

1. Marine VHF radio equipment



The marine VHF radio is an invaluable piece of communications equipment that is used round the world on board of all kinds of ships, from small sailing boats to giant tankers. VHF communications are suitable for vessels remaining relatively close to the coast and within range of coast stations operating on VHF channels, but VHF can also be used for inter-ship calls anywhere on the open seas.

A set of functions and operator controls are common to traditional (voice-only) fixed-mount VHF equipment, to handheld VHF radios and to the currently available VHF devices equipped with a *Digital Selective Calling (DSC)* controller. These functions (volume, squelch, dual watch, power selection, etc) can be found within each brand of equipment, although they might differ on how they are set up or implemented.

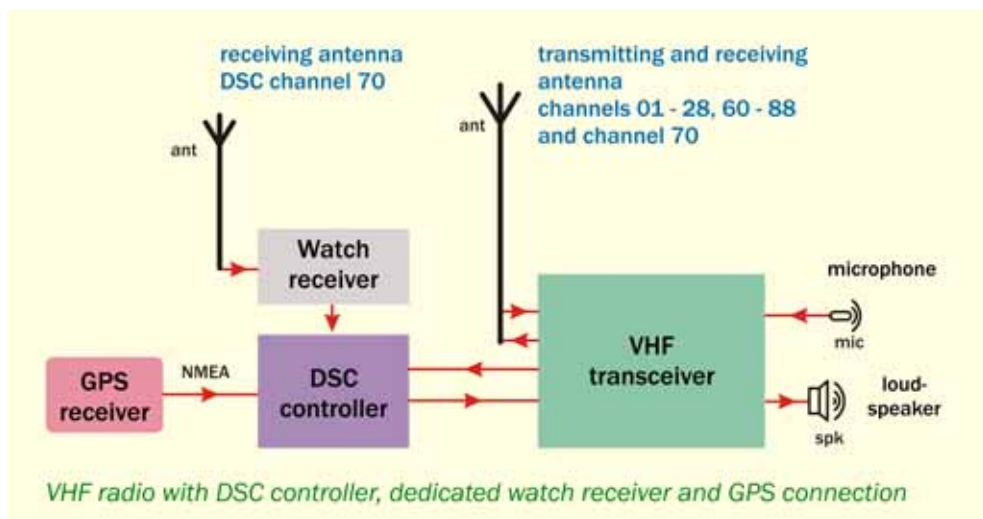
DSC provides a simple and reliable means of establishing contact prior to starting voice communications. The DSC controller sends a digital signal that will ring other DSC radios by triggering an alarm and displaying details about the caller and the nature of the call. Once a DSC call has been transmitted to a particular station or to all stations in the area, a *voice message* should be sent in the normal way. Marine VHF radios fitted with DSC functions may also offer a single-button distress alert facility and automatic watch-keeping.

Handheld VHF equipment can render great service to those at sea, being used as additional or back-up equipment in the cockpit, or in a life-raft in an emergency. Some of the models now have a built-in GPS receiver and a limited set of DSC functions.

Digital Selective Calling allows mariners to instantly send an automatically formatted distress alert to the coastguard or other rescue authority anywhere in the world. DSC also allows mariners to initiate or receive distress, urgency, safety and routine radiotelephone calls to or from any similarly equipped vessel or shore station, without requiring either party to be near a radio's loudspeaker. The the digitally transmitted information (eg MMSI number, distress position) is displayed in writing.

Furthermore, Digital Selective Calling allows calling to a particular station selectively by its MMSI number (see below for a definition). In the event of a distress alert, or an announcement of an urgency or safety call, all ships and all coast stations in range are alerted.

VHF radios equipped with a DSC controller have a dedicated watch receiver to monitor channel 70 using a receiving antenna (small craft and pleasure boats have only one common antenna). A VHF–DSC radio should have a GPS interface to obtain the position of the ship.



Channel 70 is automatically selected for all the communications in DSC. It is reserved worldwide for the exclusive use of Digital Selective Calling. Once a contact has been established on channel 70 by digital transmission, the communication continues by analogue transmission (in radiotelephony) on a working channel.

When a DSC call is received by another station, its VHF radio starts ringing an alarm and details of the call are displayed. If the call remains unanswered, these details are recorded in the VHF radio's log of received calls. If the call is taken immediately by the station called, the two VHF–DSC radios are automatically tuned to the same working channel for subsequent voice transmissions.

The automatic nature of Digital Selective Calling and of its reception makes watch keeping on channel 70 automatic as well.

GPS receiver interface

When a GPS receiver is connected to a ship's system, the marine VHF radio shows the position of the ship and the current time. The accurate position of a ship in distress will be included as part of any DSC distress alert, giving valuable information for the search-and-rescue operations. Many VHF radios can also request positions of other ships and respond to a position request of another ship station or a coast station.

List of Ship Stations of the ITU

The *List of Ship Stations* contains particulars of more than half a million ship stations (name, call sign, MMSI, country, EPIRB), class of ship (eg oil tanker, yacht, ferry, ice breaker, etc) and frequency bands (eg MF, HF, VHF) used for telegraph or telephone communications. It is a combined printed and CD edition.

List of Coast Stations of the ITU

The *List of Coast Stations* contains information on coastal radio stations and coastal earth stations participating in the GMDSS (MF-, HF- and VHF-band watch-keeping, Navtex stations and SAR Coordination Centres), as well as particulars of coast radio stations providing a public correspondence service (see below).

For each coast station you will find the type of services provided (eg radiomedical consultation, weather reports), contact address, etc. For each radio channel, the MMSI to be used, transmitting and receiving frequencies, class of emission, transmitter power, watch-keeping hours and the geographical co-ordinates of the transmitting antenna are all given.

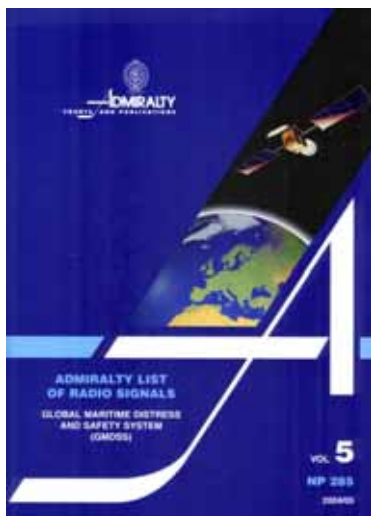
There are separate notes about charges and accounting authorities for public correspondence services.



List of Call Signs of the ITU

List of Call Signs and Numerical Identities of Stations Used by the Maritime Mobile and Maritime Mobile-Satellite Service contains the identification codes of stations.

Admiralty List of Radio Signals (ALRS)



Admiralty List of Radio Signals (ALRS), published in 6 volumes by the UK Hydrographic Office, provides a comprehensive source of information on several aspects of maritime radiocommunications: vol 1 – Coast Radio Stations; vol 2 – Radio Aids to Navigation; vol 3 – Maritime Safety Information Services; vol 4 – Meteorological Observation Stations; vol 5 – Global Maritime Distress and Safety System; vol 6 – Pilot Services, Vessel Traffic Services and Port Operations.

Public correspondence

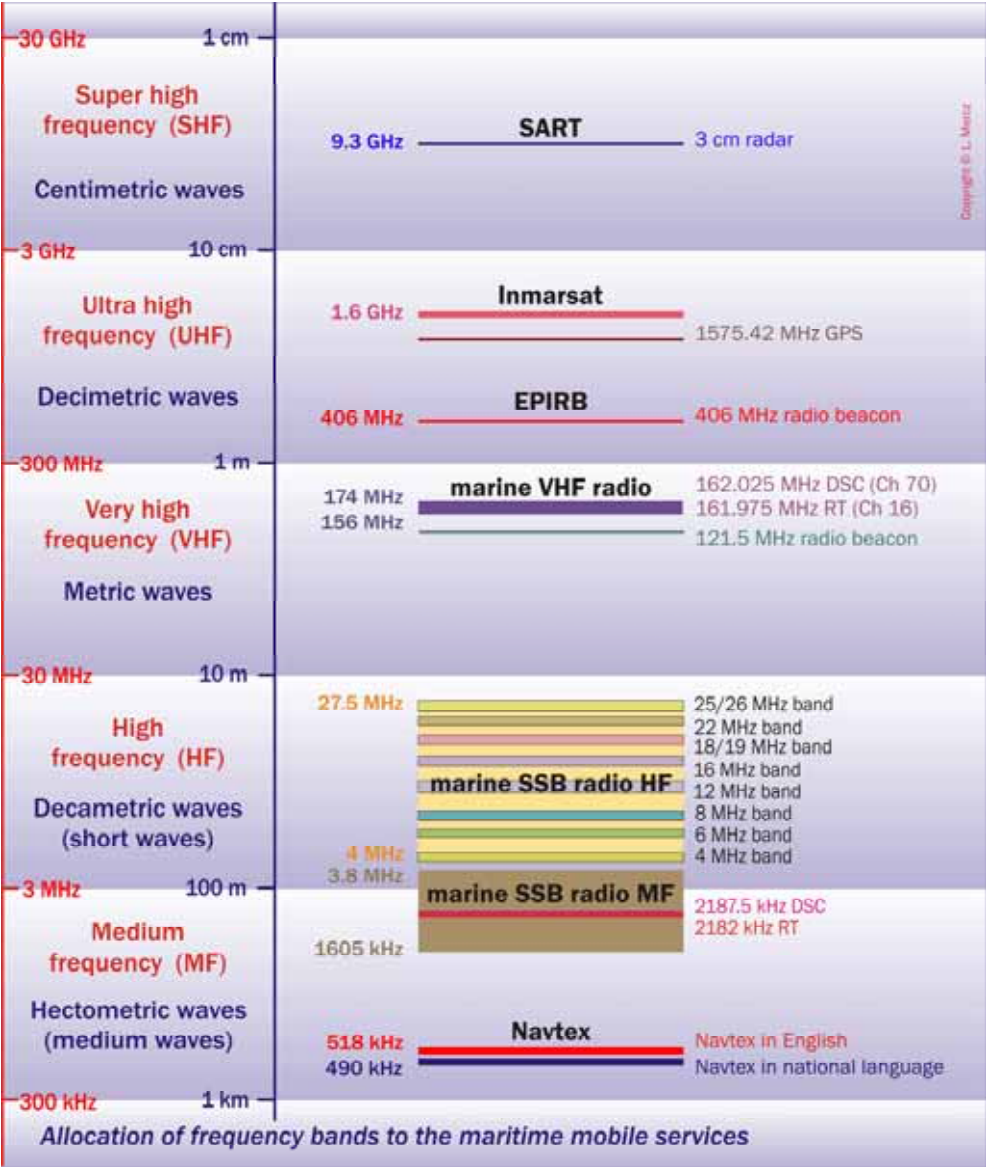
Communications by radio at sea are free of charge, except radiotelephony, radiotelegram and radiotelex services with a subscriber at land, officially known as *public correspondence*.

The coast stations that accept public correspondence (sometimes called Marine Operators) link calls with the relevant subscribers, and details of the working channels can be found in the ITU's *List of Coast Stations*, in yachting almanacs and in other reference works. Many large ship stations are also open to public correspondence.

Frequency bands and radio wave propagation

In the radio spectrum there are three frequency bands for the maritime mobile service used for communications by marine VHF radios and marine MF/HF SSB radios. The spectrum has moved towards higher frequencies as radiocommunications has developed over the last hundred years. Thus we have:

- the marine SSB radio in the medium frequency (MF) band of 1,605–3,800 kHz;
- the marine SSB radio in the high frequency (HF) band of 4.0–27.5 MHz; and
- the marine VHF radio band of 156–174 MHz.

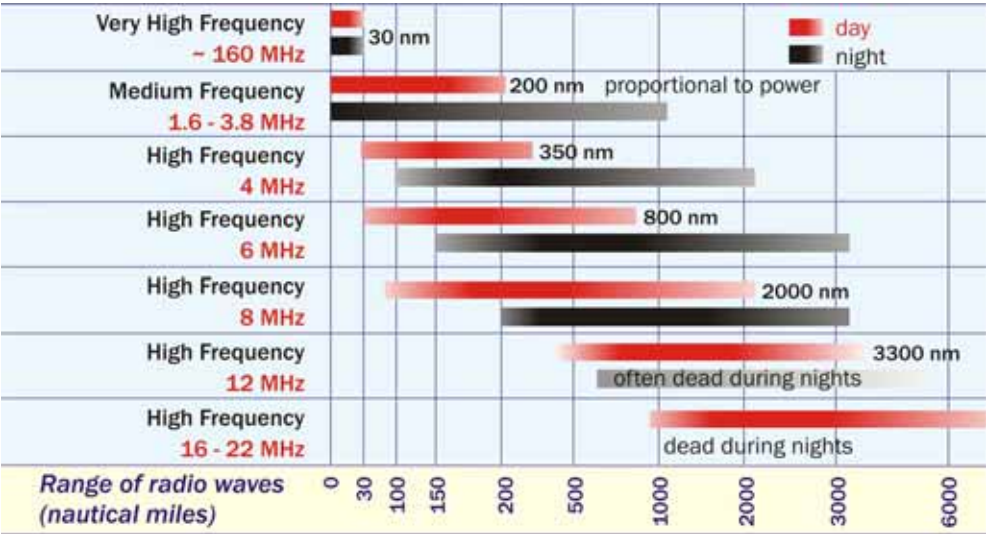


In addition to these radio bands, others frequency bands are assigned for different types of communication in the Global Maritime Distress and Safety System (GMDSS).

- **Direct (line-of-sight) waves:** the transmitter and the receiver are visible to each other. This type of propagation is characteristic of the very high frequencies of marine VHF radios and AIS systems, as well as those of satellite communications.

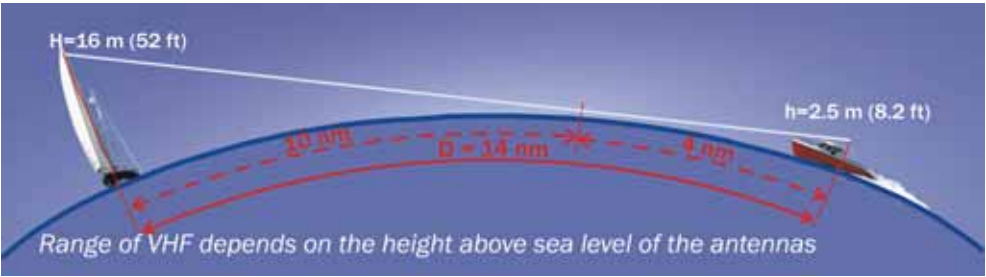
Range of radio waves

The *range* of a radio communications link is defined as the farthest distance that the receiver can be from the transmitter and still maintain a sufficiently high signal-to-noise ratio for reliable signal reception. Different parts of the radio spectrum have extremely different ranges, and the next diagram indicates such ranges.



VHF transmission range

The radio waves for VHF travel in straight lines from the transmitting antenna, but the distance up to which they can be received is limited by the curvature of the Earth’s surface. With full power, the communications range of a VHF signal is determined mainly by the height of the transmitting and receiving antennas.



The range, *D*, for a VHF transmission is given by the relation:

$$D \text{ [nautical miles]} = 2.5 \times (\sqrt{H \text{ [metres]}} + \sqrt{h \text{ [metres]}})$$

where *H* and *h* are altitudes above sea level of the two antennas.

Example: on board *Neptune* during an Atlantic crossing, you meet an oil tanker under flag of Malta. You want to contact it, but you cannot read the tanker's name.

Send your national flag and contact the tanker by VHF on channel 16, like this:

Northwest bound tanker with red funnel.

*This is Neptune, Neptune, the British yacht on your port side. Do you read me?
Over.*

As the tanker keeps aural watch on channel 16, normally you would hear its answer:

Station calling on channel 16.

*This is oil tanker Marbella. Please say again your name and call sign.
Over.*



You answer on channel 16:

*Marbella, this is Neptune, call sign Foxtrot Lima Six Two Zero Five.
Good afternoon. Could you please give me the last weather forecast for this area?
Over.*

Still on channel 16, *Marbella* proposes to switch to channel 08:

*Neptune, this is Marbella.
Good afternoon. Advise you change to VHF channel zero eight.
Over.*

Neptune confirms the change of channel on channel 16, before changing channel:

*Marbella, this is Neptune, changing to VHF channel zero eight.
Over.*

Marbella continues on channel 08:

*Neptune, this is Marbella.
The weather forecast for the area at 1200 hours UTC is
Do you need anything else? What is your destination?
Over.*

Neptune says goodbye on channel 08:

*Marbella, this is Neptune.
Thank you very much, nothing else. My destination is Gibraltar. We expect to ...
Over.*

The deck officer of *Marbella* on channel 08:

*Neptune, this is Marbella.
Have a good trip. Fair winds.
Out.*

Quiz 4

Questions

- 01 How should you identify the called station and your own station in each transmission?
- 02 What does the procedure word *Over* signify?
- 03 How should you ask for the repetition of a message or part-message that has been misheard?
- 04 How do you spell the name of the yacht *Mercator*?
- 05 What can you do to avoid harmful interference to other stations when you are calling a nearby station?
- 06 Generally speaking, who controls the communication process?
- 07 Who chooses the working channel when talking to a coast radio station?
- 08 Who chooses the working channel when communicating with another ship?
- 09 How would you say that you will be close to a boat in distress in about a half an hour?
- 10 When should you give the name of the called station three times?
- 11 What happens when you press the PTT (press-to-talk) switch on the microphone of your VHF radio?
- 12 What should you do prior to the commencement of a transmission?
- 13 What do you say if you are uncertain of the identity of a station calling your boat?
- 14 How can you pay for any telephone conversations made via a coast station?
- 15 What are the channels from which you can nominate a working channel when you call another yacht, boat or ship?
- 16 In coastal cruising, how can you receive a telephone call from the family at home or from your office?
- 17 Why should you learn to use a small set of standard marine communication phrases in English as defined by the International Maritime Organization?
- 18 How often should an unanswered DSC routine call be repeated?
- 19 Which channel is used for initial contact between ships via a handheld VHF radio without DSC functions?
- 20 How long should a routine call on channel 16 last before changing to a working channel?



Answers on next page.

Operating a marine VHF radio

Getting started

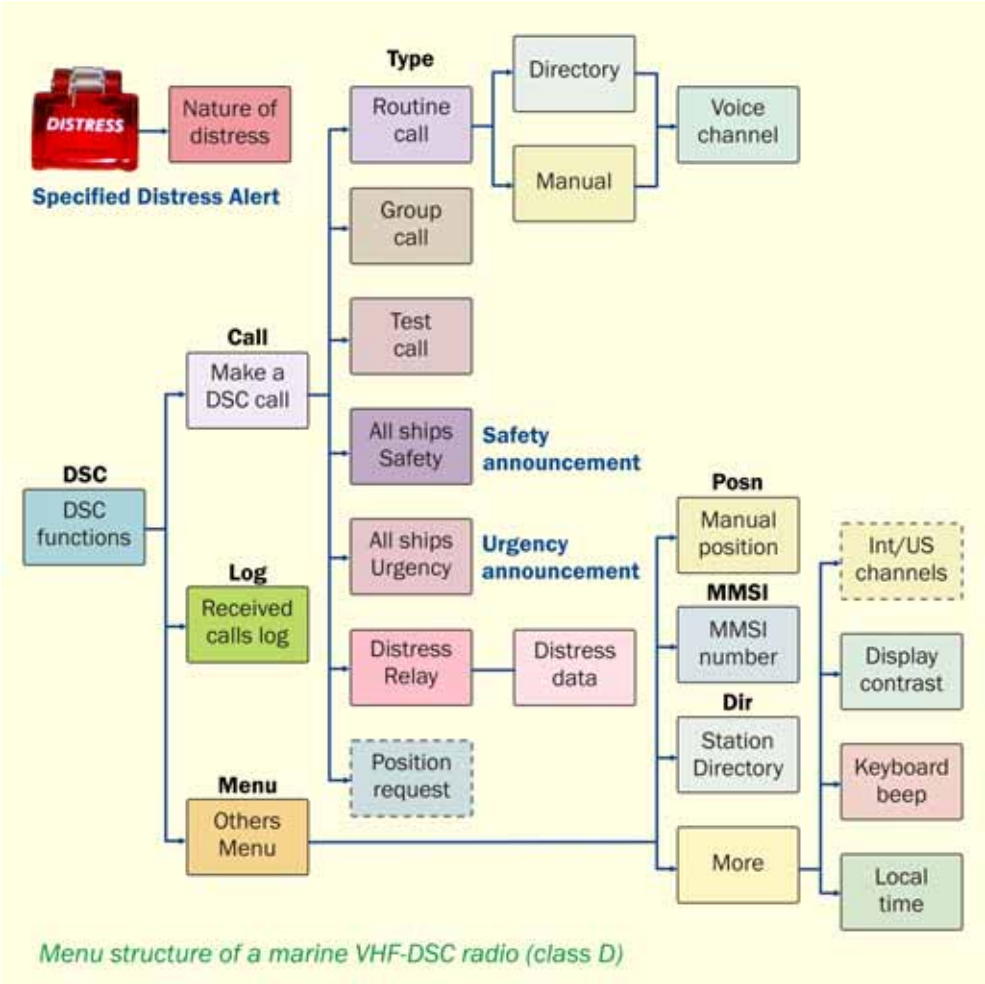
When your marine VHF radio is switched on, channel 16 is selected and high transmission power is set. Channel 16 is used for establishing initial contact with a station and for emergency communications. Channel 16 is monitored during both dual-watch and triple-watch modes of VHF radio operation. While standing by, you must monitor channel 16. When a VHF–DSC is switched on, the equipment will automatically monitor channel 70 for incoming DSC calls.

Adjust the audio volume and set the squelch level until background noise disappears.

Understanding the DSC functions

To use the DSC functions for anything other than a distress alert, it is necessary to understand the menu structure, the interface and the guide to the information on the display of your VHF–DSC radio.

The diagram below shows the DSC functions of a marine VHF radio with Class D controller, as implemented by the *Mercator Marine VHF Radio Simulator*.



Alligator, this is the Swiss yacht Mercator.

Good afternoon. We left the *Maddalena archipelago* two days ago.

Have you got a mooring in *Porto Cervo*?

Over.

If your DSC routine call remains unanswered, wait 5 minutes, call again, wait 15 minutes and call again. If the VHF–DSC of the called station was switched on, your unsuccessful call will be *Alligator's* log of received calls.

Calling a coast radio station – example

Using a VHF–DSC radio, a digital selective call replaces the initial voice call. The ship calls a coast radio station by its MMSI number, so you have to prepare a list of the stations likely to be called. No working channel need be proposed, because when the coast station acknowledges the reception by DSC, it will nominate a working channel for the subsequent voice conversation.

Example: The Norwegian fishing vessel *Fiskeladden*, on its way to the *Spitzberg*, makes contact with *Floro Radio* for a radiomedical consultation.

The MMSI number of *Floro Radio* is 002570500 and was previously recorded in the directory of the VHF radio of *Fiskeladden*. *Floro Radio* provides a radiomedical consultation service, according to the MARS database. There is no urgent need of help, but the captain would like to get medical advice concerning some health problems of a crew member. He is therefore making a routine call – not an urgency call, which is to be used for requesting medical assistance.

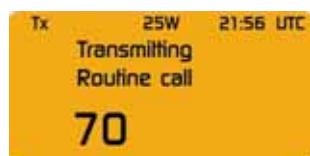
Fiskeladden contacts *Floro Radio* on the VHF radio by an individual routine call.

Select **Call** and choose **Type of Routine call**:



Scroll through the directory until *Floro Radio* is found. No voice channel is proposed as it will be nominated by the coast radio station.

Initiate the transmission by **Send**, then by the **ENT** key.

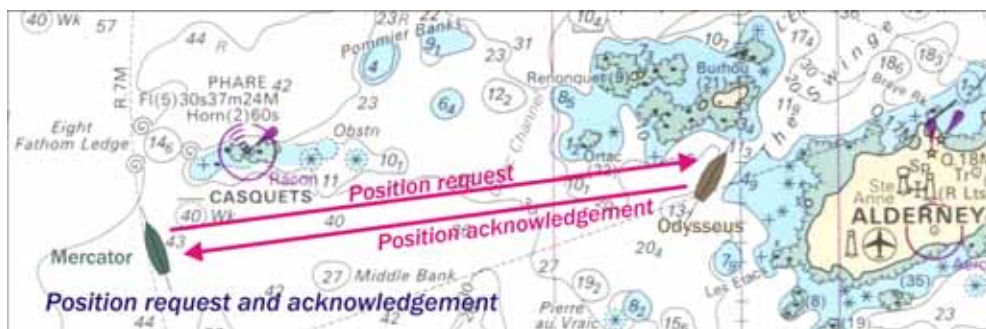


Transmission of the individual routine call by DSC on channel 70 takes about half a second.

An audible alarm rings at *Floro Radio* and the MMSI of *Fiskeladden* is displayed.

Floro Radio proposes channel 23, a duplex working channel used by Gulen, one of several sites of Floro Radio, the closest to the calling vessel's position. Floro Radio has even several offshore sites, each keeping watch on its own working channel).





Position report call

The *Position report* call by DSC is the inverse of a *position request*: instead of requesting the position of another vessel, the *position report* function allows you to send your position to another vessel. This function is not a standard Recommendation ITU-R M.493 call, but most high-end VHF radios have implemented it. The other vessel normally sends an acknowledgement, either automatically or manually.

Pooling request call

Another simple but powerful function is used by coast stations. It is not standard on Class A or Class D controllers, but some VHF–DSC radios offer the function.

A *pooling request* call by DSC is originated from a coast radio station to know whether a specific vessel (identified by MMSI number) is within communications range. The vessel's acknowledgement means "Yes, I am within range," but no position is transmitted. A *pooling request* thus establishes nearness but does not convey a vessel's exact position.



6. Distress, urgency and safety communications



Safety of navigation is a major concern for all ships, from huge tankers to small pleasure boats, even if the vessels are not participating in the Global Maritime Distress and Safety System (GMDSS). The latest issue of the *ITU's Radio Regulations* make distress, urgency and safety voice procedures compatible for all vessels, whether equipped with VHF–DSC radios or with voice-only radios without any DSC functions.

A marine VHF radio with integrated DSC functions allows transmission of a *distress alert* by the push of a **DISTRESS** button, and this alert will be received by all ships and coast stations within range of their VHF–DSC by means of its automatic watch receiver. The most vital information, namely the identity and position of the vessel in distress and (generally) the nature of distress, are made available immediately.

A distress alert, and also a distress relay, must be followed by the appropriate voice **MAYDAY** calls on channel 16, so as to inform stations without DSC facilities.

Similarly, an *urgency announcement* and a *safety announcement* sent by DSC are followed respectively by a **PAN PAN** and by a **SECURITE** voice message, with all necessary details supplied.

These *operating procedures* for receiving or transmitting a distress, urgency or safety communication by marine VHF radio are strictly regulated and should be well understood by radio operators.

Since it is not possible to practise distress, urgency and safety procedures on a real radio, a VHF radio simulator is the ideal method to ensure you are ready for the unexpected.

General provisions

The *Global Maritime Distress and Safety System (GMDSS)* has been set up to provide an international communication network to assist vessels in distress. All distress communications in the maritime mobile service – whether by radiotelephony, Digital Selective Calling (DSC), satellite techniques and/or direct-printing telegraphy (telex) – must be conducted strictly in accordance with correct procedures. This ensures that vessels in distress obtain help without delay.

There are 3 levels of emergency defined in the GMDSS and, in order of priority, they are: *Distress*, *Urgency* and *Safety* – well known by their signals of *MAYDAY*, *PAN PAN* and *SECURITE* used in radiotelephony.

Digital Selective Calling (DSC) does not replace traditional radiotelephony but uses the latest technology to enhance it. A brief digital sequence will activate all alarms in any VHF–DSC radios within range and alert any operators of those radios to listen on the distress, urgency and safety channel for the subsequent voice call and message.

A digital selective call transmitted on channel 70 contains the identity of the calling station and the priority or purpose of the call. Most importantly, a distress alert also includes the position of the distressed vessel and possibly the nature of the distress.

But there are many traditional fixed-mount VHF radios and handheld VHF sets in use without the DSC facility. Therefore each and every DSC call should be immediately followed by a radiotelephony call and message so that voice-only stations are not excluded from modern marine communications. The revised procedures of the latest *ITU Radio Regulations* make this possible.

Terminology of calls and messages

We use the generic term *call* in the broadest sense to designate both DSC calls and radiotelephony (ie voice) calls – using the term *alert* to designate all types of DSC call is incorrect. The Radio Regulations terminology of DSC calls is: distress alert, urgency announcement, safety announcement and routine call.

Category	Priority	DSC calls	Signals in radiotelephony	Kind of message
<i>Distress</i>	1	Distress alert	distress signal: <i>MAYDAY</i>	Distress call and message
<i>Urgency</i>	2	Urgency announcement	urgency signal: <i>PAN PAN</i>	Urgency call and message
<i>Safety</i>	3	Safety announcement	safety signal: <i>SECURITE</i>	Safety call and message
<i>Routine</i>	4	Routine call	–	routine message (none of the above)

Priority of communications

VHF radio calls have four levels of priority defined for maritime mobile services:

1. *Distress* alerts, distress acknowledgements, distress relays, distress traffic.
2. *Urgency* announcements, urgency calls and messages.
3. *Safety* announcements, safety calls and messages, test calls, position requests.
4. *Routine*: individual routine calls, group calls, polling and telephone call requests.

Distress communications

Distress is defined as a situation where, in the opinion of the master, a vessel, aircraft, vehicle or person is in grave and imminent danger and requires immediate assistance.

A dismasting or a disabled engine offshore does not in itself qualify for a distress call. However, a yacht sinking, or a man overboard in severe weather or sea conditions and with little chance of recovery by those on board, is in grave and imminent danger and would qualify for a distress communication.

A distress communication by a VHF–DSC comprises a *distress alert* that is started with the **DISTRESS** button and sent by DSC, and then a voice *distress call* and a *distress message* with **MAYDAY** on channel 16, providing the position and requesting immediate assistance. The form of distress communications is defined by the RR Article 32.

Never use the Distress call when your ship or person is not in an emergency situation. A distress call should be transmitted only when immediate help is needed.

Only the skipper of a vessel can authorise the sending of a distress alert. It has priority over all other radio traffic and automatically imposes radio silence on all stations in the area not involved in the rescue.

Distress alert by DSC

The red **DISTRESS** button makes it possible to transmit a distress alert automatically with the MMSI number of the boat, the position and the UTC time at this position, and possibly the nature of the distress.

The **DISTRESS** button is covered by a red flip-top cover. This spring-loaded cover must be lifted before the button can be pressed, so as to avoid accidental depression.



Lift the cover on the **DISTRESS** button and press the button *briefly*.

The Distress alert menu will appear on the DSC screen.

If you press and *hold down* the **DISTRESS** button for 5 seconds, a Distress alert will be sent immediately with the default option for the nature of distress as **Undesignated**.

As the distress alert includes the ship's position and the UTC time when it was valid, check the GPS position information.



If no valid position is indicated, the latitude and longitude values flash and the **Posn** function appears, which allows updating the position manually.

See chapter 5 on how to update your position manually.



If you have sufficient time, select the appropriate nature of the distress, presented as a number of options.

Scroll through via the **Sel** soft key – ie **Fire, Explosion;**

Flooding; Collision; etc. Then press **ENT** to confirm.



Lift the cover on the **DISTRESS** button, *press and hold down for 5 seconds* using the DSC countdown to zero (see below).

If the **DISTRESS** button is released before five seconds are up, the radio will return to normal operation and no distress alert will be sent.

Although the **PAN PAN** call will not necessarily impose general radio silence, you should expect an immediate response from one or more stations called. Probably the nearest coast radio station or the coastguard will respond.

Urgency communications – example

Example: You are on board the fishing vessel *Trident*, on the way to St Helier (Jersey). In the Western Passage, the vessel's propeller has been entangled in a heavy fishing net and its engine does not therefore function any more. The current of 3.5 knots is pushing the vessel towards the rocks of Demi-de-Pas.

You have to ask for towing assistance, because within 30 minutes *Trident* will be broken on the rocks of Demi-de-Pas. You send an *urgency call* by DSC to all stations, and then a voice call on channel 16.

Urgency announcement sent by DSC

Your VHF radio is in dual-watch mode on channel 14 in order to monitor *St Helier Port Control*. You switch to DSC mode and select **Call** to make an urgency announcement:



Select the **Type** of digital call: **All ships Urgency call**. The voice communication will follow on channel 16. Initiate the call by **Send**, and then confirm via the **ENT** key.

In a few seconds, channel 16 is selected automatically with high power of 25 watts.



The following calling sequence is transmitted by DSC:



Ship stations and coast stations within range will receive the call and the alarm will ring on their VHF–DSC radio.

Urgency call and message by voice

Trident will use a complete identification of the station, including its MMSI number, so that stations receiving the voice call will know that the vessel is the one that had transmitted the urgency call by DSC a few seconds earlier. *Trident* would say:

should, where practicable, be transmitted on a working channel; a suitable indication to this effect should be made at the end of the safety call.

First alternative:

Safety call on channel 16 and instructions to change to a working channel:

SECURITE, SECURITE, SECURITE.

ALL STATIONS, ALL STATIONS, ALL STATIONS or {name of the called station}

THIS IS {name of the vessel}, {name of the vessel}, {name of the vessel},

CALL SIGN {call sign of the vessel},

MMSI {MMSI of the vessel}.

Please switch to {working channel} to listen ...

The *safety message* is transmitted on the working channel:

{the text of the safety message}.

OUT.

Second alternative:

Safety call and Safety message on the selected working channel:

SECURITE, SECURITE, SECURITE.

ALL STATIONS, ALL STATIONS, ALL STATIONS {or name of the called station}

THIS IS {name of the vessel}, {name of the vessel}, {name of the vessel},

CALL SIGN {call sign of the vessel}, spelled

MMSI {MMSI of the vessel}.

{the text of the safety message}.

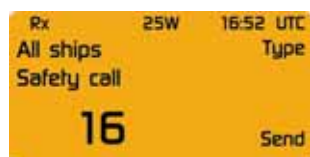
OUT.

The text of the safety message could well include the vessel's position or the position of an obstruction.

Safety call by a ship station – example

Example: on board the French fishing vessel *Allegro*, at the mouth of the Gironde estuary in position 45° 36.4' N, 001° 30.2' W, on February 13 at 17h50 you see drifting logs which are judged to be dangerous to navigation.

Switch to DSC mode and select **Call** then the **Type** of the call:



Scroll to **All ships Safety call**.

The subsequent voice communication will be sent on channel 16. Time is now 16:52 UTC.

Initiate by **Send** and then confirm by the **ENT** key.



Answers

- 01 The Global Maritime Distress and Safety System (GMDSS), since 1999.
- 02 Marine VHF radios should have DSC functions to conform with GMDSS carrying requirements, but the *voice* procedures are applicable to all ship stations.
- 03 Priority of messages: 1, distress; 2, urgency; 3, safety.
- 04 When, in the opinion of the master, a vessel or a person is under the threat of grave and imminent danger, for which immediate assistance is required.
- 05 Press the red **DISTRESS** button on your VHF–DSC radio and hold it down for five seconds. It must be followed by a voice **MAYDAY** call and message.
- 06 No. A *distress alert* is sent by Digital Selective Calling (DSC) and a *distress call* is by radiotelephony (voice) starting with the distress signal **MAYDAY**.
- 07 Distress alerts by DSC and distress calls by voice are never addressed to a particular station; these calls are used to alert all stations.
- 08 A distress alert or distress call should only be sent on the authority of the master (captain, skipper, etc) or other person responsible for the ship.
- 09 The MMSI number of the ship in distress, her position, and the UTC time when the position was valid.
- 10 If time allows, the nature of the distress should be included in a distress alert, by scrolling through the available distress categories.
- 11 The coast station keeps continuous watch on VHF channel 70 and will send an acknowledgement immediately by DSC to all stations within range.
- 12 Yes. If for whatever reason no acknowledgement has been received after 15 seconds' wait, a voice *distress call and distress message* should be transmitted.
- 13 A *distress relay* call is sent by DSC and individually addressed to a coast station or rescue co-ordination centre A **MAYDAY RELAY** call should follow by radiotelephony.
- 14 By switching the VHF radio off and then on again (to terminate repeat messages) and by transmitting on channel 16 a message including **PLEASE CANCEL MY DISTRESS ALERT OF** {UTC time}.
- 15 Stations not directly involved with ongoing distress communications may not transmit on the distress channel, to prevent interference to distress traffic.
- 16 The coordinating station – usually an MRCC – broadcasts the message **SEELONCE FEENEE** (pronounced as the French expression *silence fini*).
- 17 The station is preparing to transmit an *urgency message*, possibly concerning the safety of a ship or person.
- 18 By an *urgency announcement* by DSC, and the subsequent **PAN PAN** message stating *I require medical assistance*.
- 19 The word **SECURITE** spoken three times at the beginning of a safety call.
- 20 Safety calls are most often transmitted by MRCCs concerning navigational safety, but ships can also announce such dangers to navigation.

7. The Global Maritime Distress and Safety System



The *Global Maritime Distress and Safety System (GMDSS)* is an international system using advanced communications technology designed to enhance ship-to-shore communications and provide automated distress alerting.

Compliance is *mandatory* for SOLAS vessels (large cargo and passenger ships) on international voyages or in open seas. For smaller fishing boats and commercial vessels, the availability of GMDSS equipment is required by the national legislation of maritime countries (with reduced carriage requirements).

At present, GMDSS is *voluntary* for small craft and pleasure boats, but a growing number of vessels are fitted with GMDSS radiocommunications equipment and can take advantage of the benefits of this distress and safety system.

The principle of GMDSS is that search-and-rescue authorities ashore, as well as shipping in the immediate vicinity of a ship in distress, will be rapidly alerted to a distress incident so that they can assist in a coordinated Search and Rescue (SAR) operation with the minimum of delay.

The system also provides for the promulgation of *Maritime Safety Information (MSI)*, for example navigational and meteorological warnings and forecasts and other urgent safety information to ships.

GMDSS ensures in the whole world the totality of the radiocommunications necessary for safeguarding human life at sea. You must therefore carefully consider the options that are available to you, thinking about your own needs for training and equipment in order to understand and use GMDSS.

The organisation of search and rescue

The International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) coordinate, on a global basis, all the efforts to provide search-and-rescue (SAR) services. Briefly, their goal is to provide an effective worldwide system, so that wherever people sail or fly, SAR services will be available if needed.

Search and Rescue regions

The globe is divided into search-and-rescue regions (SRRs), each with a rescue co-ordination centre (RCC) and associated SAR services, which assist anyone in distress within the SRR without regard to nationality or circumstances.

Search-and-rescue regions are established by agreements among nations, so as to ensure that primary responsibility for coordinating search-and-rescue services for each geographical area is assumed by some state or other. In practice, SAR facilities are likely to be provided by the nearest country having the most appropriate SAR assets.

SAR Convention

The SAR Convention of the IMO was aimed at developing an international SAR plan so that, no matter where an accident occurs, the rescue of persons in distress at sea will be coordinated by a SAR organisation and, when necessary, by cooperation between neighbouring SAR organisations.

Although the obligation of ships to go to the assistance of vessels in distress was enshrined both in tradition and in international treaties (such as the SOLAS Convention), there was no international system covering search-and-rescue operations. In some areas there was a well established organisation able to provide assistance promptly and efficiently; in others there was nothing at all.

The technical requirement of the SAR Convention defines the responsibilities of governments in relation to organisation and coordination (the legal framework, the organisation of available resources, communications facilities, etc).



IAMSAR Manual

The *International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual*, 3 volumes) provides guidelines for a common aviation and maritime approach to organising and providing a SAR service.

Rescue Co-ordination Centre (RCC)

The SAR Convention requires the establishment of Rescue Co-ordination Centres (RCCs) and Sub-Centres (RSC). An RCC is an operational facility with the responsibility for promoting efficient organisation of SAR services and to coordinate the conduct of SAR operations within a search-and-rescue region.

Typically, an RCC will receive a distress alert and then assume responsibility for SAR operations for that incident. However, there may be times when the first RCC to receive the distress alert will not be the responsible RCC and the responsibility is transferred promptly and in an orderly manner to another RCC.

8. Marine communications equipment



SOLAS vessels are fitted with GMDSS equipment according to the sea areas in which they operate. Smaller vessels (merchant ships, fishing boats, superyachts, etc) comply with the carriage requirements of regional or national regulations. Also, when the safety of life is the key factor, pleasure boats are fitted with simplified GMDSS equipment.

Marine VHF radios with DSC controllers are now the equipment of choice for communications at sea. Marine MF/HF SSB radios also have integrated DSC with dedicated watch receivers for long-range communications and for providing access to a wealth of resources: weather data, email contact with friends and family, etc.

Satellite EPIRB beacons, now with integrated GPS, provide a secondary means of distress alerting, which removes the “search” from search-and-rescue operations.

The Navtex receiver receives and displays as plain text maritime safety information such as navigational and gale warnings and search-and-rescue information.

The Automated Identification System (AIS) is an onboard system to transmit the name, characteristics, course and speed of commercial vessels on the high seas on VHF radio frequencies, mainly to avoid collisions between vessels when transiting areas of high vessel traffic.

Radar SART facilitates the location of lifeboats or rescue rafts, as do the new AIS-SART systems.

Satellite communications offer simple and reliable alternatives but with a higher operating cost. Among them are Inmarsat C stations for distress and slow data transmissions, as well as Iridium satellite phones with global coverage.

use of mobile maritime communication procedures. You can send an individual routine call, a test call or a group call to stations having a common interest.

Since handheld VHF–DSC radios could be moved from vessel to vessel, the specific MMSI number indicates that it is a handheld device. It should not be coded with the vessel’s MMSI.



Handheld VHF radio with DSC and built-in GPS for small boats

Categories of DSC calls

Addresses of DSC calls

Distress alerts and all-ships announcements do not have addresses since these calls are implicitly addressed to all stations (ship stations and coast stations within radio range). Selective calls are directed to an individual ship station or coast station. Group calls are sent to a group of stations having a common interest using the group MMSI number.

Distress relays, urgency and safety announcements on MF/HF bands can be also addressed to specified geographic areas.

Priority of DSC calls

The types of DSC calls are listed below by category, which defines the degree of priority of the call sequence: distress, urgency, safety or routine.

Types of DSC calls and acknowledgements

Distress alerts or distress alert relays are sent to all stations and an acknowledgment is expected. For any individual call (not only routine, but an individual urgency or safety announcement) an acknowledgment is required before proceeding with the voice call and message.

Recommendation ITU-R M.493 describes the protocols of the DSC system for use in the maritime mobile service. This

Recommendation specifies the equipment classes for VHF and MF/HF bands and gives a design example of the user interface as well as automated procedures for operation in shipborne equipment.

The types of DSC call for each class of VHF–DSC radio can be summarised as follows (Tx transmit ● ; Rx receive ●):

Category	Type of DSC call	Ship station Class A		Ship station Class D		Ship station Class H		Coast station	
		Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
Distress	Distress alert	●	●	●	●	○	●	—	●
	Distress alert acknowledgement	●	●	—	●	—	●	●	●
	All ships Distress alert Relay	●	●	—	●	—	—	●	●
	All ships Distress alert Relay ack.	—	●	—	●	—	—	●	●
	Individual Distress alert Relay	●	●	☺	🎵	—	—	●	●
	Individual Distress alert Relay ack.	●	●	—	●	—	—	●	●
Urgency	All Ships Urgency call	●	●	●	●	♥	●	●	●
	Individual Urgency call	●	●	—	●	—	◻	●	●
	Individual Urgency call acknowledgement	●	●	●	—	◻	—	●	●

The benefits of marine MF/HF SSB radio

One of the most important benefits of having a marine MF/HF radio is that you are able to send by DSC a distress alert, an urgency announcement or a safety announcement to an MRCC. Marine MF/HF radios offer many other benefits: listening to worldwide broadcast stations; multi-party conversations for the exchange of information; sending and receiving email; and receiving weather charts and weather forecast data. Installation cost can be high (more than for some satellite communication systems) but operating is free (or almost free) of charge.

The Navtex system

The international Navtex service is the system for the broadcast and automatic receipt of Maritime Safety Information (MSI) on 518 kHz using the English language. MSI consists of navigational and meteorological warnings and other urgent safety-related information for vessels at sea.

Navtex (an acronym for Navigational Telex) is a component of the GMDSS to meet the requirements of the SOLAS Convention. Messages are fed into the MSI system by meteorological offices, hydrographic offices and rescue co-ordination centres, and then in each NAVAREA a co-ordinator decides which data is to be transmitted, by what means and from which stations.

The Navtex system uses radio telex (also known as Narrow Band Direct Printing or NBDP) transmission. The system mainly operates in the medium frequency band, the chief frequency being 518 kHz for all English broadcasts, and a secondary frequency of 490 kHz is in some areas used for other transmissions (often in local languages). In addition 4,209.5 kHz is allocated for Navtex transmissions in some tropical areas.

Every Navtex message is preceded by a 4-character header: the first letter identifies the station, the second letter the subject of the message, and there follows a 2-digit serial number, allocated to individual messages, that is used to avoid duplication.

Navtex receivers

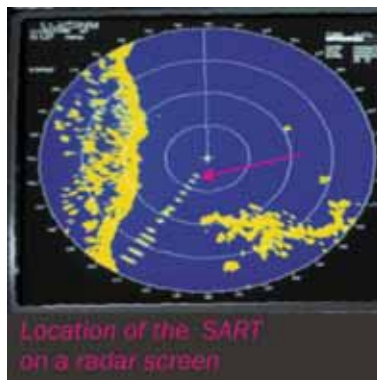
Navtex receivers are small radio receivers located in the position from which the ship is normally navigated. The Navtex receiver should have either an integrated printing device or a display screen to show newly received messages and a memory to hold messages for at least 24 hours.



Navtex receiver with a scrollable display and with large daylight-viewable colour LCD screen, providing simultaneous tri-channel monitoring

The range of radar SART is approximately 5 nm for a rescue ship and about 30 nm for an aircraft or helicopter. The SART should be mounted at least 1 metre above the water-line, but 2 metres above will increase its range to 8 nm. Some manufacturers will supply a SART with a short telescopic-type mast.

A radar SART should be tested on a regular basis as follows: switch SART to test mode, hold it in view of a radar antenna, and then check whether the visual indicator light and the audible beeper operate satisfactorily. Observe the radar screen too: concentric circles should be displayed. Check the battery expiry date because, even if the SART is equipped with a pack expected to last for 5 years, the battery life might have expired.



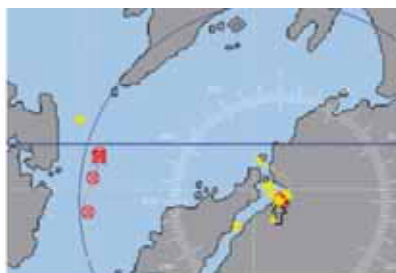
AIS-SART transmitters

As an alternative to radar SARTs in search-and-rescue operations, the IMO allows use of AIS-SART transmitters, which can be detected by a shipborne Automatic Identification System (AIS; see next section) even if there are obstacles between the rescue boat and the ship in distress.



The AIS-SART is programmed from the manufacturer with a unique ID code and receives its position via an internal GPS antenna.

This data is combined and transmitted using the international AIS channels. The transmitter sends out a specified pattern every minute, anybody who can receive and detect an AIS signal will also detect an AIS-SART.



An AIS-SART is visualized on an electronic chart, connected to the AIS transponder onboard, shown as a circle with a built-in cross.

The AIS-SART unit should be coded with a unique identity code (like an MMSI, but starting with 970). AIS-SART operates in the VHF band; it provides far more range than a conventional radar SART, and it is not affected by rain or terrain (provided the land mass is not too high above sea level, of course).

Automatic Identification System (AIS)

The Automatic Identification System (AIS) is a shipborne broadcasting system that acts like a transponder, operating in the VHF maritime band, which is capable of handling well over 4,500 reports per minute and updates as often as every two seconds. If it is overlaid on electronic chart data, it shows a mark for every significant ship within radio range, each with a velocity vector.

By clicking on a ship on an AIS chart, you can learn the ship's name, MMSI number, course and speed, classification, call sign, registration number, and other information. With such AIS information, you are able to call any ship over a VHF radio by her MMSI number via an individual routine DSC call.

C2. Protection of distress frequencies

- 2.1 Avoiding harmful interference
 - Avoidance of the transmission of false alerts
 - Status of Channel 16 and 70
- 2.2 Transmissions during distress traffic
- 2.3 Prevention of unauthorised transmissions
- 2.4 Test protocols and procedures
 - Testing DSC equipment
 - Radiotelephone test procedures
- 2.5 Avoidance of transmissions in VHF guard bands
- 2.6 Procedures to follow when a false or inadvertent Distress Alert is transmitted

C3. Alerting, Communication and Locating Signals

- 3.1 406 MHz Emergency Position Indicating Radio Beacons (EPIRBs)
 - Registration and coding
 - Operation, activation and testing
 - 121.5 MHz homing function
 - Mounting float-free mechanism
 - Battery expiry date
- 3.2 Search and Rescue Radar Transponder (SART)
 - Operation height and range
 - Battery expiry date
- 3.3 Handheld VHF
 - Operation
 - Communication range
 - Battery provision

**D. Radiotelephony procedures****D1. Ability to exchange communications relevant to the safety of life at sea**

- 1.1 Distress communications
 - Distress signal MAYDAY
 - Distress call
 - Distress message
 - Acknowledgement RECEIVED MAYDAY
 - Follow-up distress traffic
 - The control of distress traffic
 - SEELONCE MAYDAY and SEELONCE FEENEE
 - Transmission of a distress message by a station not itself in distress
 - MAYDAY RELAY
- 1.2 Urgency communications
 - Urgency signal PAN-PAN

SART 121, 145

- radar SART 145
- AIS-SART 146

scanning channels 11sea areas 123–125, 150search and rescue (SAR) 128secrecy of communications 28security, definition 119SÉCURITÉ 109SEELONCE DISTRESS 101SEELONCE FEENEE 102SEELONCE MAYDAY 101semi-duplex operation 50ship movement 52, 161–162ship radio licence 28ship stations 28, 33, 60ship-to-ship calls 65, 78–80Short Range Certificate (SRC) 29, 153simplex channels 49, 51–52simplex operation 49simulator of VHF radio 89, inside back coverSMCP 63, 70SOLAS Convention 35SOLAS ships 36, 150Special Drawing Rights (SDR) 35spelling 62–63spelling numbers 63squellch 10, 74SRC (Short Range Certificate) 29, 153SSB MF/HF transceiver 53, 138stations 28, 30, 126syllabus of SRC examinations 153

Tango

taxation 35telemedical see radiomédicale 107test call 77, 137*
time UTC 31, 75–76traffic list 34transceiver 8, 53transmission (emission) 10, 49

transmitting power 10, 21, 80, 93transponder, SART 121, 145–146

Uniform

unanswered calls 69, 81undesigned distress alert 94urgency, definition 104urgency communication

- announcement by DSC 104
- call and message 105–106
- urgent medical assistance 107

urgency signal, PAN PAN 105UTC (Co-ordinated Universal Time) 31, 75–76

Victor

Vessel Traffic Services (VTS) 30Very High Frequency (VHF) 42VHF channels 48, 50–52, 161VHF channel usage 50–52VHF–DSC radio 11, 134–137VHF–DSC in the GMDSS 118, 123, 134VHF, metric waves 42VHF radio set 7, 8–24voice (radiotelephony) calls 57, 58–72volume of audio output 9, 21volts, voltage 19voluntary ships 36, 150

Whiskey

watch-keeping 31, 77, 158

- on channels 16 and 70 31
- in the GMDSS 31, 127
- dual watch 10, 31

watts 10, 21, 93, 138weather by VHF 109, 164weather by Navtex 139–140weather forecasts 130, 140wheelmark 37working channels 51

X-ray

Yankee

Zulu

zulu time 31