MARITIME COMMUNICATIONS
SATELLITE SYSTEMS AND EQUIPMENT

AMC | UNIVERSITY*of* TASMANIA

Australian Maritime College

Australian Government

acma
Australian
Communications
and Media Authority

FOREWORD

This text is recommended as the study guide for candidates undertaking the examination for the Marine Satellite Communications Endorsement (MSCE also known as Satcom).

Procedures and requirements outlined in the text are based on the International Radio Regulations formulated by the International Telecommunication Union (ITU), on provisions governing the use of radio transmitters in Australia laid down in the Radiocommunications Act 1992, and on radiocommunications station licence conditions set by the Australian Communications and Media Authority (ACMA).

Information about obtaining the MSCE qualification for operators with Inmarsat satellite communications (compulsorily or voluntarily fitted) is available on the web at **www.amc.edu.au/marineradio**

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GENERAL INFORMATION, EXAMINATIONS AND REPLACEMENTS

Currently examination and certification services for the satellite endorsement is provided through the Office of Maritime Communications (OMC) at the Australian Maritime College on behalf of the Australian Communications and Media Authority. In this handbook, the Office of Maritime Communications will be referred to as the OMC, the Australian Maritime College the AMC, and the Australian Communications and Media Authority as the ACMA.

Syllabi for the MSCE and the examination questions will primarily be based on the symbolised sections showing a ■.

An examination will normally consist of a written exercise.

The OMC will only issue the MSCE to a successful candidate providing the following conditions are met:

a) that the candidate already holds one of the following certificates of proficiency:

- Long Range Operator Certificate of Proficiency
- Short Range Operator Certificate of Proficiency
- Marine Radio Operators Certificate of Proficiency
- Marine Radio Operators VHF Certificate of Proficiency
- Restricted Radiotelephone Operators Certificate of Proficiency
- 3rd Class Commercial Operators Certificate of Proficiency
- First Class Commercial Operators Certificate of Proficiency
- Second Class Commercial Operators Certificate of Proficiency
- Radiocommunications Operators General Certificate of Proficiency
- An overseas qualification considered by the ACMA to be an equivalent of one of the above;

b) that a copy of this certificate is submitted to the OMC with the candidate's examination papers; and

c) that the candidate is sixteen years of age or over (Current legislation does not permit the issue of a certificate of proficiency to a candidate under the age of sixteen. Candidates must be of 16 years of age before being accepted for examination).

Certificates of endorsements will be issued to successful candidates.

All candidates are required to produce proof of identity and age at the time of examination.

An application to be examined for an MSCE is made to the OMC.

Examinations for the MSCE are only available at organisations with suitable Inmarsat equipment or simulation of Inmarsat equipment available for training. The trainer must be suitably qualified to the same level that the training is being conducted to. Revisions questions are available at http://www.amc.edu.au/handbooks.

Examination fees are charged, current fees are available at http://www.amc.edu.au/omc-fees.

If an operator's certificate of endorsement is lost, mutilated or destroyed, or a change of name has occurred, the holder may obtain a replacement by making written application to the OMC.

Where issue of a replacement MSCE is required because of damage or change of name, the original certificate of endorsement should accompany the application. In the case of change of name, documentary proof of the change should be included; for example, a marriage certificate or deed poll document.

A fee is charged for the replacement of a MSCE current fees are available at http://www.amc.edu.au/omc-fees.

It is in the interests of candidates applying for a replacement for a lost MSCE to provide information regarding the place and approximate date of original issue.

Candidates for the MSCE who have lost the certificate of proficiency, needing to be endorsed, may submit an application and fee for a replacement certificate at the same time as sitting for the MSCE. The MSCE will not be issued if no record can be found of the certificate to be replaced. Refer *http://www.amc.edu.au/replacement-marine-radio-operators-certificates* for further information about replacement of certificates.

MARITIME COMMUNICATIONS SATELLITE SYSTEMS AND EQUIPMENT: GENERAL INFORMATION

THE INTERNATIONAL MARITIME SATELLITE ORGANISATION

The International Maritime Satellite Organisation (Inmarsat) operates a system of satellites providing a range of telecommunications services to vessels. The system also incorporates distress and safety communications. ◾

INMARSAT SYSTEM

The Marine Inmarsat system employs four operational satellites in geostationary orbit above the equator, over the Atlantic, Indian and Pacific Oceans. In combination the satellites provide continuous high quality communications to virtually the entire Earth's surface. (Except the polar regions) back-up satellites are ready for use if necessary. ◾

The geostationary orbit of the satellites means that each moves at exactly the same rate as the Earth's own rotation and therefore remains in the same relative position to any point on the Earth. ◾

Powered by solar energy, each satellite acts as a transmitting and receiving station, relaying messages between stations located on the Earth's surface. ◾

Each satellite has its own area of coverage (known as a 'footprint') which is that part of the Earth's surface within which an antenna can obtain a view of the satellite. ◾

The coverage chart shows the four Marine Inmarsat satellites and their coverage areas. These areas are called ocean regions and are designated as follows:

- the Pacific Ocean Region (POR); at 143.5° East
- the Indian Ocean Region (IOR); at 25° East
- the Atlantic Ocean East Region (AOR East) and; at 54° West
- the Atlantic Ocean West Region (AOR West) at 98° West ◾

Inmarsat satellite placement and coverage
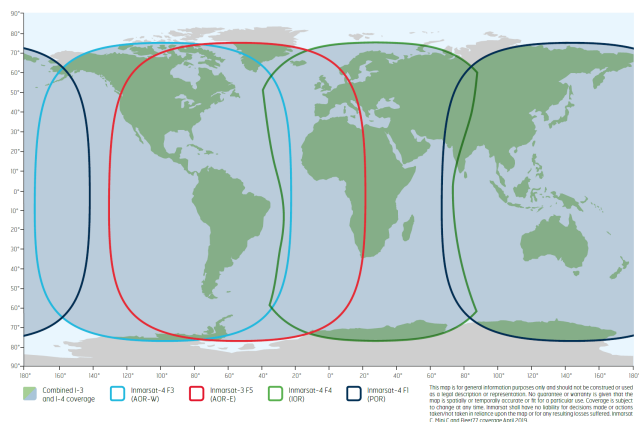
INMARSAT SYSTEM STATIONS

An Inmarsat installation aboard any vessel is referred to as a Ship Earth Station (SES). ■

Each ocean region has a number of Land Earth Stations (LES) which provide the communications interface between vessels at sea and shore based telecommunications networks. This function is fully automated and is effectively transparent as far as the Inmarsat system user is concerned. Each LES has an associated Maritime Rescue Co-ordination Centre (MRCC). ■

The Australian LES is located at Perth WA and serves the) Pacific (POR) ocean regions. Its associated MRCC is located in Canberra and is operated by AMSA. ■

Each ocean region has a Network Co-ordination Station (NCS) which is responsible for the overall management for the exchange of traffic in its region. ■

COMMUNICATIONS SERVICES

Operating at ultra high frequencies (UHF) in the 1.5 to 1.6 GHz and super high frequencies (SHF) in the 4 to 6 GHz bands, the Inmarsat system provides the following types of communications:

- telex in store and forward modes;

- telephone and

- computer data in both real time, and store and forward modes. ■

Priority distress facilities exist for Ship Earth Stations. Once a vessel selects and transmits a 'distress priority' signal, the call is automatically routed to an appropriate Maritime Rescue Co-ordination Centre. ■

TYPES OF INMARSAT SHIP TERMINALS

Inmarsat-C provides a data (telex) exchange in the store and forward mode. This means that there is no real time connection between the originating station and the receiving station, and delivery may be in the order of 2 to 7 minutes. Inmarsat-C does not provide telephone communications (voice). ■

Inmarsat Fleet F77 is equipped to meet the latest distress and safety requirements as specified by the International Maritime Organisation (IMO) in resolution A.888 for voice pre-emption and prioritisation within the Global Maritime Distress and Safety System (GMDSS). Inmarsat Fleet F77 was approved by IMO's Maritime Safety Committee (MSC75) as meeting the requirements and recommended fitting on vessels participating within the GMDSS

The first Inmarsat Fleet service, Fleet F77, provides for voice communication by connecting to the telephone network and both the high quality and speed of a full 64 kbit/s Mobile ISDN service and the flexibility of the Inmarsat Mobile Packet Data Service (MPDS). ■

INMARSAT-C SHIP EARTH STATIONS

COMMUNICATIONS CAPABILITY

Inmarsat-C is a two way data messaging system that enables users to transmit and receive messages to and from other Ship Earth Stations as well as telex and data subscribers anywhere in the world. ■

Inmarsat-C does not provide voice communications. ■

The Inmarsat-C service operates on a store and forward basis. A message must be completely assembled by the operator prior to transmission. On command the equipment transmits that message in packets (or bursts) of data. ■

The routine delivery time for an Inmarsat-C message depends on message length but is in the order of two to seven minutes. Once the message is successfully delivered, a delivery advice message will be sent to the originating station. ■

The Inmarsat-C service allows the necessary interchange of data to support the Vessel Monitoring System (VMS) used by fisheries management authorities in Australia and other parts of the world.

TERMINAL EQUIPMENT

An Inmarsat-C Ship Earth Station consists of an antenna, an electronics unit, a message processor, a visual display unit (VDU), keyboard and printer. The message processor may contain a floppy disk drive for storing transmitted and received messages. An Enhanced Group Calling (EGC) receiver will be incorporated. ■

Transmitted messages are prepared on the keyboard prior to transmission or may be transferred by floppy disk from other computer sources. Received messages will be available on the VDU and/or the printer. ■

The terminal will provide an audible and/or visual alarm to alert a vessel's watch keeper to the reception of any distress or other important message received by the Enhanced Group Calling system. ■

Operators should take care that computer virus infection is not transferred to the terminal software. ■

Inmarsat-C only requires a narrow bandwidth of radio spectrum to enable communications. As a consequence, only relatively low power is required to communicate with the satellites, and a small, lightweight omnidirectional (radiating equally in all directions) antenna is necessary. ■

The omnidirectional characteristics of the antenna mean that it requires no moving parts and stabilisation against vessel movement is not necessary. ■

Ideally, an Inmarsat-C terminal should be interfaced with satellite position-fixing equipment such as GPS, to provide current position information in the event of a distress situation. ■
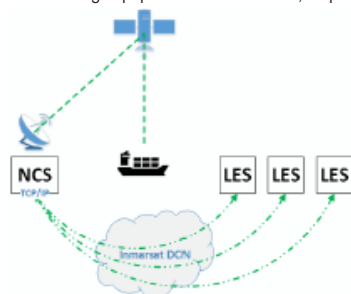
PRINCIPLES OF OPERATION

The Inmarsat-C system uses four Network Co-ordination Stations (NCS), one in each of the ocean regions, to manage communications within that region and the sattellite. The Network Co-ordination Stations are linked to Land Earth Stations by Propriety Data Networks. ■

Each NCS transmits continuously on a special satellite channel known as the NCS common channel which is used for the broadcast of service information and Enhanced Group Calling (EGC) information to Ship Earth Stations. ■

However, before Inmarsat-C service is available to a Ship Earth Station (SES) it is necessary for that SES to be logged-in to the NCS in the appropriate ocean region. ■

Once logged-in the SES equipment continuously monitors the NCS common channel when in an idle condition (that is, when not performing other tasks). ■

By using the information contained on the NCS common channel, the SES equipment can automatically gain access to a working channel for a particular Land Earth Station for the transmission or reception of a message.

LOGGING-IN AND LOGGING-OUT PROCEDURES

On initial switch-on and whenever the equipment has been switched off, it is necessary for the operator of an Inmarsat-C Ship Earth Station to perform a log-in. This simple procedure synchronises the SES's terminal to the NCS common channel and informs the NCS that the SES is operational. Some models of Inmarsat-C will perform this task automatically on switch-on. ■

As a vessel transits from one ocean region to another, it is necessary to change the log-in (for example from the Indian Ocean NCS to the Pacific Ocean NCS). Some models of Inmarsat-C will perform this task automatically while others require operator intervention.

A distress alert can still be transmitted even if the Ship Earth Station is not logged-in. ■

If, for any reason, the terminal is to be switched off for an extended time, the operator should perform a logging-out procedure. Failure to do this means that the terminal remains registered with the Network Co-ordination Station as active and a Land Earth Station may keep trying to deliver a message. This may result in an unnecessary delay in advising the sender of non-delivery of a message and charges for the repeated attempts. ■

INTERFACE WITH NAVIGATIONAL EQUIPMENT

Usually a Ship Earth Station terminal will be interfaced with the vessel's satellite position-fixing equipment (for example GPS) to provide accurate and current position information in the case of a distress alert. This information resides in the memory of the equipment's distress alert generator. ■

Accurate position information is also necessary to ensure that the terminal's Enhanced Group Calling receiver responds to shore-to-ship distress alerts and other important messages which are relevant to the vessel's position. ■

On vessels where the Inmarsat-C terminal is not interfaced with position-fixing equipment, it is essential that the vessel's position, course and speed are manually entered by the operator at intervals not exceeding 4 hours. ■

Most modern Inmarsat-C terminals have an inbuilt GPS receiver.

INMARSAT ENHANCED GROUP CALLING RECEIVERS

GENERAL INFORMATION

The Inmarsat system provides a service known as Enhanced Group Calling (EGC) which provides the broadcast of information to selected Ship Earth Stations in an ocean region. This information includes maritime safety information (MSI) that includes distress alerts, navigational warnings, meteorological warnings and forecasts, and other important safety information for vessels. ■

An EGC receiver is incorporated into Inmarsat-C equipment.

Two types of EGC messages are available SafetyNET™ and FleetNET™ (both names are registered trademarks of Inmarsat). ■

SafetyNET™ allows authorised organisations to broadcast shore-to-ship maritime safety information. Authorised organisations include:

- hydrographic offices, for navigational warnings;
- meteorological offices, for weather warnings and forecasts; and
- maritime rescue co-ordination centres, for shore to ship distress alerts, search and rescue communications and other urgent or important information. ■

FleetNET™ allows authorised organisations to broadcast information to selected groups of Ship Earth Stations. The selected SESs may belong to a particular fleet or flag, or be a registered subscriber to a commercial service. Authorised users include;

- shipowners, for the broadcast of fleet or company information;
- government's, for the broadcast of messages to a particular country's vessels; and
- news subscription services, for the broadcast of news bulletins.
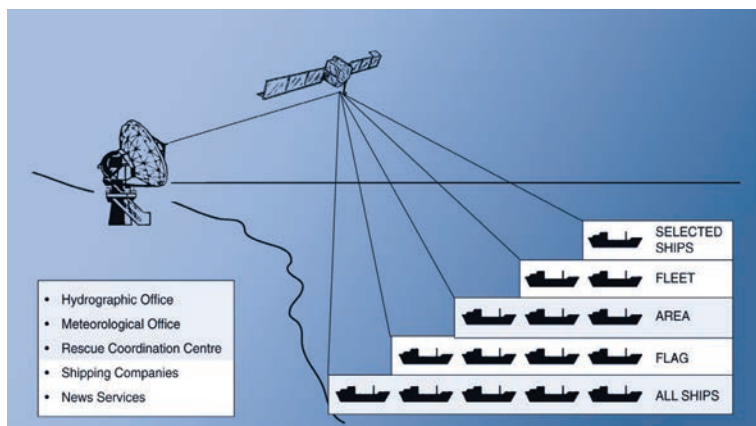
Basic concept of the Inmarsat Enhanced Group Calling System (the shaded area indicates functions of the SafetyNet™ Service)

BROADCASTS OF EGC MESSAGES

An EGC message, whether SafetyNET™ or FleetNET™, is broadcast over an entire ocean region and is received by all Ship Earth Stations which are tuned to the Network Co-ordination Station common channel. However, the message is only accepted by those EGC receivers which are in the geographical area specified by the authorised information provider, or have been programmed to accept that particular type of EGC message. All other EGC receivers reject the message. ■

EGC address selections that may be specified by an authorised information provider are:

- vessels within a fixed, or uniquely defined, geographical area;
- vessels belonging to a particular flag or fleet;
- a particular vessel; and
- all vessels within an ocean region. ■

All EGC messages carry a unique coding which allows the EGC receiver to automatically suppress storage and printing of messages that are received more than once if the original message has been correctly received. ■

BROADCASTS OF SAFETYNET™ INFORMATION

Information providers of maritime safety information make use of the EGC system's geographical area addressing capabilities. For example, EGC messages containing weather forecasts and navigational warnings will normally be sent to fixed areas, while EGC messages concerning a local storm warning or distress alert relay will be sent to a uniquely defined area. Information about EGC broadcasts of weather forecasts and warnings by the Bureau of Meteorology can be obtained from the Bureau's website (www.bom.gov.au). ■

The decision made by a Ship Earth Station's EGC receiver to accept or reject such messages is entirely electronic and relies solely on comparison with the geographical position data which resides in the memory of the EGC facility. Therefore it is essential that the EGC facility is continuously provided with correct vessel position information. If an interface with a satellite position fixing equipment is not provided, the EGC facility should be manually updated at intervals not exceeding four hours. ■

On most Inmarsat-C equipment, the position routinely entered into the distress alert generator, either manually or electronically by an interface, also updates the EGC facility. ■

Failure to update the EGC facility with the position within a 12 hour interval will result in the EGC receiver accepting all maritime safety information with priorities higher than 'routine' for the entire ocean region, regardless of the specified geographical address. ■

Operators of Inmarsat-C Ship Earth Stations which incorporate an EGC facility should obtain a copy of the Australian Marine Notice which details the arrangements for the promulgation of maritime safety information via Inmarsat's EGC system. Further information is available from the Australian Maritime Safety Authority's (AMSA) Internet site (http://www.amsa.gov.au). Further information regarding broadcasts of SafetyNET™ information can be found in the Australian GMDSS Handbook also available from AMSA offices.

Operators should also consult the equipment manufacturer's handbook for specific instructions on how to programme the EGC facility to ensure that relevant information is received and, if required, printed.

Reception of shore to ship distress alerts and messages which carry an 'urgent priority' will be marked by audible and/or visual alarms to attract the attention of a vessel's watch keeper. ■

INMARSAT FLEET F77 EQUIPMENT

GENERAL INFORMATION

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EXAMINATION REQUIREMENTS FOR THE MARINE SATELLITE COMMUNICATIONS ENDORSEMENT (SATCOM)

Candidates require an understanding of:

- The concepts underlying the Inmarsat satellite system, including location of satellites, global coverage, ocean regions, network co-ordination and control stations and land earth stations.

- The worldwide rescue co-ordination centre (RCC) network and automatic routing of distress messages.

  Candidates require a detailed knowledge of:

  - Transmission and reception of distress alerts

  - The procedures to follow in the advent of a false distress alert transmission

  - Transmission and reception of priority alerts

  - The Enhanced Group Calling system for reception of Maritime Safety Information

MARITIME SAFETY INFORMATION SERVICE PROVIDERS.

Candidates require a knowledge of:

- The functionality of Inmarsat type C and Fleet F77 equipment.

- Antenna stabilization and shadows.

- Radiation hazards associated with Inmarsat equipment installations.

- Interfacing with navigational equipment and manual position updating of Inmarsat C.

- Logging-in and logging-out of Inmarsat C.

  - Reception of EGC messages

  - Transmission and reception of routine or general communications

  - Two digit special access codes

  - Authorised users of SafetyNET™

  - Authorised users of FleetNET™

INTERNET WEBSITES FOR GENERAL INTEREST

www.acma.gov.au	Australian Communications & Media Authority
www.amsa.gov.au	Australian Maritime Safety Authority
www.training.gov.au	The National Register on V.E.T
www.bom.gov.au	Bureau of Meteorology
www.cospas-sarsat.org	Cospas-Sarsat System
www.imo.org	International Maritime Organisation
www.inmarsat.com	International Maritime Satellite Service
www.itu.int	International Telecommunications Union

CONTACT DETAILS

Australian Maritime College (AMC)

Internet
www.amc.edu.au/marineradio

Central Office
Maritime Way
Newnham TAS 7248 or
Locked Bag 1394
Launceston TAS 7250
Freecall 1300 365 262
Telephone (03) 6324 9869
Email: amcom@amc.edu.au

Australian Search and Rescue
(a division of the Australian Maritime Safety Authority)

GPO Box 2181
Canberra ACT 2601
Email: aussarquery@amsa.gov.au

Emergency Phone Numbers:
1800 641 792

Australian Communications & Media Authority (ACMA)

Internet
www.acma.gov.au

Central Office - Canberra
Red Building, Benjamin Offices
Chan Street
Belconnen ACT 2616
PO Box 78
Belconnen ACT 2616
Telephone (02) 6219 5555
Facsimile (02) 6219 5353

Outside Sydney, Brisbane, Melbourne, Perth and Cairns areas:

Telephone: 1300 850 115
(A call to this number can be made from outside the listed areas and will be charged at the local rate, except for mobile phones, which are timed.)

Bureau of Meteorology

Internet
www.bom.gov.au

Head Office - Melbourne
700 Collins Street
Docklands VIC 3000
PO Box 1289
Melbourne VIC 3001
Telephone (03) 9669 4000
Facsimile (03) 9669 4699

NOTES

INTERNATIONAL CODE FLAGS

Alfa
Diver Down Keep Clear

Bravo
Dangerous Cargo

Charlie
Yes

Delta
Keep Clear

Echo
Altering Course to Starboard

Foxtrot
Disabled

Golf
Want a pilot

Hotel
Pilot on Board

India
Altering Course to Port

Juliet
On Fire Keep Clear

Kilo
Desire to Communicate

Lima
Stop Instantly

Mike
I am Stopped

November
No

Oscar
Man Overboard

Papa
About to Sail

Quebec
Request Pratique

Romeo

Sierra
Engines Going Astern

Tango
Keep Clear

Uniform
Standing into Danger

Victor
Require Assistance

Whiskey
Require Medical Assistance

Xray
Stop Your Intention

Yankee
Am Dragging Anchor

Zulu
Require a Tug

SOME USEFUL TWO LETTER SIGNALS

AC - I am abandoning my vessel

AN - I need a doctor

BR - I require a helicopter

CD - I require immediate assistance

DV - I am drifting

EF - SOS/MAYDAY has been cancelled

FA - Will you give me my position?

GW - Man overboard. Please take action to pick him up.

JL - You are running the risk of going aground.

LO - I am not in my correct position (used by a light vessel)

NC - I am in distress and require immediate assistance

PD - Your navigation lights are not visible

PP - Keep well clear of me

QD - I am going ahead

QT - I am going astern

QQ - I require health clearance

QU - Anchoring is prohibited

QX - I request permission to anchor

RU - Keep clear of me; I am manoeuvring with difficulty

SO - You should stop your vessel instantly

UM - The Harbour is closed to traffic.

UP - Permission to enter Harbour is urgently requested. I have an emergency

YU - I am going to communicate with your station by means of the International Code of Signals

ZD1 - Please report me to the Coast Guard, New York

ZD2 - Please report me to Lloyds, London

ZL - Your signal has been received but not understood

MARINE COMMUNICATIONS
SATELITTE SYSTEMS AND EQUIPMENT