CHAPTER 4

RADIO EQUIPMENT OPERATION AND PROCEDURES

RADIO EQUIPMENT OPERATION

4.01   CONTROL FUNCTIONS

The majority of radio transceivers manufactured for the Australian market have a number of switches/controls and/or indicator lights which perform the following functions:

a.   **On - Off Power Control** - This switches the radio on or off.

b.   **Volume Control** - This controls the level of sound from the speaker and should be set for a comfortable listening level.

c.   **Mute/Squelch Control** - This control eliminates the background noise. However its setting is critical for the correct operation of the receiver. Individual equipment instructions should be consulted.

d.   **Channel/Frequency Control** - A vital function that an operator must perform is the correct selection of the channel/frequency. If the operator selects the incorrect channel/frequency it then prevents communications. Individual organisations instructions must be referred to for the correct settings of this control.

e.   **Indicator Lights** - These may be used to indicate various functions such as power on, signal receive, transmitter on and channel number. Variations between manufacturers may occur.

f.   **Microphone** - This item comprises two major components:

(1)   A 'Push To Talk' switch (PTT) which is used to change the radio from RECEIVE to TRANSMIT.

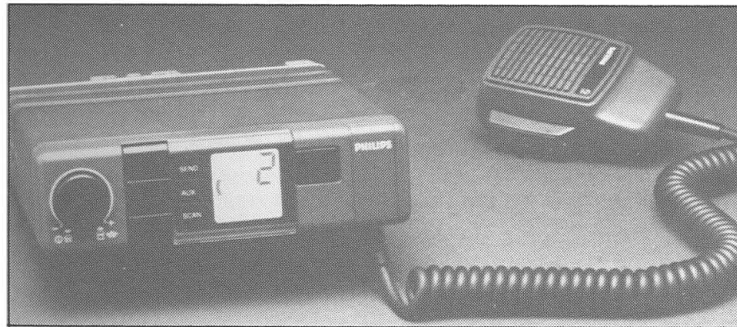(2)   A microphone to convert your voice to electrical impulses.

Figure 4:1
Mobile Two Way Radio Transceiver

4.02 MESSAGE TRANSMISSION

To TRANSMIT a Message:

a.   remove the MICROPHONE from holder;

b.   listen before transmitting, to ensure the channel is clear;

c.   raise the MICROPHONE to a position where your thumb touches the face, speak across the open grille, without shouting;

d.   depress the 'Push To Talk' (PTT) button on the MICROPHONE, transmit your message, then release the button; and

e.   if no further transmissions are required return the MICROPHONE to its holder.

Figure 4:2
Microphone Technique

4.03 TRANSMIT TIMERS

It is a regulatory requirement that all transmitters be fitted with one minute time out timers. Therefore, transmitters will not transmit continuously for periods of more than a minute. This ensures that minimum disruption is caused to a network by jammed microphone buttons.

4.04   Good operating procedures will ensure that transmissions do not approach this duration.

4.05 RECEIVING MESSAGES

To RECEIVE a message:

a.   turn the ON/OFF switch to the ON position (this switch may include other functions, ie Volume, or Mute Squelch);

b.   set the VOLUME control to the mid position;

c.   set the MUTE control, if fitted, until a rushing noise is heard;

d.   reset the VOLUME to a comfortable listening level;

e.   reset the MUTE control, if fitted, until the rushing noise is just silenced (DO NOT advance this control further as weak signals will not be heard): and

f.   determine the correct CHANNEL and select it with the CHANNEL switch control.

BASIC RADIO OPERATING PROCEDURE

4.06   The majority of modern radio systems are of telephone quality. However, certain procedures are used for the following reasons:

a.   The radio Communications Act requires a radio service to be controlled by competent operators.

b.   Radio communications may suffer from interference, which can result in misunderstood messages.

c.   Communication is only possible in one direction at a time. Chaos can result if two or more persons use the same frequency to transmit at the same time.

d.   In emergency or poor operating conditions radio traffic becomes congested and accuracy can suffer.

e.   Radio is a multi-user communications facility which requires listening before transmitting and consideration of other users.

4.07   **SCANNING**

Most modern radio transceivers are able to automatically switch between channels in sequence when the scan option (if fitted) is selected. The receiver will pause when encountering an active channel. This process is known as scanning.

4.08   There are a variety of methods of scanning but the basic concept is that the operator can monitor multiple channels with a single transceiver

4.09   **SCANNING DISADVANTAGE**

A significant disadvantage of scanning is that while the receiver is latched to signals on one channel, traffic on other channels may be missed.

4.10   **TELEPHONE/RADIO INTERFACE**

Telephone/Radio interface devices permit radio systems to be coupled with the public switched telephone network. This enables field operatives to communicate with others on the normal telephone system from their mobile or portable radio transceiver.

UNLESS YOUR RADIO SYSTEM IS SECURE THIS CONVERSATION MAY BE HEARD BY OTHER RADIO USERS.

4.11 BENEFITS OF STANDARD PROCEDURES

The use of STANDARD PROCEDURES ensures:

a. brevity;

b. accuracy;

c. speed; and

d. simplicity.

4.12 COMMONSENSE

When using radio there is no substitute for commonsense:

a. The use of profane language is not permitted on radio networks by law, and must not be used.

b. Clear speech assists reception and avoids the need for repetition or correction.

4.13 USER FACTORS

'User factors' are rhythm, speed, volume and pitch (RSVP). They will assist in achieving successful transmission of messages:

a. **Rhythm** - Ordinary conversation has a natural rhythm which needs to be preserved when speaking on radio. Say messages in short complete phrases that make sense not word by word. Avoid using redundancies like 'you know' or 'er'.

b. **Speed** - Speak slightly slower than in normal conversation, avoiding rushing or slurring words. Pause between phrases to give the receiver time to write down the message.

c. **Volume** - Speak slightly louder than normal conversation. Avoid shouting.

d. **Pitch** - Use a normal or slightly higher pitched voice.

4.14 PROWORDS

Prowords are pronounceable words or phrases which have an assigned meaning for the purpose of expediting message transmissions. An example of common prowords and their meanings are as follows:

a. **'Roger'** - Message received and understood.

b. **'This is'** - Used in conjunction with an identifying radio call sign.

c. **'Over'** - My transmission is ended and I expect a reply (Not used in conjunction with 'OUT').

d. **'Out'** - My transmission is ended, I do not expect a reply (Not used in conjunction with 'OVER').

e. **'Say again'** - Repeat all of your transmission again (Or identified portion of the message).

f. **'Wait'** - I must pause during my transmission.

4.15 RADIO CALL SIGNS

Call signs are used to identify stations on a network. The Department of Transport and Communications (DOTAC) issues a Network call sign (or call signs). However, in some cases individual organisations may allocate place names and numbers, used alone or in conjunction with the DOTAC call signs. Some examples are:

DOTAC call sign   VZ6DG
Individual call sign   Curtin Mobile 2
Abbreviated call sign   Curtin 2

The use of call signs on every transmission is unnecessary and wastes time. However, where there is a risk of confusion, full call signs should be used on each exchange.

4.16 RADIO LINK

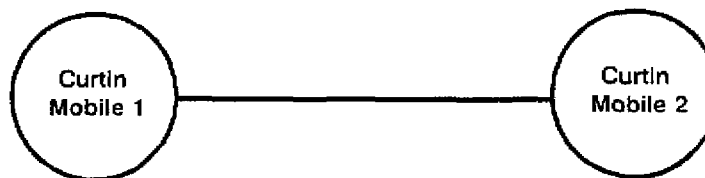A radio link is two stations operating on the same frequency for the purpose of communicating with each other·

Figure 4:3
Radio Link

4.17 RADIO NETWORK

A radio network is a group of radio stations operating on the same frequency for the purpose of communicating with each other.

4.18 CONTROL STATION

A Control Station is an assigned station on a network responsible for network management. These responsibilities may include:

a.   direction of 'radio-controlled' vehicles or personnel;

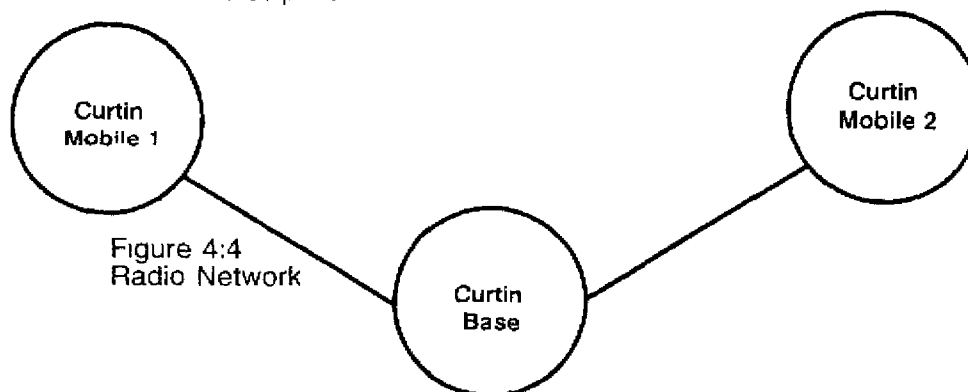b.   message handling; and/or

c.   network discipline.

Figure 4:4
Radio Network

4.19   MAKING A RADIO CALL

The principles of making a radio call are as follows:

a.   Say whom you wish to speak to (eg 'VZ6DG Curtin Base');

b.   Say who you are (eg 'This is Curtin 2'); and

c.   Say what you have to say BRIEFLY (eg 'I am returning now, OVER').

4.20   ANSWERING A CALL

The principles of answering a call are:

a.   reply to the caller with your radio call sign (eg 'Curtin 2 this is Curtin Base'); and

b.   respond to any request (eg Roger, OUT').

"VZ6DG CURTIN BASE,
THIS IS CURTIN 2,
I AM RETURNING NOW, OVER "

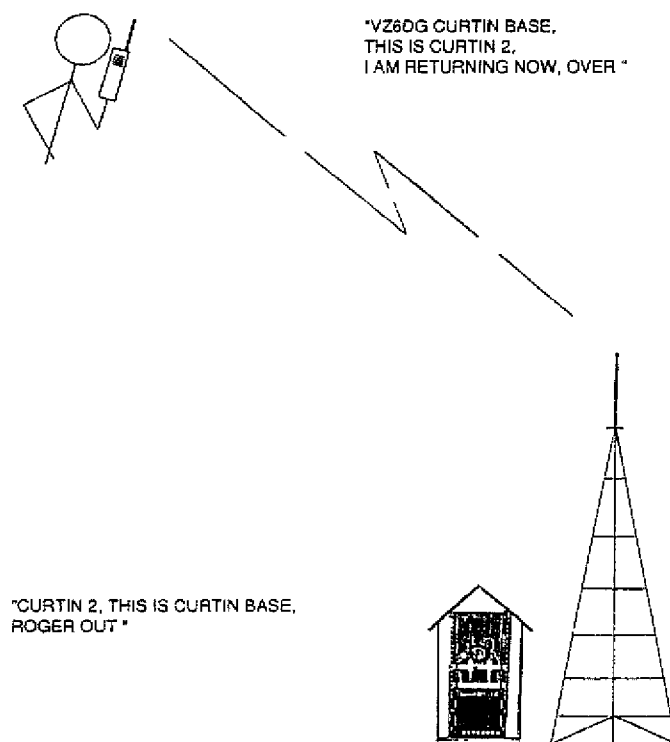"CURTIN 2, THIS IS CURTIN BASE,
ROGER OUT "

Figure 4:5
Making a Call

4.21   MESSAGE PASSING

The basic principles of transmitting radio messages are.

a.   listen before transmitting;

b.   keep messages short and concise,

c.   urgent or Priority messages must be transmitted expediently without dramatisation;

d. unusual person or place names may be spelt by using the PHONETIC ALPHABET;

e. long messages should be broken into natural sentences;

f. if messages are required to be written by the receiving operator, the message should be transmitted at writing speed; and

g. avoid the use of jargon terms.

4.22   PHONETIC ALPHABET

The phonetic alphabet (shown below), is a standard procedure for the transmission of difficult to pronounce words or place names:

A	-	Alpha	N	-	November
B	-	Bravo	O	-	Oscar
C	-	Charlie	P	-	Papa
D	-	Delta	Q	-	Quebec
E	-	Echo	R	-	Romeo
F	-	Foxtrot	S	-	Sierra
G	-	Golf	T	-	Tango
H	-	Hotel	U	-	Uniform
I	-	India	V	-	Victor
J	-	Juliet	W	-	Whisky
K	-	Kilo	X	-	Xray
L	-	Lima	Y	-	Yankee
M	-	Mike	Z	-	Zulu

The excessive use of the phonetic alphabet wastes time on radio networks. Clarification of words can very often be made using plain English spelling without the need to resort to phonetic spelling.

'Catenary, C-A-T-E-N-A-R-Y, Catenary.'

Figure 4:6

4.23   DIFFICULT CONDITIONS/WORDS

In poor conditions, difficult words or groups within the text of plain language messages may be spelt using the phonetic alphabet, and proceeded by the proword 'I SPELL'. If the operator can pronounce the word to be spelt, it should be done before and after the spelling to identify the word.

'Catenary_____I SPELL charlie alpha tango echo november alpha romeo yankee_____Catenary'

Figure 4:7

4.24 PRONUNCIATION OF NUMERALS/NUMBERS.

When numbers are transmitted by radio the rules for their pronunciation are to be observed as follows:

NUMERAL	SPOKEN AS
0	zero
1	wun
2	too
3	thuh ree
4	for wer
5	fi yiv
6	six
7	se ven
8	ate
9	niner
10	wun zero
decimal point	day see mal

Numbers should be transmitted digit by digit, except that exact multiples of hundreds and thousands may be spoken as such. To distinguish numerals from words the proword 'FIGURES' is to be used preceding those numerals.

Examples of spoken numbers:

NUMBER	SPOKEN AS
44	for wer for wer
500	fi yiv hundred
7000	se ven thow zand
123.4	wun too thuh ree day see mal for wer

4.25 RADIO CHECKS AND SIGNAL REPORTS

IT IS ESSENTIAL THAT A CHECK BE PERFORMED WHEN FIRST USING A RADIO AND PRIOR TO DEPARTURE FROM A DEPOT OR BASE. This is particularly important because it enables faulty equipment to be detected and replaced before operations are commenced

4.26 SIGNAL REPORTS

When testing a radio or establishing a link or network it may be necessary to exchange signal strength reports with the other station.s. The following signal reports are:

a.   loud and clear (100% readability);

b.   readable (good readability 90 - 100%);

c.   weak readable (fair readability 50 - 90%);

d.   unreadable (readability of less than 10%); or

e.   nothing heard (no signal heard, check for faults).

4.27 SENSITIVE MESSAGE TRAFFIC

On occasions emergency services may find it necessary to transmit sensitive information such as casualty lists and incident details. Because radio systems can be monitored by the public, care should be taken to ensure that sensitive information is transmitted in a coded form.

4.28 While electronic coding systems can be fitted to radio transceivers, it is also possible to develop a system of prearranged code words.

4.29 Consideration should be given to passing sensitive information by other means, eg telephone or personal contact.

RADIO OPERATING CONDITIONS

4.30 TERRAIN INTERFERENCE

Due to terrain or interference, radio signals may fade or become unreadable. This is most noticeable when communicating with vehicles or portable radios. There are some steps that should be taken to improve radio communications when signal paths are deteriorating Some of these steps are.

a. request vehicles or persons to stop, or relocate: then

b. conduct radio checks until satisfactory communications are re-established. (Relocation of one metre is sometimes sufficient)

4.31 INTERFERENCE TO RADIO SIGNALS

Interference is any effect that impairs the reception of a radio signal. The interference can be natural, manufactured, or a combination of both. Natural interference is most noticeable on some High Frequency radio networks although Very High Frequency and Ultra High Frequency radio systems may also be effected. This type of interference is usually weather related and generally known as Static. Some sources of natural interference are:

a. electrical storms;

b. dust storms:

c. rain;

d. temperature inversions; and

e. ionospheric disturbances.

4.32 MANUFACTURED INTERFERENCE

Manufactured interference is usually caused by electrically operated machinery and appliances and may sound like buzzing, humming, and high pitched squealing, etc. This type of interference may be heard continually or intermittently depending on whether the electrical devices are permanently operated or switched. Examples of manufactured interference are:

a. high tension power lines;

b. electricity supply systems and facilities,