12.4A Radio Fundamentals

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INTRODUCTION

1. Most mariners buy a two-way radio so they can call for assistance if needed, but the radios are used for many other purposes as well, such as:
   - communicating with other vessels
   - talking to HMCG
   - asking for a berth at a marina
   - checking current weather conditions with the local NCI station

2. For these purposes, a Class D marine radio, with Digital Selective Calling (DSC), is most appropriate and provides smaller craft in coastal waters with the facilities required.

3. Larger sea going vessels have two-way radios which operate on different wavebands with greater range, giving them contact over greater distances. These are often Class A or B marine radios.

4. It is central to a Watchkeeper's effectiveness, that they are conversant with the basics of radio working and communications. This section sets out the minimum information needed.

SUPPLEMENTARY READING

5. In order to communicate effectively using the radio, all Watchkeepers must possess a level of understanding, comprising:

   ✓ Incident Reporting – Section 12.3A and 12.3B

   ✓ Radio Skills – Section 12.4B and 12.4C

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VOICE MESSAGING – language and terminology

The phonetic alphabet

6. The method of exchanging critical combinations of letters and numbers by voice messaging (radio or telephone), in a way which is most likely to be understood, has been traditionally called the NATO Phonetic Alphabet.

7. Strict adherence to the prescribed spelling words is required in order to prevent confusion and misunderstanding. It is also a mandatory NCI requirement that you are able to use this alphabet fluently. It comprises:

A	Alfa	K	Kilo	U	Uniform	0	Zero
B	Bravo	L	Lima	V	Victor	1	Wun
C	Charlie	M	Mike	W	Whiskey	2	Too
D	Delta	N	November	X	Xray	3	Three
E	Echo	O	Oscar	Y	Yankee	4	Fower
F	Foxtrot	P	Papa	Z	Zulu	5	Fife
G	Golf	Q	Quebec			6	Six
H	Hotel	R	Romeo	.	Decimal	7	Seven
I	India	S	Sierra	.	Stop	8	Ait
J	Juliet	T	Tango	/	Diagonal	9	Niner

8. In addition, the following must be noted:

- '0' is always '*ZERO*' never 'nought' or 'oh'
- any number with a decimal point, the word '*DECIMAL*' is used
- any sequence of numbers, for example 375 will be spoken as '*THREE SEVEN FIFE*' not 'three hundred and seventy-five'
- thus, 598.14 is 'FIFE NINER AIT DECIMAL WUN FOWER'

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Prowords aka procedure words

9. Prowords are words and phrases used to facilitate the exchange of precise information in a condensed standard oral format. Some of the most common, in alphabetical order, are:

Proword	Explanation Example
ACKNOWLEDGE	Let me know that you have received and understood this message
ALL AFTER	Used when part of a message needs to be repeated
	'*Say again all after …'*
ALL BEFORE	Used when part of a message needs to be repeated
	'*Say again all before …'*
AFFIRMATIVE	Means yes or permission granted
CLOSING DOWN	Used when a station, or mobile is closing down and will no longer be on listening watch
COPIED (or Received)	I have received and understood your message
	'Paragon Coastguard, this is XXX NCI. Copied. Out.'
CORRECT	Correct is used when someone has read back all or part of a message to confirm that it is correct (see also 'Wrong' below)
(MY) CORRECTION (IS)	An error has been made in this transmission
	'The wind is South East (my) CORRECTION (is) South West'
FIGURES	Numerals follow….
	'The vessel length is FIGURES wun three fower metres'
GO AHEAD	Used to indicate you are ready to receive a message
IMMEDIATE	An urgent message to follow (see Priority below)
I SAY AGAIN	I am repeating what I have just said
	'XXX NCI, this is Paragon Coastguard, I SAY AGAIN . . .'

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Proword	Explanation Example
I SPELL	Prefixes any spelling by phonetic alphabet you are about to make
	'Boat name is Boaty I SPELL Bravo Oscar Alfa Tango Yankee Boaty'
NEGATIVE	Means no or permission not granted
NOTHING HEARD	The response when you do not hear a reply to your communication – to be used after waiting a couple of minutes for a reply; often used by the Coastguard
OUT	This is the end of my transmission and no response is expected
	'*This is XXX NCI. Out.'*
OVER	I have completed my message/transmission and a response is required
	'XXX NCI, this is XXXXX do you have anything further? OVER'
OVER AND OUT	Is never used. Common sense tells you it is sending a conflicting message – 'please reply and do not reply'
PRIORITY	Please regard my transmission as taking precedence
RADIO CHECK	Please report the strength and clarity of my radio signal
READ BACK	Please read back the message just passed to confirm correct
	'Read back map location . . .'
RECEIVED (or Copied)	I have received and understood your message
	'Paragon Coastguard, this is XXX NCI. Received. Out.'
REPEAT	Used when asking for repetition of the whole message
ROGER	Is not an official proword (*However it is often used, especially by the Coastguard, to mean 'Message received and understood and will be complied with'* **NOTE:** *if you are asked a question and the answer is yes, use the proword 'AFFIRMATIVE')*
SAY AGAIN	I have not understood your message, please repeat
	'XXX NCI, this is Paragon Coastguard, say again all after [OR] *all before . . . '*
SEELONCE MAYDAY	Maintain radio silence unless you are involved in the current or another mayday; used by HMCG and On Scene SAR Commander for major incidents

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Proword	Explanation Example
SEELONCE FEENEE	The restrictions on transmitting are now lifted; used by HMCG or SAR commander to end Seelonce Mayday instruction
STAND BY	I will respond to you shortly
STANDING BY	I am standing by for further messages/transmissions
STATION CALLING	I did not hear your call sign; used instead of call-sign or vessel name when you could not identify caller
	'STATION CALLING XXX NCI….'
TEXT	Used as a message prefix when the message just about to be passed needs to be written down by the recipient and relayed to someone else
THIS IS	Used when identifying yourself/station at the commencement of a call or exchange of messages; always name the receiver of transmissions first before identifying as the caller
	'Paragon Coastguard, THIS IS XXX NCI . . .'
TRAFFIC	General term for radio communication
WAIT	I must pause for a few seconds, standby for further transmission, I will call back
WAIT – OUT	I must pause longer than a few seconds standby for further transmission; normally used when an immediate answer is not available, and the receiving Station needs to call you back with an answer – also used by the receiver if you inadvertently speak over someone else's transmission, the caller will instruct you to 'WAIT'
WORD AFTER **or** **WORD BEFORE**	Used when repetition of a single unidentified word in a message is required
WRONG	Used when your last transmission or part of that transmission has been misheard (if you used "*Incorrec*t" it may be misheard as "Correct")
	'Wrong. Correct version is . . . '

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COMMONLY- USED RADIO AND TELEPHONE ABBREVIATIONS

10. Whilst not formal prowords, you will routinely come across the following:

ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
OPS	Operations
RTC	Road Traffic Collision
RTB	Return to Base
SITREP	Situation Report
POB	Person(s) on Board
PV	Person(s) Visible

24-HOUR CLOCK

11. The 24-hour clock is used in all maritime communications. Its purpose is to provide an unambiguous and well-defined method of representing times.

12. HMCG always uses Universal Time Coordinated (UTC) which is the successor to Greenwich Mean Time (GMT).

13. Although extremely unlikely unless used by mistake on a marine channel, you may hear the word 'Zulu' (short for Zulu time), which is used by the military or in aviation, as a term for UTC. You may also hear 'Alpha' again in military or aviation parlance, which is UTC+1.

14. British Summer Time (BST) is UTC+1.

15. NCI's main contacts are with the public, so we use 'local' time (whether UTC or BST) during daily operations. In radio contacts with other bodies it is important to qualify times as either BST or UTC.

VOICE MESSAGING – etiquette and protocol

16. It is vitally important that NCI always demonstrates a professional image when in radio communication with the public or our colleagues in the SAR organisation.

17. The Station which is being called is always the first one identified and the Station making the call is second.

18. In all cases where NCI Stations transmit to, or receive from, HMCG, it is HMCG that is regarded as being in control of the communication.

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Using Call Signs

19. To ensure NCI presents a consistent and professional image, we conform to the standard SAR practice of using a **Call Sign**, which is location + asset, thus when initiating a communication:

"Paragon Coastguard, Paragon Coastguard
THIS IS XXX NCI, OVER"

This is an MCGA requirement, as the use of 'Coastwatch' may cause confusion with Coastguard call signs.

The response should be:

"XXX NCI, THIS IS Paragon Coastguard, OVER"

20. If you are outside your Station and using a hand-held radio, you must use the Call Sign of your Station followed by your allocated Call Sign number or an agreed handset number:

". . . THIS IS XXX NCI 32"

21. The identifying Call Sign must be used once, twice or three times according to the circumstances, when making the initial call:

"Paragon Coastguard, Paragon Coastguard
THIS IS XXX NCI, OVER"

Thereafter single identifiers must be used every time the Press to Transmit (PTT) button is depressed during the rest of the radio conversation.

22. A call finishes when one of the parties uses the Proword "*OUT*" at the end of a transmission indicating that a reply is not expected.

23. If you hear a call that is clearly intended for you, but do not catch the name or call sign of the Station calling, then reply by substituting the words "*station calling*" for the unheard call sign.

"*Station Calling XXX NCI THIS IS XXX NCI.*
SAY AGAIN, OVER."

If you get a response proceed as normal. If your call goes unanswered try twice more and if there is still no response, then:

"*Station Calling XXX NCI. Nothing heard, OUT*."

24. The following are good practice habits to adopt (but not ranked in order of importance) when ***initiating a transmission***:

- listen before you transmit to ensure you are not interfering with another call
- think before you speak
- plan your message to keep it concise and to the point, and
- record your transmission in the Logbook

25. When ***receiving a transmission***:

- know how to handle requests correctly that are outside NCI's capability – for example we are not a distress or urgency handling centre
- know how to re-direct calls appropriately to HMCG
- know how to request callers call back if there is a flurry of activity in the Station

26. Follow basic ***principles of good communication***:

- only transmit when you are fully qualified to a minimum standard of RYA SRC or being supervised by such a qualified operator
- be fully conversant with prowords and the phonetic alphabet
- always identify yourself with your call sign when transmitting
- never shut down a marine radio before finishing all operations resulting from HMCG instructions
- always maintain a calm and courteous manner

VOICE MESSAGING – using your voice

27. Clear speech and precise articulation is key to having effective transmission. Your voice is as much a tool as the radio itself. Remember the mnemonic RSVP:

- ***Rhythm*** – use your normal conversational manner as if the person receiving the communication was sitting with you; you are not an announcer
- ***Speed*** – keep a measured speed, neither too hurried nor too slow, this is especially necessary in an emergency
- ***Volume*** – a normal speaking voice is required, too loud and the microphone will overload, and your transmission will become distorted and potentially unreadable; too soft and your transmission will not carry
- ***Pitch*** – a higher voice pitch carries better than a deep one, which can be almost unintelligible; if possible pitch your voice at a slightly higher level

Use the microphone correctly – a fist microphone should be held about 2 to 5 centimetres from the mouth and slightly to one side

MARINE VHF RADIO

28. In the UK, Ofcom allocates channels and frequencies. NCI is allocated its own Channel 65 (a Duplex channel using frequencies156.325MHz to 160.925MHz)

29. Marine VHF radio equipment is installed on all large ships and most seagoing small craft. It is also used (with only slightly different regulations) on rivers and lakes.

30. Whenever a Watchkeeper is using the radio, it is possible that others may be listening. This applies to using channels other than 65 under direction of HMCG. However, it is also possible that someone with a hand-held VHF radio, tuned to Channel 65, could hear your transmission and so it is best practice to assume others are listening.

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OPERATING A MARINE RADIO

31. While there are many different makes and models of VHF marine radios and no 'standard' control panel, there are a number of generic controls common to all. It is imperative that you read and understand the manual relating to the radios in your Station and familiarise yourself with their operation.

Basic Controls

- ***Power on/off*** – a press-button on some radios but can often be combined with the Volume control.
- ***Volume Control*** – usually a rotary knob which is turned clockwise to increase volume.
- ***Squelch*** – radio reception is often accompanied by a background hiss; adjusting the squelch control will reduce the noise to acceptable levels. Be careful not to turn it up too much or distant and faint transmissions will be lost. The squelch noise should be used to assist in setting the volume as part of the switch-on procedure. Some radios have an automatic squelch facility.
- ***Power Output*** – VHF Marine band radios have both high power (25 watts) and low power (1 watt) outputs. The control for this can sometimes be on the hand-held microphone.
- ***Press to Transmit (PTT)*** – when the PTT or Pressel switch on the microphone is depressed you can speak but not listen. Release it after speaking to hear the reply.
- ***Channel Selector*** – this is usually in the form of a rotary knob or up/down keys.
- ***Dual Watch*** – dual watch enables an operator to monitor Ch16 (the distress and calling channel) and one other selected channel. The receiver is switched to monitor the selected channel but, when transmission is detected on Ch16, it automatically switches over, reverting to the selected channel when the transmission ends.
- ***Scan*** – any number of channels can be selected as favourites (tagged) and the receiver listens to each in turn, remaining with a channel if a signal is received, otherwise moving on to the next. Under the normal scan function there is no priority for Ch16 so important messages could be missed if you rely on the basic scanning mode.
- ***Priority Scan (Pri Scan)*** – scans selected channels as in the normal scan mode but will automatically lock onto a Ch16 transmission regardless of what channel is displayed on the screen at the time.

Switching-On Procedure

32. The following procedure should be used:

- switch on and adjust the:
  - squelch to hear the background hiss
  - volume whilst listening to the background hiss
  - squelch to just eliminate the background hiss
- select the required channel
- ensure the power is set to 'Low'

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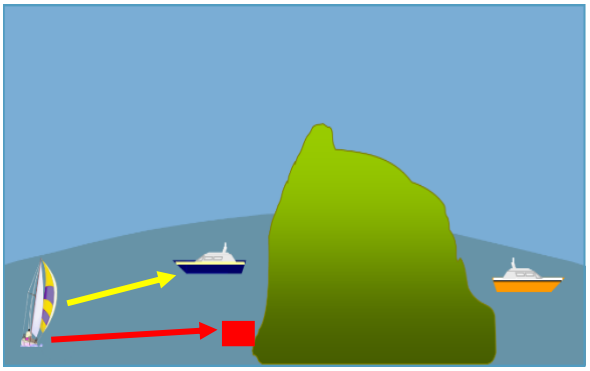
33. It is a requirement of Declared Facility Status (DFS) that certain channels must always be monitored (refer also to Section 4C – Listening Procedures). These channels are:
    - Channel 0
    - Channel 16
    - Channel 67
    - Channel 65 (reversed)

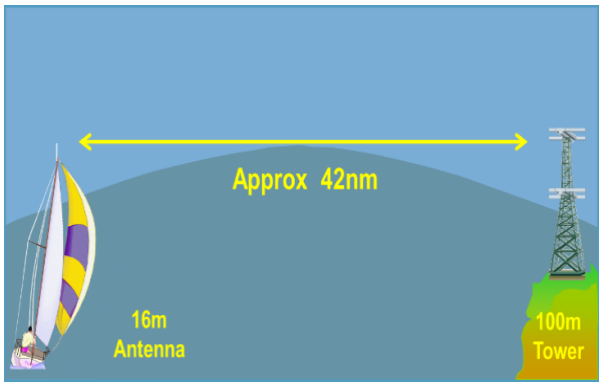
34. Stations may have other local channels (for example, marinas, lifeguards) which they also monitor – you must familiarise yourself with them if applicable.

RANGE

35. Class D marine radios operate on the Very High Frequency (VHF) waveband. Radio waves in the VHF waveband travel in straight lines and can be stopped by other objects A popular response to the range question is '*if you can see it you can talk to it*' (known as line-of-sight) and this is generally a good guide.



Remember however that the radio signal comes from the radio aerial (not the radio itself) and therefore using higher antenna allows the radio to 'see' further, as illustrated in this simple diagram.

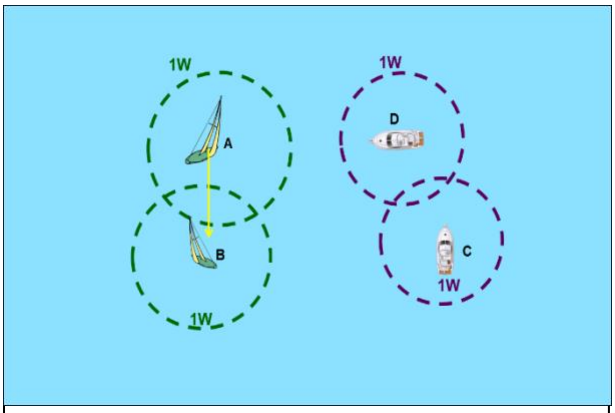


HIGH / LOW POWER

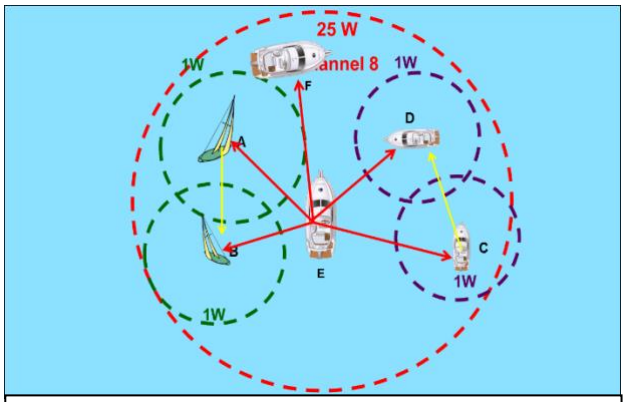
36. When a radio is switched on, 25 watts is often automatically selected. Similarly, 25 watts may be automatically selected after changing to certain channels. This should be changed to 1 watt before transmitting in order to reduce interference with other communications on the same frequency.

37. Only switch to 25 watts if your message is not received on 1 watt and it is important that it gets through. The general Ofcom directive is to use 1 watt unless you really need 25 watts.

38. Marine hand-held radios generally can choose to operate on 1 or 5 watts. Handheld DSC radios can choose to operate on 1 or 6 watts.



Here, vessels A and B and vessels C and D are holding independent conversations on the same channel using 1 watt of power

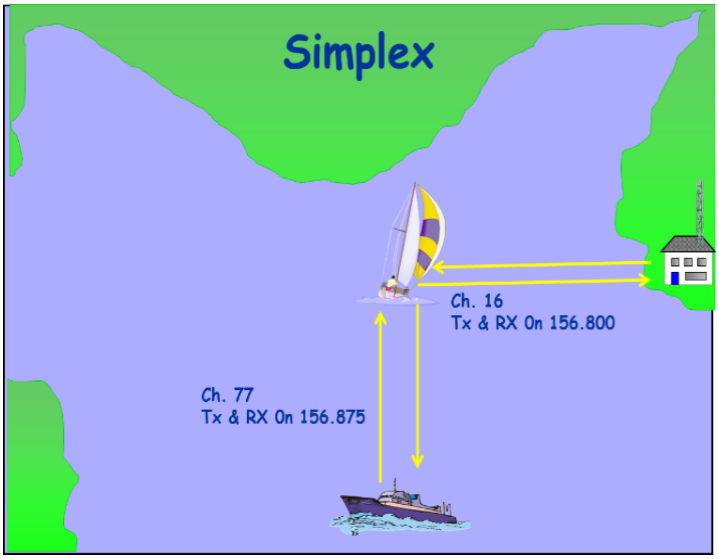


Here, vessel E is transmitting, also on the same channel, to vessel F using 25 watts and is overpowering the conversation of the other 4 vessels

SIMPLEX, DUPLEX AND SEMI-DUPLEX CHANNELS

39. Marine channels consist of two types – simplex and duplex, with designated channels internationally reserved for specific purposes.

40. **Simplex** channels use one frequency for transmitting and receiving, but in one direction at a time. This means that transmission has to cease before a message can be received. Only one person can talk at a time and so it is necessary to inform the other party that you have finished transmitting and are awaiting their reply by saying 'OVER'.



41. In this diagram, the yacht is talking ship to ship with the larger vessel on channel 77 which has one frequency 156.875 MHz. This is a simplex channel as is Channel 16 which has a frequency of 156.800 MHz.

42. **Duplex** allows for communication in both directions at the same time. Duplex requires two transmitters and two receivers (that is one transmitter and one receiver at each end of the communications link). A duplex channel is allocated two separate frequencies, one for transmission A to B and one for the receipt direction B to A. A mobile phone is an example of equipment using a duplex mode. Normally, fixed equipment (as in a base station) operates in full-duplex mode.

43. **Semi-Duplex** – where duplex channels are employed in the marine network, they are mainly operated as 'semi-duplex' and marine radios are configured accordingly.

44. Semi-duplex uses two frequencies – one for receiving and one for transmitting. A radio operating in semi-duplex mode can only transmit or receive at any one time.

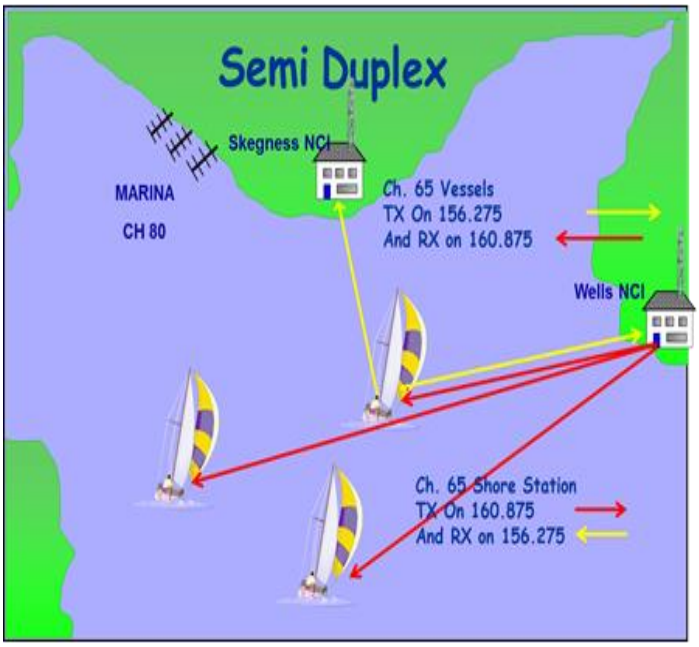
45. When the PTT button is depressed the radio switches to the transmit frequency and when it is released it reverts to the receive frequency.

46. They are mainly used for ship to shore operations and the shore stations radios are configured with reversed frequencies.

47. In this diagram vessels transmit on the yellow frequency (156.275) and receive on the red one (160.875).

48. The Shore Stations transmit on the red frequency and receive on the yellow one.

49. It is important to understand that even if all vessels are on the same duplex channel, they will not receive each other's transmissions as they are listening on another frequency.



50. Similarly Shore stations will not receive each other's transmissions.

51. It is essential that NCI Watchkeepers understand this concept as Channel 65 is a duplex channel. This is the reason we have a separate radio for channel 65 as it is configured as a shore station and shows "65 REV" (channel 65 reversed).

52. Channel 80 used by UK marinas is also a duplex channel.

USING CHANNEL 65 (NCI Working Channel)

53. Channel 65 is used to:
    - provide an additional way for vessels to obtain local weather information, as some NCI Stations broadcast local weather and sea conditions at certain times during the day
    - offer radio and AIS transponder checks on demand
    - provide the Inshore Waters Forecast (IWF) on request from a specific vessel which has missed the regular HMCG IWF broadcast; NCI must not make general broadcasts of the IWF

54. Some other examples of Channel 65 usage are:

- exercise communications
- making contact with vessels for matters relating to NCI's role as part of the SAR organisation
- accepting the intentions of local vessels that will be returning to a local mooring within a few hours, for example, a Dive Charter may pass persons on board (POB) and the location and duration of the intended dive; HMCG allows NCI to do this, though see '**passage plans**' below
- using portable (hand-held) radios within 4kms of the base station; some of our Stations use hand-held radios for safety patrols and for training purposes
- giving Watchkeepers practice; some Stations broadcast a suitable statement on opening and closing the Station and this is perfectly acceptable.

55. There are ***Mandatory Channel 65 Rules*** which must be followed:

- NCI is not allowed to broadcast the shipping forecast or IWF either in part or in full except to meet a request for the IWF from someone who has missed the regular IWF broadcast by HMCG
- if a vessel calls your Station or simply "*Coastwatch"* rather than HMCG on Channel 16 you should wait for HMCG to respond
  - If there is no response after two such calls, phone HMCG on the routine number to ask whether you should call the vessel on Channel 16 and switch them to Channel 65. Do not reply to the vessel on Channel 16 without HMCG authority **OR**
  - If you believe the situation is so grave that safety is at issue, reply on Channel 16, then
    - **a)** phone HMCG explaining what has been done and why
    - **b)** document in the Station Logbook
    - **c)** notify the Station Manager
- all communications on Channel 65 must be logged

56. In addition, Stations must not:

- ***Fail to answer a call to the station*** – all calls heard on channel 65 must be answered, even if the Watchkeeper has to say "*I'm sorry, we're busy, I'll call you back*", when a full response might interfere with a higher priority watchkeeping task
- ***Accept full passage plans from vessels*** – that is for a journey ending in a different location to its start. A vessel trying to pass such information should be directed to call HMCG on Channel 16 or 67

VHF TRANSMITTING PROCEDURES

57. All messages received on VHF radio are strictly confidential. Any relevant information should be recorded in your Station Logbook and, if necessary, be given to your relief Watchkeeper; under no circumstances should it be passed to an outside body – either orally or in writing, unless required by HMCG or the police.

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RADIO CHECKING PROCEDURE

58. When it is considered necessary to check the signal strength and readability of a Station, the calling Station initiates the procedure by use of a full call and the Prowords 'RADIO CHECK'.

"XXX NCI THIS IS Boaty Boat RADIO CHECK OVER"

"Boaty Boat THIS IS XXX NCI, you are LOUD and CLEAR,
HOW ME, OVER."

"XXX NCI THIS IS Boaty Boat, you are GOOD and READABLE,
Boaty Boat, OUT"

59. The following radio check Prowords should be used to prevent misunderstandings, they comprise two elements of the transmission – signal strength and readability of signal:

signal strength	
LOUD	*Your signal is very strong*
GOOD	*Your signal strength is good*
WEAK	*Your signal strength is weak*
FADING	*At times your signal strength fades to such an extent that continuous reception cannot be relied upon.*
readability	
CLEAR	*Very good*
READABLE	*Satisfactory*
UNREADABLE	*Quality of your transmission is so bad that it cannot be read*
DISTORTED	*Having trouble reading you because your signal is distorted*
WITH INTERFERENCE	*Having trouble reading you due to interference*
INTERMITTENT	*Can only read parts of your transmission due to breaks in reception*

You should enter the result of the radio check in the Log entry.