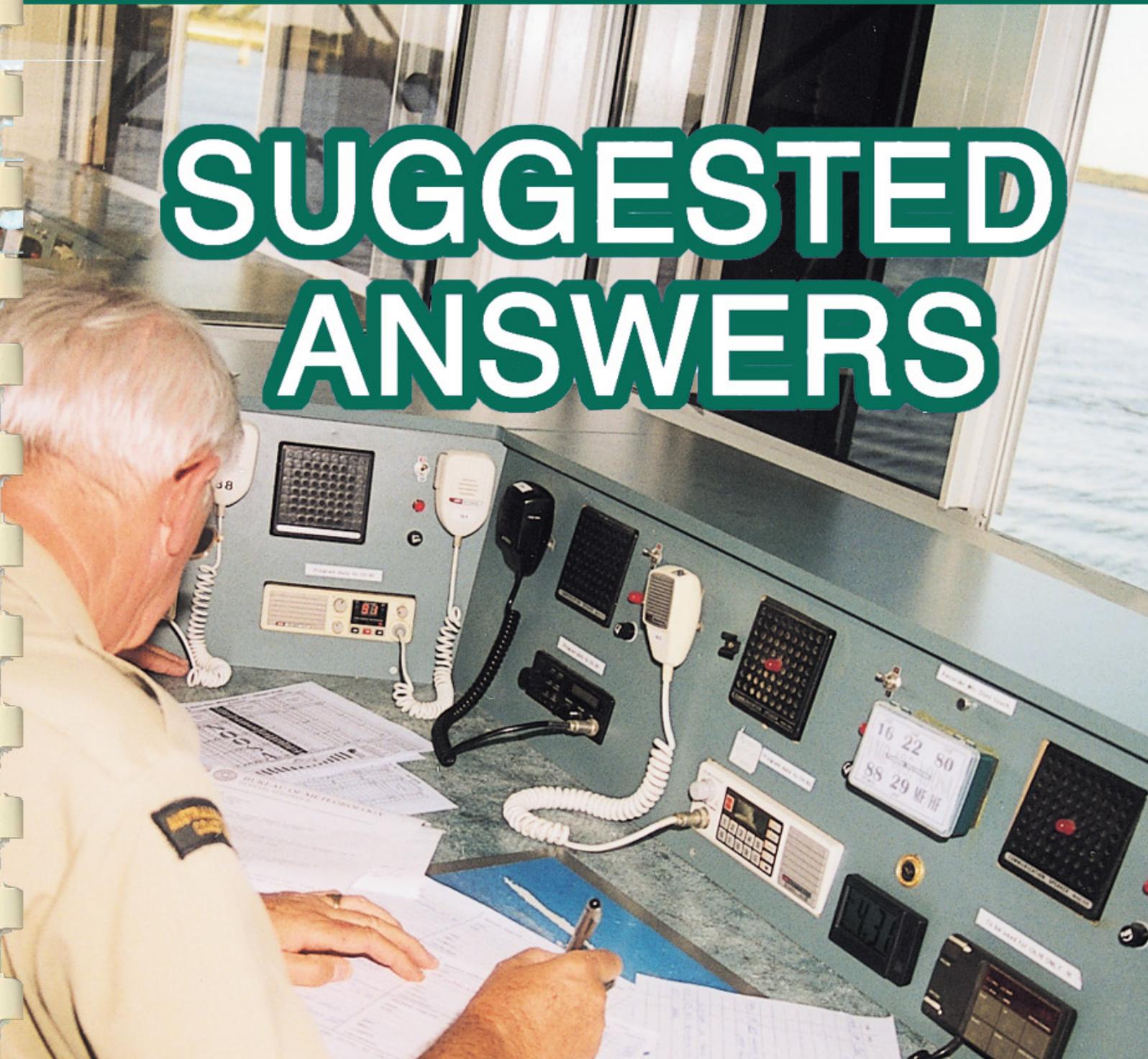


Marine Science  
For Australian Students

# Marine Radio Worksheets



# SUGGESTED ANSWERS



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## Worksheet 1: Principles of Transmission

1. Hertz discovered that radio waves could be made by using a generator to charge an antenna.
2. A carrier wave is a radio wave that “carries” information to produce a sound.
3. a) amplitude  
b) wavelength  
c) trough.
4. a) modulation is altering the frequency of amplitude of a carrier wave to transmit sound.  
b) skip is when a 27 MHz radio wave is bent back to Earth by the ionosphere, and can be detected hundreds or thousands of km away. (See Fig 7.2).  
c) radiotelephony is the sending of voice signals by radio waves.
5. The “theory of propagation” explains how radio frequency energy is transmitted through space from the antenna as ground waves or sky waves.
6. Modulation A = amplitude modulation (am)  
Modulation B = frequency modulation (fm)
7. Sky waves travel through the air and can bounce back off the ionosphere. Ground waves use up their energy quickly and can be blocked by island.
8. Skip could be a problem because you might pick up messages sent from hundreds or thousands of km away, but might not be able to communicate with your local coast station.

## Worksheet 2: EPIRB

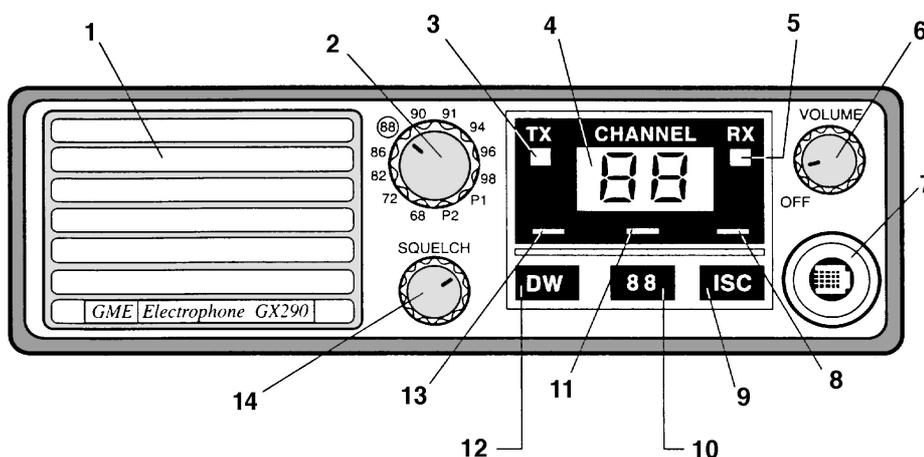
1. Emergency Position Indicating Radio Beacon.
2. When activated, an EPIRB sends a radio signal to an orbiting satellite. They transmit on 121.5 MHz, 243 MHz (until 2009), and 406 MHz.
3. 406 MHz EPIRBs provide global coverage.
4. If an EPIRB is accidentally activated, switch it off and ring 1800 641 792 as soon as possible.
5. The Rescue Co-ordination Centre is located in Canberra and is responsible for the national coordination of both maritime and aviation search and rescue.
6. Satellites have made EPIRBs more effective. The 406 MHz digital signal has meant that information about the type of vessel in distress can be transmitted.
7. Australia's Local User Terminals are located in Albany (WA) and Bundaberg (QLD).
8. Boats operating more than 900 km offshore should use 406 MHz EPIRBs. After 2009, all vessels that are required to carry an EPIRB will require 406 MHz EPIRBs.
9. EPIRB is a transmission only; it doesn't have a receiver. EPIRBs don't use voice signals.
10. The answer to the first part of this question is not in the text.  
121.5 MHz Beacon: Time to relay signal accurately varies. (Information not in text)  
406 MHz Beacon: Time to relay signal accurately instantaneous.

*Additional Information: The 121.5 MHz signal is analog and is not stored aboard the satellite. The satellite must see the beacon and the ground station simultaneously for a 121.5 MHz transmission to be detected; thereby giving an average notification time of 6 hours. The 406 MHz signal is digital and can be stored aboard the satellite for later relay to the next available ground station, thereby giving it global capability and a 1-hour average notification time.*

11. a) If an EPIRB is activated off the Queensland coast, the EPIRB sends a radio signal to an orbiting satellite, which stores and relays the signal to the LUT (probably the one in Bundaberg), which is linked to the RCC in Canberra. The RCC contacts the nearest suitable rescue authority to conduct search and rescue operations.  
b) Some problems that may occur with the rescue situation in Fig 11.2 could include: no nearby search and rescue organisations, or they might take a long time to arrive; the vessel could be North of Australia's area of responsibility; sharks, crocodiles, stingers and heat stroke.  
c) SAR: Search and rescue  
LUT: Local User Terminal  
RCC: Rescue Coordination Centre.
12. Students' own responses. For example:  
Carrying an EPIRB is important because it can alert rescuers when you are in an emergency situation. They are not very expensive any more, and are well worth the money if they can save your life.

## Worksheet 3: Transceiver controls

No	Name	Function
1.	Front mounted speaker	Emits audible sound waves that the operator can hear.
2.	Channel selector	Used to select the channel or frequency that you wish to transmit or receive on.
3.	Transmit indicator	LED that lights up when you are transmitting a message.
4.	LED channel display	Indicates what channel/frequency is selected.
5.	Receive indicator	Shows that the transmitter is not transmitting and is in receive mode.
6.	Volume on/off control	Turns the equipment on and off and controls the volume of signals coming from the speaker.
7.	Microphone socket	Socket for connecting microphone.
8.	ISC indicator	Indicates that the ISC switch is activated.
9.	ISC switch	Interference suppression circuit- combines with a built-in noise limiter to eliminate electrical interference.
10.	Channel 88 switch	(on 27 MHz radios) selects Channel 88 for distress and initial contact.
11.	Channel 88 indicator	Indicates that radio is tuned to Channel 88.
12.	Dual watch switch	When activated, permits a listening watch on two different (VHF) channels.
13.	Dual watch indicator	LED that indicates that the dual watch switch is activated.
14.	Squelch control	Stops the constant and annoying background hiss or roar from the receiver.



## Worksheet 4: Types of calls

### 1. Channel usage table

Type of Call	27 MHz	VHF	MF/HF
Distress and Initial calling	88	16	2182
Supplementary distress and urgency	86	67	4125, 6215, 8291, 12290, 16420
Non-commercial	96	72, 73, 77	2284, 2524
Professional fishing service	72, 82	71, 72, 77	2112, 2164, 4620
Commercial service (including charter vessels)	68	6, 8, 72, 74, 78	2636

- The antenna of a marine radio radiates and gathers radio energy into and from space.
- The power supply to a marine radio supplies electrical energy to the transmitter and receiver.
- The three types of marine radio are 27 MHz (27 Meg), VHF and MF/HF.
- Small boat operators use a 27 MHz radio to:
  - Obtain up-to-date weather forecasts
  - Report arrival and departure times if going out to sea
  - Listen to fishing details
  - Communicate with shore stations and other vessels
  - Listen to radio broadcasts advising of overdue vessels at sea.
- A 27 MHz radio is normally left on channel 88 to receive incoming calls or monitor distress signals.
- A VHF radio is normally left on channel 16 to receive incoming calls or monitor distress signals.
- Users of VHF and/or MF/HF radios require a marine radio qualification.
- It is useful for 27 MHz operators to have marine radio qualifications so that they are familiar with the correct procedures, and are able to use VHF or MF/HF equipment if required.
- Advantages and disadvantages table.

Radio type	27 MHz	VHF	MF/HF
Advantages	Cheap No Licence needed Easy to install	High quality sound No interference Seaphone compatible	World-wide communication Radiotelephone and DSC compatible
Disadvantages	Interference congested limited range	Needs operators certification	Expensive, complex to install, needs individual station licence.

## Worksheet 5: Digital selective calling

1. GMDSS: Global Maritime Distress and Safety System  
DSC: Digital Selective Calling
2. Advantages of DSC include:
  - a. One step, push button distress communications.
  - b. Automatically provides priority, position and identification information.
  - c. A DSC alert contains the following information as digitised data:
    - the identity of the calling station
    - the priority of the alert- distress, urgency or safety
    - the stations being called
    - the position of the vessel.
4. No - DSC techniques will not be introduced into the 27 MHz marine band.
5. This question is not answered directly in the Radio Workbook. Small craft users can purchase class D DSC equipment, which is useful for position polling- automatically reporting your position to the coast station.
6. A ship station is identified by a unique 9-digit identification number.
7. DSC reduces the amount of calls received because only stations selected by the transmitting station will decode the sent messages.
8. The use of DSC in small ships is only just starting in Australia. Its widespread use by small ships is many years off.
9. DSC calling frequencies are:
  - MF/HF: 2187.5, 4207, 6312, 8414.5, 12577, 16804 KHz
  - VHF: 70
10. DSC techniques are largely automated and only stations selected by the transmitting station will receive incoming messages.
11. Note: the question asks for four steps- there are five steps on page 20:
  - a. Select the DSC distress channel.
  - b. If time permits key in or select:
    - nature of distress (Sinking fast)
    - position of the vessel (100 nm SE of Sydney)
  - c. Initiate the distress alert.
  - d. Change to associated radiotelephony channel.
  - e. Send the radiotelephony distress call and message as you would on a radio without DSC.
12. An inadvertent DSC alert can be cancelled by:
  - a. Immediately switch off the transceiver as this will cancel any automatic repeats of the DSC alert.
  - b. Switch the transceiver on and select the radio frequency on which the alert was transmitted.
  - c. Broadcast to all stations on the appropriate frequency giving the vessel's name, call sign and cancellation of the distress alert.

13. If you hear a DSC alert from another vessel, you should listen on the associated radiotelephony channel for the distress message that should follow. You should not reply using DSC.
14. The steps to transmit a DSC safety alert, and subsequent safety call and message are:
- Tune the transceiver to the appropriate DSC frequency or channel (2187.5kHz, VHF channel 70 etc)
  - Select the “all ship” call format.
  - Select the “Safety priority”.
  - Operate the appropriate transmission button.
  - Tune to the associated radiotelephony frequency/channel
  - Transmit the safety SECURITE signal by voice and announce the working frequency/channel for the transmission of the message.
  - Change to the working frequency/channel and announce the message using the standard voice procedure.

NOTE:

- Stations receiving a DSC Safety Alert should not acknowledge it. Instead they should tune their radio to the associated radio/telephony frequency/channel and await voice message.

## Additional information

A few digits and numbers have a modified pronunciation compared to general English:

Letter to be transmitted	Code	Word to be used Spoken as
0	Zero	ZEEROH
1	One	WUN
2	Two	TOO
3	Three	TREE
4	Four	POWER
5	Five	FIFE
6	Six	SIX
7	Seven	SEVEN
8	Eight	AIT
9	Nine	NINER
10	One zero	WUNZEEROH
1000	Thousand	TOUSAND
Decimal point	Decimal	DAY-SEE-MAL
Full stop	Stop	STOP
/ Oblique	Stroke	OBLIQUE

## Worksheet 6: Marine Radio

1. Matching question list A with list B

<b>List A</b>	<b>List B</b>
<u>Verify</u>	- Check your information and advise me
<u>ISC Switch</u>	- Eliminates electrical interference
<u>VHF Distress Channel</u>	- Channel 16
<u>27 MHz Distress Channel</u>	- 27.88 MHz
<u>Squelch Control</u>	- Reduces background noise
<u>ROMEEO</u>	- Message received and understood

2. Phonetics completion

<u>K</u> ilo	<u>N</u> ovember	<u>W</u> hisky	<u>F</u> oxtrot
<u>O</u> scar	<u>D</u> elta	<u>I</u> ndia	<u>L</u> ima

3. Unscrambled words

- |            |                |
|------------|----------------|
| a. Aerial  | b. Transmitter |
| c. Antenna | d. Microphone  |
| e. Power   | f. Hertz       |
| g. Waves   | h. Signal      |
| i. Marine  | j. Radio       |

4. Four important voice procedures for good voice communication are rhythm, speed, volume and pitch (RSVP).
5. Radio silence periods are enforced so that operators can hear weak signals from vessels that may be seeking help. Radio silence periods are three minutes long and begin every hour and every half hour.
6. It is important to listen on the distress channels as much as possible. The more operators listening on these channels, the better the chance of a weak distress message being received.

# Worksheet 7: Tuning a marine radio

Student's own results

## Worksheet 8: Sending a message

### Note

In many local areas it is common practice to only say vessel names and call signs twice. The local Coastguard says this is acceptable procedure, but that names should be spoken three times if radio signals are not clear.

1. a) The vessel's name is said three times because the first call alerts you, the second and third call confirm that the call is for you. Hearing on a boat at sea is difficult.

b) Strict radio procedure (\*see note above):

SAY – (the other vessel's name) THREE TIMES

SAY – (this is) ONCE

SAY – (your boat's name and call sign) THREE TIMES

SAY – OVER

When you receive an answer, decide on a working frequency

SAY – OVER after each transmission and then

SAY – OUT at the completion of the conversation.

2. Students' own answer

Eg In the Redcliffe region, the most commonly used radio frequency is VHF channel 73.

3. Operators usually listen in on the distress and initial calling frequencies such as VHF channel 16.

4. Students' own answer

(In the Redcliffe region, operators usually transfer to VHF channel 73).

5. 21            “two one”  
6.34            “six decimal three four”  
6am            “zero six decimal zero zero hours” (Oh-six-hundred)  
3.35pm        “one five decimal three five hours” (15.35hrs)  
\$131.34       “one three one decimal three four dollars”  
14              “one four”  
12 noon        “one two zero zero hours”  
10.25pm      “two two decimal two five hours” (22.25hrs)

6. Example of a logging in message with a local VMR (local procedure is say words twice unless poor reception).

Call on channel 16 (VHF) or channel 88 (27mHz)

VMR 448 Mackay, VMR 448 Mackay, this is Tubby, Tubby. (OVER)

Tubby, Tubby this is VMR 448 Mackay, VMR 448 Mackay, change to channel 73

VMR 448 Mackay, VMR 448 Mackay, this is Tubby, Tubby. Travelling to Saint Bees Island. ETA one zero decimal three zero hours. 2 adults, 3 children on board. (OVER)

Tubby, Tubby this is VMR 448 Mackay, VMR 448 Mackay. You are logged in, please advise on your return. (OVER)

VMR 448 Mackay, VMR 448 Mackay, this is Tubby, Tubby ROMEO to that (OUT).

Tubby, Tubby this is VMR 448 Mackay (OUT).

7. Example of a radio check

Call on channel 16

Redcliffe Coast Guard, Redcliffe Coast Guard, this is Reef Seeker, Reef Seeker (OVER)

Reef Seeker this is Redcliffe Coast Guard please switch to Channel 73.

Redcliffe Coast Guard, this is Reef Seeker Reef Seeker, just fitted a new VHF radio and wanting a radio check (OVER)

Reef Seeker this is Redcliffe Coast Guard your signal strength is FOWER to FIFE (OVER)

Redcliffe Coast Guard, this is Reef Seeker Reef Seeker, thank you (OUT)

Reef Seeker this is Redcliffe Coast Guard (OUT)

## Worksheet 9: Phrases and meanings

Phrase	Meaning
Affirmative	Yes
Negative	No
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
Over	My transmission is ended and I expect a response from you.
Out	My transmission is ended and no response is expected.
Stand-by	Wait and listen until I re-transmit.
Standing-by	I am waiting for you to call me again.
Romeo	Message received and understood.
Acknowledge	Let me know that you have received and understood the message.
Go Ahead	Proceed with your message.
I Say Again	I am repeating my message <i>Note: the 'self-explanatory' on page 26 confuses students and they write this term as part of their answer.</i>
Say Again	Repeat your message
That is Correct	That is correct (and also for this one, students write 'self-explanatory' as their answer)
Verify	Check your information and advise me.
CQ	General call to all stations. Hello all stations. Used in Morse.
Wilco	Message received and will carry out instructions.

## Worksheet 10: Phonetic alphabet

1. The phonetic alphabet is more useful than simply spelling words because some letters sound alike, such as B, C, D, E, G, P, T, and V.
2. Particular syllables are emphasised (usually UNDERLINED UPPERCASE) to ensure uniformity of pronunciation, and to make the words sound more distinct from each other.

For example, Delta and Victor both end with –tah; Whiskey and Yankee both end with –key.

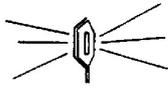
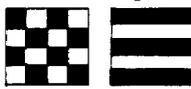
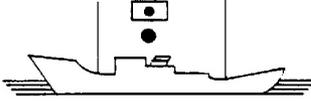
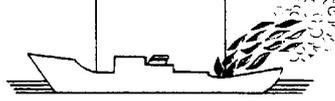
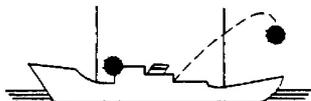
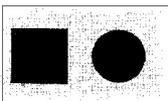
3. Preparation:           PRE - PAH - RAY - SHUN  
Communication:       COM - MYOO - NEE - CAY – SHUN  
Radio:                 RAY – DEE – OH  
Station:                STAY – SHUN
4. Sea Witch Two:  
SIERRA, ECHO, ALFA, WHISKEY, INDIA, TANGO, CHARLIE, HOTEL,  
TANGO, WHISKEY, OSCAR.
5. Student's own name spelled in the phonetic alphabet.
6. Student's own message.
7. B has been BUTTER, BEER and BAKER before it was BRAVO. Changing it to BOAT would only lead to confusion. The "O" sound in boat could be mistaken for ROMEO.
8. ETA: Estimated Time of Arrival- the time you will get to your destination.  
ETD: Estimated Time of Departure- the time you will leave your location.
9. The international radiotelephony spelling alphabet (or NATO phonetic alphabet) replaced the previous separate phonetic alphabets used by the British, American and Canadian military.  
Different branches of the military even had their own alphabet- leading to difficulty in communication. Words were selected so that they could be pronounced correctly by non-native English speakers.
10. Messages should be kept short, as unnecessary conversation should be avoided to keep the airways clear. All radio operators can hear your message, unlike a private telephone.

## Worksheet 11: Radiotelephony alarm signals

1. The purpose of a radiotelephony alarm signal is to attract the attention of other marine radio operators that a message is about to follow.
2. The alarm signal is an alternating high and low tone. You would hear a distinctive 'warbling tone'.
3. The alarm from a coast station can be identified because it is followed by a single low tone that lasts for 10 seconds.
4. The distinctive warbling sound, followed by a 10-second low tone would be used if a coast station was transmitting an urgent cyclone warning.
5. See figure below.

### Distress signals

When a vessel is in distress and requires assistance she shall use or exhibit the signals prescribed

1.  A gun or other explosive signal fired at intervals of about a minute.
2.  A continuous sounding with any fog-signalling apparatus
3.  Rockets or shells throwing red stars fired one at a time at short intervals
4.  A signal made by radio, telegraphy or by any other signalling method consisting of the group (SOS) in the Morse code
5.  A signal sent by radio telephony consisting of the spoken word 'MAYDAY' or a DSC distress alert
6. The international code signal of distress indicated by N.C. 
7.  A signal consisting of a square flag having above or below it a ball or anything resembling a ball
8.  Flames on the vessel (as from a burning tar barrel, oil barrel etc.)
9.  A rocket parachute flare or a hand flare showing a red light
10.  A smoke signal giving off orange-coloured smoke
11.  Slowly and repeatedly raising and lowering arms outstretched to each side
12. **DISTRESS SIGNALS**  
Merchant Ship Search and Rescue Manual  
 

### Note for first edition:

ERRATA - Delete the words "Colour in and" from Question 5 so the questions asks: *Complete the diagrams below of common distress signals.*

## Worksheet 12: Distress signals

1. Distress signals in different situations.

At Night	Sunny Day	Foggy Morning	Cloudy Day
Gun, rockets, red flare, fog horn, Morse code, flames on board	Gun, Square/ball, slowly raise and lower arms, fog horn, Morse code, N/C flag, flames on board, orange smoke flare	Gun, rockets, red flare, fog horn, Morse code, flames on board	Gun, rockets, red flare, fog horn, Morse code, flames on board

2. If you lose your signalling mirror, you could use a watch face, mobile phone screen, knife blade or any other reflective surface.

3. Morse code for distress is · · · — — — · · ·

This is seldom used today, because most vessels are equipped with Radio- so Mayday, Securite and Pan Pan are easier to use. Interestingly, SOS remained the maritime radio distress signal until 1999, when it was replaced by the Global Maritime Distress Safety System.

4. A radiotelephony distress message may be transmitted only on the authority of the master or skipper, or the person responsible for the safety of that vessel.

5. Students' own research.

## **Worksheet 13: Mayday video**

The Mayday video is a bit out of date now and there are no plans to revise it at this time.

There are a number of small video clips regarding safety on

<http://www.amsa.gov.au>

### **Further information**

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[www.amsa.gov.au](http://www.amsa.gov.au)

## Worksheet 14: Mayday

### 1. MAYDAY, MAYDAY, MAYDAY.

This is Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four

MAYDAY. This is Sea Witch Victor Lima One, Two, Three, Four.

Position on Maclean Reef. Hull holed. Sinking. Four adults on board. EPIRB activated. Abandoning into life raft.

OVER.

### 2. Here are some instructions for a McMurdo 406 MHz EPIRB. (Note This is not covered directly in the workbook)

- If the vessel is sinking and there is time to fetch the EPIRB then this should always be done.
- Release the EPIRB from its mounting bracket and carry it to the liferaft.
- Once the liferaft is in the water, uncoil the lanyard and tie it to the liferaft, then throw the EPIRB overboard so that it floats next to the liferaft.
- The EPIRB will operate because its sea switch will automatically activate.
- The EPIRB can be activated manually by sliding the cover to the left (breaking the seal) and then momentarily pressing the ON button.

### 3. MAYDAY

Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four

THIS IS

Wet Paper One, Wet Paper One, Wet Paper One. RECEIVED MAYDAY (or Romeo, Romeo, Romeo). In position one zero nautical miles from Maclean Reef. Proceeding at two zero knots. ETA your position three zero minutes (or other speed/time).

OVER.

### 4. MAYDAY

HELLO ALL STATIONS, HELLO ALL STATIONS, HELLO ALL STATIONS (Or Charlie Quebec x3) THIS IS Wet Paper One. Zero eight decimal three zero hours (or other time). Sea Witch Victor Lima One, Two, Three, Four

SEELONCE FEENEE.

## Worksheet 15: Pan Pan

### 1. PAN PAN, PAN PAN, PAN PAN

Hello All Stations, Hello All Stations, Hello All Stations

This is Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four

MAYDAY. This is Sea Witch Victor Lima One, Two, Three, Four.

One zero miles north of Maclean Reef (or other distance)

Hit submerged log and lost propeller and am drifting south

No immediate danger

Require Urgent assistance

OVER

Or similar message- the ACA sample message is

“30 NAUTICAL MILES DUE WEST FROM CAPE DORA LOST PROPELLER  
ESTIMATE DRIFTING SOUTHWEST AT 3 KNOTS REQUIRE TOW URGENTLY

OVER”

### 2. A PAN PAN message may be sent when the safety of a vessel, aircraft or person is at risk.

Some examples include (from Wikipedia) fouled propeller, engine failure, out of fuel, unsure of position, fire that has been extinguished, man overboard, medical emergency.

BUT

you should consider making a routine call before a PAN PAN if all you need is a routine help and are not in immediate danger.

### 3. PAN PAN messages make communication more efficient when the transmitting station has a very urgent message to transmit (but is not in distress) concerning the safety of a ship, aircraft or person.

### 4. A Pan Pan message is an urgency signal concerning the safety of a ship or aircraft or the safety of a person.

## Worksheet 16: Securite

### Note:

The word SAY-CURE-E-TAY is used below (and in Worksheet 24), as this is used in the ACA manual. In the second edition we will change the book to reflect this pronunciation.

1. SAY-CURE-E-TAY, SAY-CURE-E-TAY, SAY-CURE-E-TAY

Hello All Stations, Hello All Stations, Hello All Stations

This is Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four

This is Sea Witch Victor Lima One, Two, Three, Four. Safety message follows on channel niner one.

Hello All Stations

This is Sea Witch Victor Lima One, Two, Three, Four

Sighted submerged log in the main shipping Channel in Hypothetical Bay, one zero miles from Lynch River.

OUT

2. A Securite message may be sent for navigational warnings, such as a shipping container, log, or a buoy out of position. Securite messages are also used for weather warnings. A boat may send a Securite message if it is unable to manoeuvre, such as a yacht that is becalmed near a shipping lane.
3. Securite messages make communication more efficient when the transmitting station has a safety message to transmit, such as a navigational or meteorological warning.
4. A Securite message is a safety signal.

## Worksheet 17: Find-a-word puzzle

The position of the First letter of each word is given below. (Row, Column)

Radio (1,14)	VHF (13,16)	Digital (6,3)	Securite (15,18)
Romeo (3,11)	PanPan (9,6)	Mayday (17,7)	EPIRB (10,7)
Beacon (11,12)	Emergency (12,9)	Hertz (10,1)	Transceiver (14,8)
Antenna (1, 25)	Receiver (7,20)	Transmitter (7,10)	Microphone (16,9)
Frequency (2,2)	Skywaves (5,1)	Over (11,22)	Propagation (15,6)
Modulation (6,12)	Squelch (19,8)	Channel (20,18)	Clarifier (20,1)
Phonetic (18,10)	Seelonce (13,25)	Battery (5,12)	Distress (11,1)
Log (3,19)	Urgency (8,9)	Safety (1,1)	CQ (17,5)
Knots (16,4)	Out (1,22)	Alarmsignal (4,4)	DSC (18,18)
GMDSS (12,4)	Inmarsat (19,15)	Callsign (2,13)	Warnings (3,1)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	S	A	F	E	T	Y	Y	L	V	J	A	K	X	R	A	D	I	O	R	R	G	O	U	T	A
2	Y	F	R	E	Q	U	E	N	C	Y	H	Y	C	A	L	L	S	I	G	N	J	S	S	X	N
3	W	A	R	N	I	N	G	S	F	S	R	O	M	E	O	A	F	B	L	O	G	U	R	R	T
4	L	F	J	A	L	A	R	M	S	I	G	N	A	L	J	U	U	I	W	J	J	M	W	I	E
5	S	K	Y	W	A	V	E	S	I	M	Z	B	A	T	T	E	R	Y	Z	G	Z	K	U	L	N
6	E	Z	D	I	G	I	T	A	L	K	B	M	O	D	U	L	A	T	I	O	N	C	Y	Z	N
7	B	M	F	L	Y	L	P	B	F	T	R	A	N	S	M	I	T	T	E	R	O	T	H	O	A
8	J	V	E	S	V	U	D	A	U	R	G	E	N	C	Y	B	Y	A	L	E	I	T	Q	J	B
9	W	Y	G	J	Y	P	A	N	P	A	N	C	E	Y	O	E	E	L	S	C	U	U	J	I	Q
10	H	E	R	T	Z	U	E	P	I	R	B	G	U	U	I	J	A	C	G	E	D	U	A	L	S
11	D	I	S	T	R	E	S	S	V	Y	Z	B	E	A	C	O	N	B	Q	I	U	O	V	E	R
12	Y	E	O	G	M	D	S	S	E	M	E	R	G	E	N	C	Y	G	X	V	V	N	U	A	J
13	L	J	H	X	B	D	X	L	X	S	P	U	A	A	L	V	H	F	P	E	T	B	Z	V	S
14	P	K	A	R	V	L	B	T	R	A	N	S	C	E	I	V	E	R	V	R	D	H	O	S	E
15	W	D	M	V	D	P	R	O	P	A	G	A	T	I	O	N	J	S	E	C	U	R	I	T	E
16	N	T	R	K	N	O	T	S	M	I	C	R	O	P	H	O	N	E	X	R	P	V	E	U	L
17	L	T	P	S	C	Q	M	A	Y	D	A	Y	E	W	M	T	X	P	D	C	U	S	M	C	O
18	U	K	Z	C	W	G	Q	D	M	P	H	O	N	E	T	I	C	Y	D	S	C	O	I	G	N
19	K	J	A	E	O	O	J	S	Q	U	E	L	C	H	I	N	M	A	R	S	A	T	E	K	C
20	C	L	A	R	I	F	E	R	Q	I	K	A	E	X	J	J	X	C	H	A	N	N	E	L	E

## Worksheet 18: Connecting a 27 MHz Transceiver

1. The three components to identify are the wiring harness, fuses and antennas.
2. A wiring harness contains BLACK NEGATIVE, RED POSITIVE and an EARTH (colour not in book). The table below may be of some interest- Australia uses/used the “alternative” system, although it seems that the IEC is the most common.

Table 1 - Common Mains Colour Codes

Conductor	IEC	US	Alternative
Active (Line)	Brown	Black	Red
Neutral	Blue	White	Black
Earth	Green/Yellow	Green	Green

(From <http://sound.westhost.com/earthing.htm>)

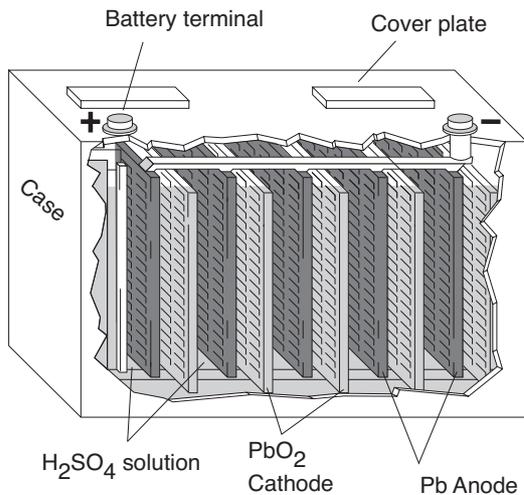
3. A fuse is a weak point designed to protect the circuitry should a fault develop. Its essential component is a metal wire or strip that melts when too much current flows, which breaks the circuit in which it is connected, thus protecting the circuit’s other components from damage due to excessive current.
4. (Not in workbook) An amp rating is the rated current of the fuse. This is the maximum current that will be allowed to flow through the fuse before it blows. This will be written in either Amps (A) or milliamps (mA) on the side of the fuse.
5. A fuse holder is usually spring loaded. This means that a spring will push the fuse out. .
6. An antenna connection plug is a coaxial cable and has a central and an outer core (like a TV antenna).
7. When connecting the antenna to the radio, the plug should be gently pushed into the receiving socket and then pulled into place by tightening a threaded sleeve.
8. If you connect the battery before the antenna is connected you will short out the transceiver. The radio is trying to send a signal and having no antennae, sends it through the radios electronics.
9. Connect the Earth wire first so you don't confuse the red and black wires and blow up the radio. By law you need to use a qualified electrician to do this type of work.
10. The RED harness lead is connected to the POSITIVE (+ve) terminal.
11. The BLACK earth is connected to the NEGATIVE (-ve) terminal.
12. The power should be switched on only after the antenna has been connected.
13. The electrolyte found in a battery is usually sulphuric acid (H<sub>2</sub>SO<sub>4</sub>). Battery acid is corrosive and the fumes irritate the eyes. The gas in batteries is explosive.
14. The white-green powder that builds up on the terminals of a battery is a form of corrosion that can affect the battery’s ability to supply current.

## Worksheet 19: Installation and faults

Component	Where component is located	Care that needs to be taken
Antenna and fittings	Plug is on the radio transceiver. Antenna is mounted on high point on the boat.	Connected properly. Regular wiping to prevent salt build-up. Matched with radio and tuned properly.
Microphone	Attached to the front of the radio unit	Connected properly. If faulty, receiver works but no transmission. Carry a spare one.
Radio earth	Rear of transceiver- connected to metallic or earthing plate on hull.	Needs to be earthed- or operator will experience a sharp burning sensation from metallic parts of the radio.
Fuse box	Part of the wiring harness (usually somewhere dry)	Correct amp rating. Check fuse is intact.
Battery acid level	Inside the battery.	Use demineralised water Maintain half-way between plates and filler hole.
Battery terminals	On top of battery.	Keep greased and free of corrosion.
Battery charging	By the alternator in the motor- otherwise use jumper leads.	Remove the covers over the cells to allow the explosive gas to escape.

## Worksheet 20: The battery

1. See Figure 47.1 Parts of a battery



### Battery care note

1. Use a good quality marine battery - check it at regular intervals and charge it when necessary.
2. Batteries should always be secured in brackets and properly ventilated.
3. Keep terminals, cables and casing clean. Grease cables regularly.
4. Terminals and connections need to be tight and secure.

2. When charging a battery remove the covers over the cells to allow the explosive gas to escape, do not go near the battery with a naked flame or cigarette and take care to not cause a spark in the vicinity.
3. When carrying a battery make sure the liquid in it (battery acid) does not spill.
4. Nearly all marine batteries are 12 Volts.
5. When using jumper leads with batteries, take care to put the clamps on the correct terminals. Positive to positive (red to red) and negative to negative (black to black).

Check with your local garage for further details of ways to charge specific types of batteries.

6. Make sure you connect the red (positive) to red (positive) terminal **FIRST**. If you connect red to black for sure you will blow up some electronics somewhere.
7. A sacrificial anode is a zinc block that corrodes (galvanic corrosion) in seawater, protecting the other metal parts.
8. Batteries are an essential part of the electrical system of a larger boat with a key to start the motor.
9. Some rules when using a battery are:
  - be careful not to spill acid on yourself
  - don't smoke near a recharging battery
  - use protective clothing.
10. A hydrometer is a floating glass tube with markings that show the density of the liquid it is floating in. Hydrometers are used for battery acid, marine aquaria and home-brew kits.
5. Battery cells need to be topped up with distilled water and checked with a hydrometer.
6. Batteries should never be overcharged. They should be charged at a rate as set down by the manufacturer. Turn the power off before removing charging leads to prevent an explosion.

## **Worksheet 21: Make a reference card**

Students' own reference cards.

You can obtain free stickers with frequencies and call signs from your local marine rescue organisation.

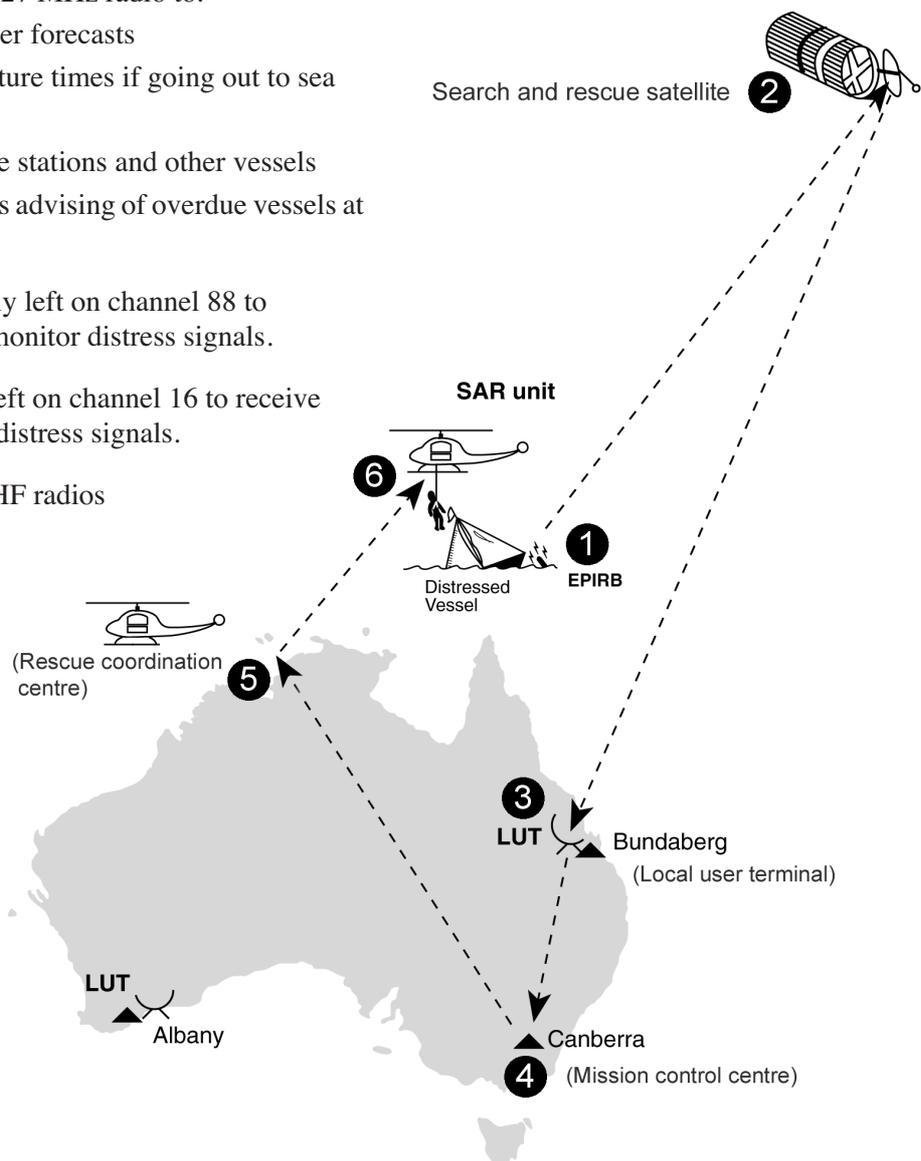
## **Worksheet 22: Logging of messages**

Students' own radio log.

You may be able to keep a radio on during a normal lesson, and fill out the table when a message is heard.

## Worksheet 23: Review questions

1. Skip is when a 27 MHz radio wave is bent back to Earth by the ionosphere, and can be detected hundreds or thousands of km away.
2. The three major parts of a marine radio are: the antenna; the transmitter and receiver (transceiver); and the power supply.
3. The transmitter turns our voice signals spoken into the microphone into radio carrier waves. These carrier waves are then modulated with our speech signals.
4. The receiver selects those radio waves that we require, and de-modulates them to recover the voice information. The voice signals are magnified by the amplifier and produced by the loud speaker.
5. The antenna radiates radio frequency energy during transmission, and gathers radio energy from space when receiving.
6. The three types of marine radio are 27 MHz, VHF and MF/HF.
7. An EPIRB is an Emergency Position Indicating Radio Beacon: a radio transmitter that assists in determining the position of a vessel in distress...
8. Small boat operators use a 27 MHz radio to:
  - obtain up-to-date weather forecasts
  - report arrival and departure times if going out to sea
  - listen to fishing details
  - communicate with shore stations and other vessels
  - listen to radio broadcasts advising of overdue vessels at sea.
9. A 27 MHz radio is normally left on channel 88 to receive incoming calls or monitor distress signals.
10. A VHF radio is normally left on channel 16 to receive incoming calls or monitor distress signals.
11. Users of VHF and/or MF/HF radios require a marine radio qualification.
12. See Figure opposite.



13. The signal from a 406 MHz EPIRB is picked up instantaneously by a geostationary satellite. These satellites orbit the Earth “listening” for active beacons, and relay their position to the MRCC via a LUT.

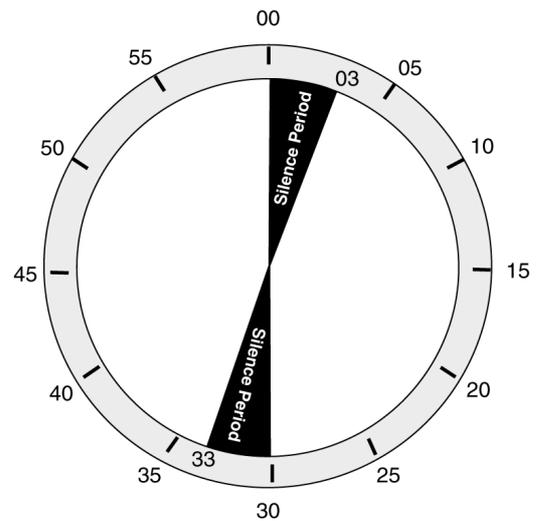
14. Students’ own message. An example:

Tubby, Tubby, Tubby,

This is Reef Seeker, Reef Seeker, Reef Seeker

Over.

15. Radio silence periods occur for three minutes every hour and half hour, so that weak distress messages can be heard. See figure opposite



16. ERRATA: Swap Q's 16 & 17. Then give an example of a Securite message,

Ans:

**Safety signal and call (on a distress channel)**

- SAY-CURE-E-TAY, SAY-CURE-E-TAY, SAY-CURE-E-TAY
- Hello all stations, Hello all stations, Hello all stations
- This is Reef Seeker, Reef Seeker, Reef Seeker
- NAVIGATION WARNING, LISTEN ON VHF Ch 67

**Safety signal (after changing channel)**

- SAY-CURE-E-TAY, SAY-CURE-E-TAY, SAY-CURE-E-TAY
- Hello all stations, Hello all stations, Hello all stations
- This is Reef Seeker, Reef Seeker, Reef Seeker
- Large log floating in Bribie Channel about one Nautical mile past McFarline Bridge
- OUT

17. Securite means that what follows is important safety information. The word comes from the French *sécurité*, which means “security”.

18. A PAN PAN message is an URGENCY signal, and may be sent when the safety of a vessel, aircraft or person is at risk.

19. A PAN PAN message could be used in the following instances: fouled propeller, engine failure, out of fuel, unsure of position, fire that has been extinguished, man overboard, or medical emergency.

For example:

PAN PAN, PAN PAN, PAN PAN

Hello All Stations, Hello All Stations, Hello All Stations

This is Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four.

This is Sea Witch Victor Lima One, Two, Three, Four. One zero miles north of Maclean Reef. Hit submerged log and lost propeller and am drifting south. No immediate danger. Require Urgent assistance.

OVER

20. A MAYDAY message is a distress signal, and may only be used when the vessel is in grave and imminent danger.

21. MAYDAY, MAYDAY, MAYDAY.

This is Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four... Sea Witch Victor Lima One, Two, Three, Four

MAYDAY. This is Sea Witch Victor Lima One, Two, Three, Four.

Position on Maclean Reef.

Hull holed.

Sinking.

Four adults on board. EPIRB activated. Abandoning into life raft.

OVER.

22. If you hear a MAYDAY call but cannot provide assistance, you should wait a short while to hear whether the coast station replies or another vessel can offer assistance. If no-one else replies, you should acknowledge the call (RECEIVED MAYDAY) and then take steps to attract the attention of a coast station (MAYDAY RELAY).
23. An antenna can become faulty if broken by wind or water, or by a build-up of salt. If the antenna was not connected properly the output needle would flicker, the speaker would crackle and messages would cut in and out.
24. A blown fuse is one that has melted due to too much current flowing through it. If the fuse has blown there will be no transmission or reception and no dial lights.
25. To get the best radio transmission, the battery should be:
- kept clean, dry and free of corrosion
  - filled with electrolyte to the correct level
  - kept fully charged
  - placed in a high, accessible, protected location close to the transceiver.

## Worksheet 24: Theory test

1. SAY-CURE-E-TAY, SAY-CURE-E-TAY, SAY-CURE-E-TAY

Hello All Stations, Hello All Stations, Hello All Stations

This is Wet Paper, Victor Lima Mike One, Two, Three, Four... Wet Paper, Victor Lima Mike One, Two, Three, Four ... Wet Paper, Victor Lima Mike One, Two, Three, Four.

Safety message follows on channel niner one. (or VHF 72)

Hello All Stations

This is Wet Paper, Victor Lima Mike One, Two, Three, Four

Sighted red shipping container in the shipping channel Three Zero miles South East of Cape Moreton...

OUT

2. Using the VHF Radio-

Select the DSC channel 70

Select all stations/all ships and Urgency

Initiate alert

Switch to Channel 16 then broadcast:

PAN PAN, PAN PAN, PAN PAN

Hello All Stations, Hello All Stations, Hello All Stations

This is Wet Paper, Victor Lima Mike One, Two, Three, Four... Wet Paper, Victor Lima Mike One, Two, Three, Four ... Wet Paper, Victor Lima Mike One, Two, Three, Four.

Position Three Zero miles South East of Cape Moreton

Engine failure and am drifting North at three knots.

No immediate danger

Require Urgent assistance

OVER.

3. MAYDAY

Seahunter, Victor November November, Eight, Eight, Four... Seahunter, Victor November November, Eight, Eight, Four... Seahunter, Victor November November, Eight, Eight, Four.

This is Wet Paper, Victor Lima Mike One, Two, Three, Four... Wet Paper, Victor Lima Mike One, Two, Three, Four ... Wet Paper, Victor Lima Mike One, Two, Three, Four

RECEIVED MAYDAY (or Romeo, Romeo, Romeo)

In position three zero miles South East of Cape Moreton.

Estimate one zero miles from your position,

Proceeding at one three knots

ETA your position four five minutes

OVER.

4. If no-one else has answered Cool Charm's distress message, you should acknowledge and transmit a mayday relay, then advise a coast station immediately This can be done using DSC, by selecting the coast station (not all ships) and the distress relay setting. The subsequent radio message could be:

MAYDAY

Cool Charm

This is Wet Paper, Victor Lima Mike One, Two, Three, Four... Wet Paper, Victor Lima Mike One, Two, Three, Four ... Wet Paper, Victor Lima Mike One, Two, Three, Four

RECEIVED MAYDAY

Then:

MAYDAY RELAY MAYDAY RELAY MAYDAY RELAY

This is Wet Paper, Victor Lima Mike One, Two, Three, Four... Wet Paper, Victor Lima Mike One, Two, Three, Four ... Wet Paper, Victor Lima Mike One, Two, Three, Four

On behalf of Cool Charm

Who is Five Zero miles North East of Cape Moreton

Vessel on Fire and abandoning into liferaft

OVER.

5. MAYDAY, MAYDAY, MAYDAY.

This is Wet Paper, Victor Lima Mike One, Two, Three, Four... Wet Paper, Victor Lima Mike One, Two, Three, Four ... Wet Paper, Victor Lima Mike One, Two, Three, Four

MAYDAY. This is Wet Paper, Victor Lima Mike One, Two, Three, Four.

Position Three Zero miles South East of Cape Moreton.

Hull holed and sinking fast after striking submerged container

Estimate ten minutes afloat.

Red and White Eight metre cabin cruiser.

Four people on board. EPIRB activated.

Preparing to abandon into life raft.

OVER.

## Worksheet 25: Revision test

### Knowledge and understanding

1. c) Heinrich Hertz
2. a) amplitude modulation
3. b) MF/HF
4. d) 27 MHz
5. a) Sky waves travel much further than ground waves before they lose their energy
6. c) VHF
7. b) squelch control
8. b) a small battery operated floating transmitter
9. c) noise limiter
10. b) over
11. d) delta
12. c) Securite
13. b) Pan Pan
14. b) three minutes beginning every hour and every half hour
15. c) the antenna had a bad connection.

### Information processing and reasoning

1.  $f = 27.00 \text{ MHz}$   
 $v = 340 \text{ m/sec}$   
 $\lambda = ?$   
 $v = f \lambda$   
Therefore,  
 $\lambda = v / f$   
 $\lambda = 340 / 27$   
 $\lambda = 12.6 \text{ metres}$

The wavelength of the waves is 12.6 metres.

2. a) To hear a 50 Hz sound requires an intensity of 60 decibels (approx)  
b) The human voice can produce sounds between 100 and 3000 (approx) Hz  
c) The lowest frequency a musical instrument can make is 50 Hz.  
d) 5000 Hz reaches the pain threshold at 140 decibels.  
e) To hear a 100 Hz sound requires an intensity of 40 decibels (approx), whilst the 50 Hz requires 60 decibels. So it requires 100 times less sound energy to hear the 100 Hz sound.  
f) The human ear can hear 10 000 Hz at an intensity of 90 -120 decibels  
g) The lowest intensity note a musical instrument can make is 40 – 50 decibels, which can still be heard at a frequency between 1000 – 2000 Hz.



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