ship earth stations, emergency position-indicating radiobeacons, marine antenna systems, radio equipment for survival craft together with all auxiliary items, including power supplies, as well as general knowledge of other equipment generally used for radionavigation, with particular reference to maintaining the equipment in service.

2.5 General knowledge of factors that affect system reliability, availability, maintenance procedures and proper use of test equipment.

2.6 General knowledge of microprocessors and fault diagnosis in systems using microprocessors.

2.7 General knowledge of control systems in the GMDSS radio equipment including testing and analysis.

2.8 Knowledge of the use of computer software for the GMDSS radio equipment and methods for correcting faults caused by loss of software control of the equipment.

3 Regulations and documentation

The operator should have knowledge of:

.1 the SOLAS Convention and the Radio Regulations with particular emphasis on:

.1.1 distress, urgency and safety radiocommunications;

.1.2 avoiding harmful interference, particularly with distress and safety traffic;

.1.3 prevention of unauthorized transmissions;

.2 other documents relating to operational and communication procedures for distress, safety and public correspondence services, including charges, navigational warnings, and weather broadcasts in the Maritime Mobile Service and the Maritime Mobile Satellite Service;

.3 use of the International Code of Signals and the IMO Standard Marine Navigational Vocabulary.

4 Watchkeeping and procedures

Training should be given in:

.1 communication procedures and discipline to prevent harmful interference in the GMDSS subsystems;

.2 procedures for using propagation prediction information to establish optimum frequencies for communications;

.3 radiocommunications watchkeeping relevant to all GMDSS subsystems, exchange of radiocommunications traffic, particularly concerning distress, urgency and safety procedures and radio records;

.4 use of the international phonetic alphabet;

.5 monitoring a distress frequency while simultaneously monitoring or working on at least one other frequency;

.6 ship position-reporting systems and procedures;

.7 communication procedures of the IMO Merchant Ship Search and Rescue Manual (MERSAR), using radiocommunications;

.8 radio medical systems and procedures.

5 Practical

Practical training, supported by appropriate laboratory work, should be given in:

.1 correct and efficient operation of all GMDSS subsystems and equipment under normal propagation conditions and under typical interference conditions;

.2 safe operation of all the GMDSS communication equipment and ancillary devices, including safety precautions;

.3 adequate and accurate keyboard skill for the satisfactory exchange of communications;

.4 operational techniques for:

.4.1 receiver and transmitter adjustment for the appropriate mode of operation, including digital selective calling and direct-printing telegraphy;

.4.2 antenna adjustment and re-alignment, as appropriate;

.4.3 use of radio life-saving appliances;

.4.4 use of emergency position-indicating radio beacons (EPIRBs);

.5 antenna rigging, repair and maintenance, as appropriate;

.6 reading and understanding of pictorial, logic and module interconnection diagrams;

.7 use and care of those tools and test instruments necessary to carry out at-sea electronic maintenance at the level of unit or module replacement;

.8 basic manual soldering and desoldering techniques and their limitations;

.9 tracing and repair of faults to board/module level;

.10 recognition and correction of conditions contributing to the fault occurring;

.11 basic maintenance procedures, both preventive and corrective, for all the GMDSS communication equipment and radionavigation equipment;

.12 methods of alleviating electrical and electromagnetic interference such as bonding, shielding and bypassing.

6 Miscellaneous

The operator should have knowledge of, and/or receive training in:

.1 the English language, both written and spoken, for the satisfactory exchange of communications relevant to the safety of life at sea;

.2 world geography, especially the principal shipping routes, services of rescue co-ordination centres (RCCs) and related communication routes;

.3 survival at sea, the operation of lifeboats, rescue boats, liferafts, buoyant apparatus and their equipment, with special reference to radio life-saving appliances;

.4 fire prevention and fire fighting with particular reference to the radio installation;

.5 preventive measures for the safety of ship and personnel in connection with hazards related to radio equipment, including electrical, radiation, chemical and mechanical hazards;

.6 first aid, including heart-respiration revival technique;

.7 co-ordinated universal time (UTC), global time zones and international date line.

ANNEX 3

RECOMMENDATION ON TRAINING OF RADIO OPERATORS RELATED TO THE GENERAL OPERATOR'S CERTIFICATE

1 General

1.1 Before training is commenced, the requirements of medical fitness, especially as to hearing, eyesight and speech, should be met by the candidate.

1.2 The training should be relevant to the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), the provisions of the Radio Regulations annexed to the International Telecommunication Convention (Radio Regulations) and the provisions of the International Convention for the Safety of Life at Sea (SOLAS) then in force, with particular attention to provisions for the global maritime distress and safety system (GMDSS). In developing training requirements, account should be taken of knowledge of the following items, which is not an exhaustive list.

2 Theory

2.1 Knowledge of the general principles and basic factors necessary for safe and efficient use of all the subsystems and equipment required in the GMDSS sufficient to support the training requirements listed in the practical section of this annex.

2.2 Knowledge of the use, operation and service areas of the GMDSS subsystems, including satellite system characteristics, navigational and meteorological warning systems and selection of appropriate communication circuits.

3 Regulations and documentation

The operator should have knowledge of:

.1 the SOLAS Convention and the Radio Regulations with particular emphasis on:

.1.1 distress, urgency and safety radiocommunications;

.1.2 avoiding harmful interference, particularly with distress and safety traffic;

.1.3 prevention of unauthorized transmissions;

.2 other documents relating to operational and communication procedures for distress, safety and public correspondence services, including charges, navigational warnings, and weather broadcasts in the Maritime Mobile Service and the Maritime Mobile Satellite Service;

.3 use of the International Code of Signals and the IMO Standard Marine Navigational Vocabulary.

4 Watchkeeping and procedures

Training should be given in:

.1 communication procedures and discipline to prevent harmful interference in the GMDSS subsystems;

.2 procedures for using propagation prediction information to establish optimum frequencies for communications;

.3 radiocommunications watchkeeping relevant to all GMDSS subsystems, exchange of radiocommunications traffic, particularly concerning distress, urgency and safety procedures and radio records;

.4 use of the international phonetic alphabet;

.5 monitoring a distress frequency while simultaneously monitoring or working on at least one other frequency;

.6 ship position-reporting systems and procedures;

.7 communication procedures of the IMO Merchant Ship Search and Rescue Manual (MERSAR), using radiocommunications;

.8 radio medical systems and procedures.

5 Practical

Practical training should be given in:

.1 correct and efficient operation of all GMDSS subsystems and equipment under normal propagation conditions and under typical interference conditions;

.2 safe operation of all the GMDSS communications equipment and ancillary devices, including safety precautions;

.3 accurate and adequate keyboard skills for the satisfactory exchange of communications;

.4 operational techniques for:

.4.1 receiver and transmitter adjustment for the appropriate mode of operation, including digital selective calling and direct-printing telegraphy;

.4.2 antenna adjustment and re-alignment as appropriate;

.4.3 use of radio life-saving appliances;

.4.4 use of emergency position-indicating radio beacons (EPIRBs).

6 Miscellaneous

The operator should have knowledge of, and/or receive training in:

.1 the English language, both written and spoken, for the satisfactory exchange of communications relevant to the safety of life at sea;

.2 world geography, especially the principal shipping routes, services of rescue co-ordination centres (RCCs) and related communication routes;

.3 survival at sea, the operation of lifeboats, rescue boats, liferafts, buoyant apparatus and their equipment, with special reference to radio life-saving appliances;

.4 fire prevention and fire fighting with particular reference to the radio installation;

.5 preventive measures for the safety of ship and personnel in connection with hazards related to radio equipment, including electrical, radiation, chemical and mechanical hazards;

.6 first aid, including heart-respiration revival technique;

.7 co-ordinated universal time (UTC), global time zones and international date line.

ANNEX 4

RECOMMENDATION ON TRAINING OF RADIO OPERATORS RELATED TO THE RESTRICTED OPERATOR'S CERTIFICATE

1 General

1.1 Before training is commenced, the requirements of medical fitness, especially as to hearing, eyesight and speech, should be met by the candidate.

1.2 The training should be relevant to the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), the provisions of the Radio Regulations annexed to the International Telecommunication Convention (Radio Regulations) and the provisions of the International Convention for the Safety of Life at Sea (SOLAS) then in force, with particular attention to provisions for the global maritime distress and safety system (GMDSS). In developing training requirements, account should be taken of knowledge of the following items, which is not an exhaustive list.

2 Theory

2.1 Knowledge of the general principles and basic factors, including VHF range limitation and antenna height effect necessary for safe and efficient use of all the subsystems and equipment required in the GMDSS in sea area A1, sufficient to support the training requirements listed in the practical section of this annex.

2.2 Knowledge of the use, operation and service areas of the GMDSS sea area A1 subsystems, e.g. navigational and meteorological warning systems and the appropriate communication circuits.

3 Regulations and documentation

The operator should have knowledge of:

.1 those parts of the SOLAS Convention and the Radio Regulations relevant to sea area A1, with particular emphasis on:

.1.1 distress, urgency and safety radiocommunications;

.1.2 avoiding harmful interference, particularly with distress and safety traffic;

.1.3 prevention of unauthorized transmissions;

.2 other documents relating to operational and communication procedures for distress, safety and public correspondence services, including charges, navigational warnings and weather broadcasts in the Maritime Mobile Service in sea area A1;

.3 use of the International Code of Signals and the IMO Standard Marine Navigational Vocabulary.

4 Watchkeeping and procedures

Training should be given in:

.1 communication procedures and discipline to prevent harmful interference in the GMDSS subsystems used in sea area A1;

.2 VHF communication procedures for:

.2.1 radiocommunications watchkeeping, exchange of radiocommunications traffic, particularly concerning distress, urgency and safety procedures and radio records;

.2.2 monitoring a distress frequency while simultaneously monitoring or working on at least one other frequency;

.2.3 digital selective calling system;

.3 use of the international phonetic alphabet;

.4 ship position-reporting systems and procedures;

.5 communication procedures of the IMO Merchant Ship Search and Rescue Manual (MERSAR) using VHF radiocommunications;

.6 radio medical systems and procedures.

5 Practical

Practical training should be given in:

.1 correct and efficient operation of the GMDSS subsystems and equipment prescribed for ships operating in sea area A1 under normal propagation conditions and under typical interference conditions;

.2 safe operation of the relevant GMDSS communication equipment and ancillary devices, including safety precautions;

.3 operational techniques for:

.3.1 use of VHF, including channel, squelch, and mode adjustment, as appropriate;

.3.2 use of radio life-saving appliances;

.3.3 use of emergency position-indicating radio beacons (EPIRBs);

.3.4 use of NAVTEX receiver.

6 Miscellaneous

The operator should have knowledge of, and/or receive training in:

.1 the English language, both written and spoken, for the satisfactory exchange of communications relevant to the safety of life at sea;

.2 services of rescue co-ordination centres (RCCs) and related communication routes;

.3 survival at sea, the operation of life boats, rescue boats, liferafts, buoyant apparatus and their equipment, with special reference to radio lifesaving appliances;

.4 fire prevention and fire fighting with particular reference to the radio installation;

.5 preventive measures for the safety of ship and personnel in connection with hazards related to radio equipment, including electrical, radiation, chemical and mechanical hazards;

.6 first aid including heart-respiration revival technique.

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ANNEX 5

RECOMMENDATION ON TRAINING OF PERSONNEL PERFORMING MAINTENANCE OF THE GMDSS INSTALLATIONS ABOARD SHIPS

1 General

1.1 Reference is made to regulation IV/15, Maintenance requirements, as contained in the 1988 amendments to the 1974 SOLAS Convention concerning radiocommunications for the GMDSS and to resolution A.702(17) on radio maintenance guidelines for the GMDSS related to sea areas A3 and A4 which includes in its annex the following provision:

> "4.2 The person designated to perform functions for at-sea electronic maintenance should either hold an appropriate certificate as specified by the Radio Regulations, as required, or have equivalent at-sea electronic maintenance qualifications, as may be approved by the Administration, taking into account the recommendations of the Organization on the training of such personnel."

1.2 The following guidance on equivalent electronic maintenance qualifications is provided for use by Administrations as appropriate.

1.3 Training as recommended below, does not qualify the person to be an operator of GMDSS radio equipment, unless he holds an appropriate radio operator's certificate.

2 Maintenance training equivalent to the first-class radioelectronic certificate

2.1 In determining training equivalent to the maintenance elements of the first-class radioelectronic certificate, knowledge of the items referred to in the following paragraphs contained in annex 1 to the present resolution should be taken into account, but the list should not be considered exhaustive.

2.2 Theory

2.1, 2.3, 2.4, 2.5, 2.6, 2.7 and 2.8.

2.3 Practical

5.2, 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11 and 5.12.

2.4 Miscellaneous

6.4, 6.5 and 6.6.

3 Maintenance training equivalent to the second-class radioelectronic certificate

3.1 In determining training equivalent to the maintenance elements of the second-class radioelectronic certificate, knowledge of the items referred to in the following paragraphs contained in annex 2 to the present resolution, should be taken into account, but the list should not be considered exhaustive.

3.2 Theory

2.1, 2.3, 2.4, 2.5, 2.6, 2.7 and 2.8.

3.3 Practical

5.2, 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11 and 5.12.

3.4 Miscellaneous

6.4, 6.5 and 6.6.