MOUNTAIN RESCUE COMMUNICATIONS

General

Communications, in all its forms, is vital to the efficiency and safety to MRT operations and training.

Most MRT members are mountaineers first, mountain rescuers second; that is to say that they joined the Mountain Rescue Service because of an interest in mountaineering, not the other way round. Carrying a radio on the hill is, in many ways, alien to the aesthetics of mountaineering, and to many, radios are noisy and “comms” are boring. However, a good knowledge of communications can save as many lives as good Immediate and Emergency Care. Even during routine training, comms can be important. We have all suffered the following:

a. The inability to catch that ideal, impromptu vehicle pickup.

b. The helicopter that flies past, tantalizingly close but out of contact.

c. Having to continue with plan A because you can’t get through to the other party to inform them that you wish to alter your route.

To be successful, the communications network must extend reliable two-way communications from the first informant, all the way through the police, ARCC and MRT signals control vehicle, to the most remote a party leader - and back again if necessary. Previous large incidents such as the Lockerbie disaster have consistently shown that communications have been pivotal to the success or failure of the early SAR phase. Too much dependence on one or another mode of communication inevitably means that that particular system can become inoperative or saturated at a critical stage.

Comms failure is often blamed on equipment or systems but sometimes the problem lies with the operator. Each team member must strive to become a proficient communicator who can wring the best from his radio equipment and be able to manipulate and improvise where the situation demands - so that the message really does get through when it matters.

Communications Development Over the Years

In the early days, teams’ communications equipment for contacting ARCC consisted of a CW-only (morse) transmitter-receiver, similar to the sets used in the Lancaster bombers of the Second World War. This meant that only the one established wireless operator (the term “WOp” is still used today) could use the set - if the temperamental instrument worked, that is. The hill-set then in use was a heavy valve set which weighed as much as, or more than, a day-sack. They were so inefficient and ineffective that reciprocal routes during training were the norm- this meant that the sets could be hidden at pre-arranged spots near the beginning of each party’s route and picked up by the party coming the other way! During weekend training exercises, teams were usually called out, not by radio, but by the nearest policeman.

In the mid-sixties, a more compact and resilient HF set with the newly developed and efficient single sideband (SSB) voice mode was issued and, the big breakthrough, miniature transistorised VHF sets were supplied for issue to hill parties. These “Hillsets” were now worthy of the name and though their transmit power was low (0.2 of a watt) and they used Amplitude Modulation (AM) instead of the modern Frequency Modulation (FM), if used correctly they were capable of consistent and reliable comms. Snowdon - Ben Nevis was recorded several times using these sets.

During the late seventies, the Clansman PRC-320 HF set was supplied to the teams. By this time, the RAF MRTs have been provided with an exclusive FM hill-set frequency (channel) but had to carry a separate AM set to maintain essential contact with their civilian colleagues.

In 1988 the Mountain Rescue Committee of Scotland (MRC of S) opted to move from the low-band VHF AM channel to a mid-band VHF FM channel near the Marine Band sector. Meanwhile, the Mountain Rescue Committee of England and Wales (MRC) kept its low band VHF channel but changed from AM to FM. This meant that effectively, the Scottish RAF MRTs had to adopt a different VHF band to maintain the essential liaison with the civilian teams in their areas. They have the same basic radio type but in a version which is not compatible with their southern RAF MRT counterparts.

The Current Scene

Today, RAF MRTs are equipped with, and use, a wide variety of communications equipment. When called out from their base stations, the team is alerted either by radio-pager (often with alphanumeric message), cell-phone, or over the usual telephone networks. The initial information from the ARCC usually sets in motion a tried-and tested cascading alert system, using telephones and radio pagers, to call in the other members of the team.

If the MRT is already out on exercise, the ARCC has the option of tasking it over High Frequency (HF) radio (which every member of the team should be able to use), Satellite telephone (SatComm), cellphone, pager, local telephone number or, the final back-up, the nearest police unit through the relevant police HQ.

While the team are enroute to the incident, they are usually in contact with the ARCC or police on cellphone or, when this is not possible, by HF radio. Within the convoy, the information gathered either by the WOp or Team Leader is disseminated to all members by Very High Frequency (VHF) radio. If the Team Leader elects to go ahead of the convoy he can pass information to the main convoy through the alpha-numeric pagers, another cell phone, or the team's second HF set.

Once the MRT has arrived at the nominated Incident Control Point, communications on HF, SatComm, cellphone or land-line are established and maintained with the ARCC, and HF, VHF or UHF means can be used to contact helicopter or fixed wing assets. Contact with MRT parties on the hill is maintained using VHF 'hill-sets', lightweight cellphone, or exceptionally, by alpha-numeric pagers. If the search or rescue widens to beyond the normal range of VHF line-of-sight communications, a "Link" may be established on a prominent (and often exposed) point which, if properly positioned, should sufficiently extend the radio coverage. As an emergency short-term measure, an airborne relay in the shape of a helicopter or even a Nimrod can be considered.

Communications Developments in the Future

Advances in communications are as difficult to predict as forecasting snow conditions, but likely developments include an increasing use of satellite communication systems and a move towards digital data and facsimile modes in addition to present voice systems.

The Command, Communications and Control vehicle (C3) is fitted with a properly engineered and filtered radio suite and adequate space for search planning and briefing. Data can be sent on mobile fax through the medium of the cellphone, by HF, via a laptop computer and modem, or over a Satcomm link.

RADIO TYPES AND THEIR OPERATION

RAF MRTs use the following types of radio:

a. **High Frequency (HF).** HF radios are used for direct communications with the ARCC and SAR helicopters. Each MRT has two HF Sets. One is permanently mounted in the Command and Control vehicle, while the other set is available for link or operational detachments.

b. **Very High Frequency (VHF).** VHF portable radios are used for communications between search parties, the Command and Control vehicle and SAR helicopters. Two types of VHF radio are used: hill sets (Motorola XTS), base sets (Philips FM 1100) and vehicle mounted sets. Civilian MRTs also use VHF radios on a designated rescue frequency.

c. **Ultra High Frequency (UHF).** The UHF radio is mounted within the Command and Control vehicle and can be remoted. This radio can provide communications between the Control vehicle, SAR helicopter and fixed wing assets (eg Nimrod).

d. **Motorola Talkabout.** A compact radio with 8 channels and 38 codes offering many combinations. They have a maximum line of sight range of 3 Km, which is reduced in woods or built up areas. They can be used freely in situations where “chit chat” would overload a potentially busy network eg searches, crash guard or when out climbing etc. Full operating instructions are available in the manufacturers handbook.

MRT Hill Sets

Also referred to as hand or pocket sets, the hill set is the teams’ most commonly used radio See **Fig 66**. They work in the VHF/FM High Band. This part of the frequency spectrum acts very like light - in general terms, it provides line-of-sight communication or, in other words, if you can see where the other set is, you should be able to speak to it. The signal is transmitted from, and received by, the antenna.

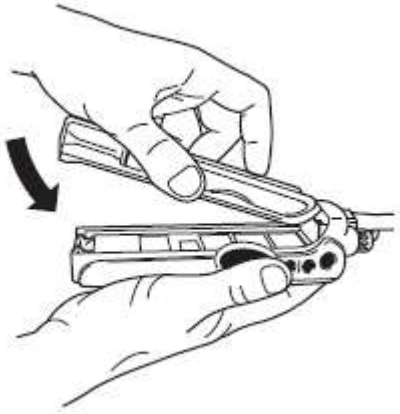
Some important additions to the line-of-sight rule are:

a. This signal can sometimes bounce off sides of mountains, rock faces, roofs of buildings, walls - indeed any surface which is not transparent to radio waves.

b. The sharp tops of ridges, such as Crib Goch or the Cuillin may cause “knife-edge refraction”. This phenomenon is caused when a signal hits the top of the sharp ridge and is refracted down the other side of the hill at roughly the same angle that it came up. This may explain why, certainly on the old MR frequency, it was possible to speak to someone half-way across the causeway on the Miners Track, over Crib Goch, from the Cromlech car-park area. Like all these phenomenon, a few feet either way can make a difference and a change of frequency may wipe it out altogether.

FIG:66 The Motorola XTS 5000R MRT Hill Set
(Remote microphone not shown)

c. Summer foliage and some substances tend to absorb radio signals if they are in direct line between the aerials. A bare antenna whip or wire touching wet or green foliage can more or less wipe your signal out. NOTE; it is the **antenna** where the signal is initially received and where your transmission finally departs - not the microphone or any other part of the radio. The hill sets use one frequency, or channel, at a time. This means that within the range of one group of sets, only one radio can transmit on the channel at any one time - the rest must wait till it finishes. This is called **simplex** operation; **duplex** operation is when two frequencies are employed and both can transmit and receive at the same time.



XTS 5000R Battery

FIG:67 The Motorola XTS 5000R battery fitting or replacement

The following procedures should be followed when operating a MR hill set:

a. **The battery:** More problems are caused by discharged or faulty batteries than by any other single cause. Check with the WOp that you have a fully charged battery and take a spare if you are on call out or if the day is going to be a long one. The contacts of spare batteries must be insulated to prevent karabiners or other metal items shorting the terminals out – this can result in fire or explosion. Think of the flight safety implications if you're onboard a helicopter at the time! See **Fig 67**.

b. **Physical security of antenna and external microphone:** Ingress of water must be the next most common fault. Although the radio handset is integrally waterproof, the microphones are less so if the external microphone is u/s, or the set doesn't seem to be working, remember to try the internal microphone. Loss of the antenna is embarrassing and renders the set useless - check it, but don't over-torque it. Try removing the battery, drying it and the radio terminals, and replacing it with a fresh battery.

c. **The controls:** If the combined on-off switch / volume control is set too low, you may not hear someone calling you on a windy ridge or near helicopters. If it is set too high, the microphone loudspeaker will overload and cause distortion.

NOTE: Turning up the volume control has no effect on the transmit power, only the incoming noise level.

d. **Check that the set is on the correct channel:** A feature of the XTS 5000R is that it can be set to transmit / receive on a number of different channels (frequencies). Note also that the radio is able to operate on high power and low power.

The reasons for this are:

i. When you transmit, you use ten times more battery power than when receiving. The high power setting is the most powerful of any hill set currently available and equates to 6 watts of transmitted power. The low setting is 1 watt. If you can easily get through on low power, there is no point in wasting valuable battery power.

e. **The Squelch button:** This little-understood control is invaluable for receiving poor or fluctuating signals. If the squelch button is pressed, the hissing sound heard is the background atmospheric noise which the set is always capable of picking up but from which you are mercifully spared by a relay which does not allow the loudspeaker to be activated until a present level of incoming signal has been reached. This level has been carefully chosen so that the atmospheric noise does not normally reach the level necessary to switch (or "lift") the squelch relay - yet is sensitive enough to switch when a fairly weak transmission is picked up on the frequency. When the transmission stops, there is not enough signal strength to keep the relay open so it switches back and the set is silenced.

Selection of the squelch facilities over-rides this relay and allows you to hear intermittent signals - usually from a moving vehicle or from someone who has failed to seize the opportunity to rest. If you are transmitting on high power and suspect that the distant set is less powerful, press the squelch button to hear everything that the set is capable of picking up. If you keep the squelch button pressed in until a bleep is heard the squelch is lifted (the hiss begins) until you press the button again and are rewarded with blissful silence. It is a useful facility for receiving these rapidfade and very weak signals, so don't ignore it - practice with it.

f. It is important that your antenna, and all the other parties' radio, is/are vertical because this makes the sets more efficient and more compatible. If you look at television aerials, you will see that they are generally all aligned in the same direction (polarised).

After checking the set and setting the controls, comes the question of where to position the set. By far the best place to place the radio is at the top of the rucksack, as far from the body as possible, with the aerial pointing straight up. A few inches extra height can often dramatically increase the range. Where to put the microphone is an important, but slightly controversial issue. Perhaps the best solution is to clip the handmic to the shoulder straps of your rucksack, just below the top of the shoulder. The lead passes under the armpit and the clip pushes over the cord tag - gravity does the rest. This solution puts the microphone near the ear, allows you to be fast on the draw if a first-come, first-served helicopter lift is offered; and means that when you take your rucksack off, the microphone goes with it - instead of being stretched to breaking point if it's in your jacket pocket.

Before leaving for the hill, carry out a radio check with the base set radio to confirm that you have good two-way comms. On returning to base camp, ensure that all batteries used are put on charge and that the radio is stored in its correct place. If you have encountered any problems with the radio during the day, tell the WOp, who can then arrange for it to be checked or repaired on return to camp.

Operating Hints

While not strictly "Procedure", the following hints will help ensure that your message gets through and saves time-wasting. They concentrate on VHF hill set use.

FIG:68

a. Ensure that your aerial is high and vertical - above 2 metres often seems to make a big difference. In poor conditions, try standing on a boulder or a trig point – see **Fig 68** - people may think you eccentric, but it works. If you are in a glen / valley, try standing on the middle of a bridge if there's one handy.

b. If reception is broken, ask the other station to stand still, then move around until you get the best reception, and stay there. Notwithstanding (a) above, if reception is best in a particular postion, keep the antenna still in that position.

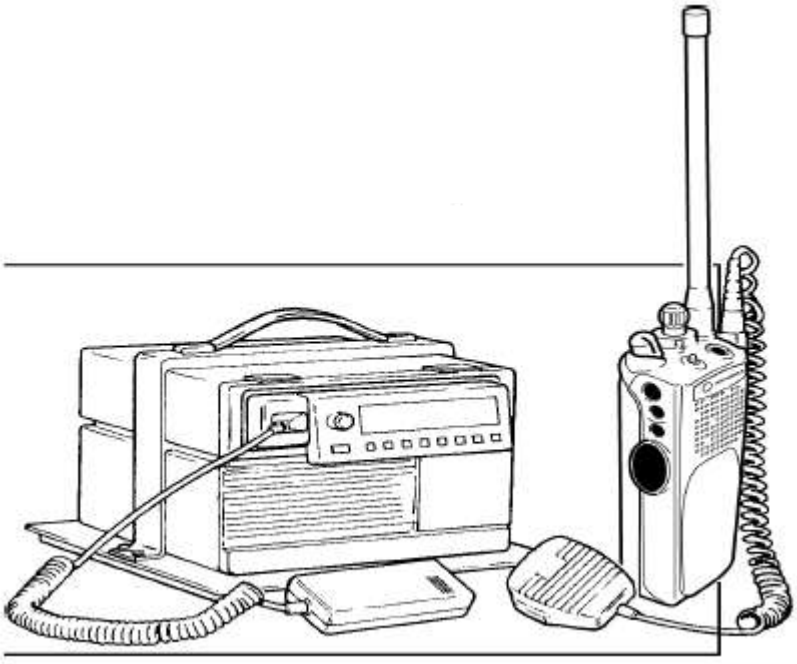


Fig 69: RAF MRS VHF RADIOS - Philips FM 1100 Base Set (Left) Motorola XTS 5000R Hill Set (Right)

c. If the other 'intermittent' station is in a vehicle and it cannot reasonably stop, try 'lifting' the squelch on your radio. To do this, press the squelch button on the side of the hill set for about 5 seconds. To reinstate the squelch, quickly press the squelch button again.

d. Attach the microphone to a purposedesigned loop on your rucksack shoulder strap.

e. Find what combination of distance and position of the mic, relative to your mouth, gives the best results; this is often about 8 cms away and turned sideways so that the air from you mouth is not blowing directly on to the microphone. Remember to shield the mic from the wind, otherwise the other station will merely hear wind noise and an incoherent message.

f. Set the volume control high enough so that you can hear other stations in adverse conditions, but not so high that it distorts. Half to three-quarters is usually about right. The volume level does not affect the transmit power.

g. When transmitting with a fully-charged battery, a constant red light should illuminate on the top of the radio and an audio bleep is heard. If you observe this light flashing it is an indication that the battery will soon lose power and should be changed.

h. If an important message requires sending, but two-way comms cannot be established, either relay the message through another station, or transmit the message “blind”, repeating the message after a short break in transmission.

MRT Base Sets

Each RAF MRT is equipped with a Philips FM1100 VHF / FM Transceiver for communications between the operational or training base camp and parties on the hill-set (**Fig 69**).

The Control Console has 8 function buttons, an On / Off button, a 4 or 6 digit display, 16 programmable indicators and a rotary volume control knob (**Figs 70**).

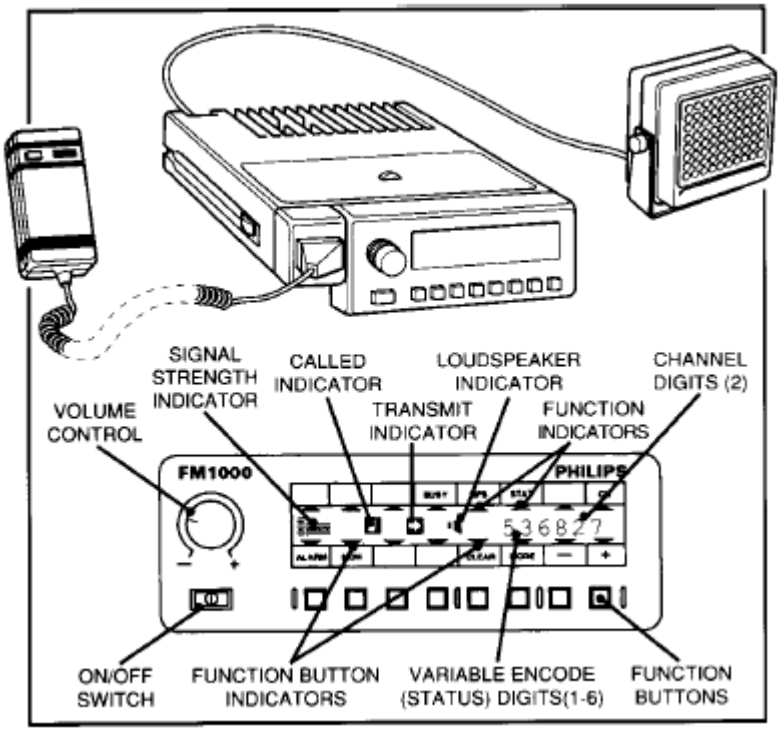
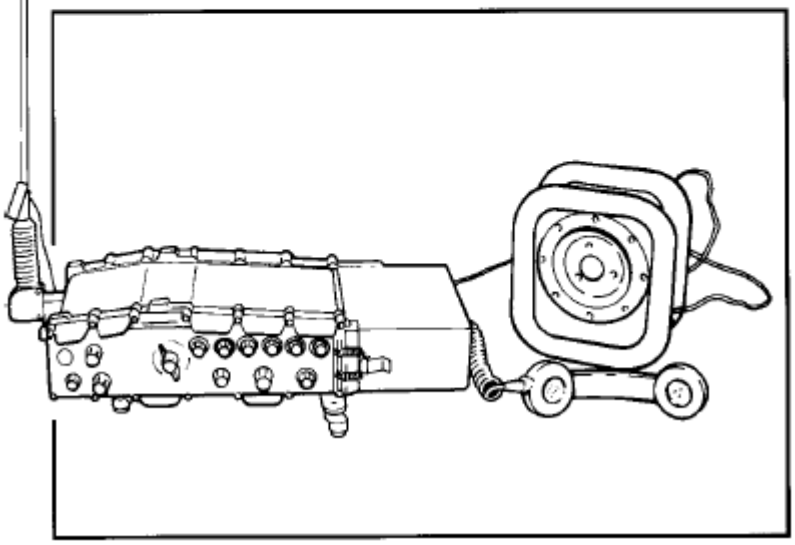


Fig 70: THE PHILIPS FM1100 MRT BASE SET
RADIO (Carry frame not shown)
Philips FM1100 Control Console

High Frequency Radios

High frequency (HF) radios work by bouncing signals between the earth’s surface and the ionosphere, which is a series of ionised layers encircling the earth some 50,000 ft above. These layers allow the signal to be reflected onto the receiving unit. As a guide, the layers will reflect between 5 MHz - 30 MHz during the day and below 5 MHz at night, due to the variable height of the ionosphere. HF communications are often poor when using the standard whip antenna and it may be necessary to consider other alternatives such as an end-fed antenna. All team members should be capable of operating the HF radio sets (**see Fig 71**). By far the best way to learn its correct operation is to use it and regular training should be carried out under the supervision of the team WOp.

FIG:71 *Clansman PRC 320 HF Radio*



Ultra-High Frequency Radios

Like VHF, Ultra-High Frequency (UHF) radios work on line of sight, although the range in this case can be as low as eight miles. Reception levels can be improved by replacing the fixed antenna on the Command and Control vehicle with a multi-directional antenna, fitted to the top of the vehicles telescopic mast. This radio is seldom used by MRTs, although selected team members should be trained in its operation for those times when it is required.

Link Stations and Radio Logs

During a large-scale search and rescue operation or when operating in an area of poor or difficult communications, it may be necessary to establish a communications link station. The link station is provided with radio and other equipment necessary to communicate with all rescue agencies, military or civilian. As in the Command and Control vehicle, all communications should be logged in an official Radio Log (B Sigs 1). When complete, the log becomes an official document and may be used in any investigation by the Police or Board of Inquiry after the event.

RADIO PROCEDURE

Why Should we Use a Procedure?

When rock-climbing, it soon becomes obvious, particularly in windy conditions or when the run-out is long or round a corner, that unless a standard series of calls are used and a limited number of possibilities are expected by the listener, confusion (potentially disastrous) usually results. Another example often encountered is when the passenger in the left-hand seat of a Land-Rover calls “Clear left” to assist the driver at awkward junctions. In this case, use of “OK”, “Yes”, or a number of other occasional calls can easily lead to a mistake and by a process of unconscious refinement, “Clear left” has become the accepted call.

Radio has always been capable of producing noisy and difficult reception and over the years operators have proved that, even in testing conditions, if the brain expects to hear only a limited number of options, it is more effective at selecting the correct one than it would be if the operations were infinite. Radio Procedure provides the means of reducing the options by defining what should be said, when it should be said, the order in which it is said and lastly, how it should be said.

a. **What:** Think out what you are going to say before your press the transmit button; keep it short and concise if possible but not to the extent that it doesn’t make sense any more or sounds too contrived. The old adage “Engage brain before engaging mouth” is a good one.

b. **When:** Don’t butt in to another conversation; listen before your transmit. If another party has found the casualty(ies), resist the temptation to call and find out what the “gen” is. The other party will be busy and will call as soon as possible with all the relevant information. If a helicopter is winching, avoid transmitting unless your message is vital.

c. **The order in which it should be said:** Stick to the procedure unless you are doing a stretcher lower. Remember that it is all very well if you and the person you are speaking to understand perfectly - everyone else within hearing distance may need to know who you are and they may have come into range half way through your conversation. It takes less than a second to give your call-sign each time.

d. **How:** Speak clearly, slightly slower than normal, and keep the normal rhythm of speech going - this helps the receiving station to understand the meaning of the message.

Speech over radio is called Radio Telephony (RT), so the procedure we use to describe it is often called RT Procedure. There are a number of different RT procedures which have developed to cope with special jobs or conditions. Air Traffic Control (ATC) procedures are short and clipped to allow a high volume of traffic to be passed and to keep each frequency (channel) as free as possible, so as to allow any emergencies immediate access to the channel. There is little interference on the aeronautical channels and no physical barriers between the aircraft and ATC aerials, so reception is usually good.

The conditions that we work under with our hill sets are quite different since good reception is not so certain and, although we want to keep the channels as clear as possible, it is not as much a priority as on aeronautical frequencies: clarity and accuracy is our main aim. Remember that one clear and slow transmission is quicker than having to repeat one snappy message - try it if you don’t agree, but include the thinking and transmission time of the request for the repeat.

The various radio links used by RAF MR are often poor. Not only do we use HF for our MRT - ARCC comms, but our VHF hill and vehicle sets often have physical barriers (hills) blocking or impairing reception. We are required to use the RT procedure laid down in the ACP125 on the HF radio links (bear in mind that reception of HF is potentially world-wide) and as this procedure is also appropriate for our hill and vehicle sets, it makes sense to use only one procedure. This has the added advantage that there should be no embarrassing lapses over HF which is monitored by radio enthusiasts and the 'Media'. The essential elements of the ACP125 procedure are easy to grasp and, more important, are simple and sensible. The notes at Annex A adhere to the ACP125 while being adapted for MR use.

NON-RADIO COMMUNICATIONS FACILITIES

Cellular Telephones

Every RAF MRT is equipped with a number of cellular telephones (cell-phone) which are primarily used to maintain a supplementary (to HF) communications link with the ARCC. There are presently two systems in use, Cellnet and Vodaphone, each having certain advantages / disadvantages over the other (mainly concerned with coverage) and neither system can yet give guaranteed communications due to the many "dead" areas throughout the UK. Such areas are, however becoming fewer and smaller as the available coverage is improved.

The introduction of the cell-phone has greatly enhanced the communication capabilities of MRTs, allowing person-to-person conversations to take place from remote sites and outside the confines of radio procedure. Cell-phones are, however, an INSECURE means of communication which is frequently monitored by the media. **Information which is in any way sensitive should not be passed on via the cell-phone network.**

All MRS mobile phones have a facility known as Access Overload Control (ACCOLC) which gives them priority over non-ACCOLC units during periods of maximum traffic when invoked.

Satellite Communications

Each of the RAF MRTs were issued with a Satellite Communications (SatComm) terminal in May 1994, thus giving teams access to a "state-of-the-art" facility and guaranteed two-way communications from anywhere in the world. See **Fig 73**.

NERA WORLDPHONE / SATCOMM

Satellite telephones provide a means of voice and fax communications when other means such as land line or mobile phone comms are not available. The Nera Mini-M WorldPhone operates via the Inmarsat constellation of geo-stationary satellites and has so far been deployed with the MRS to Alaska, Albania and Nepal. Calls are, however, very expensive and use of the WorldPhone must therefore be carefully controlled. For full operating instructions refer to the manufacturers handbook or the Communications Training Package. The SatComm is powered by mains or battery and can be set up within minutes of arrival at a forward base. As yet, it cannot be used while in transit. It does, however, have the capability to be coupled to a Fax machine, thus allowing hard copy (such as search area and missing person information) to be transmitted and received irrespective of the location.

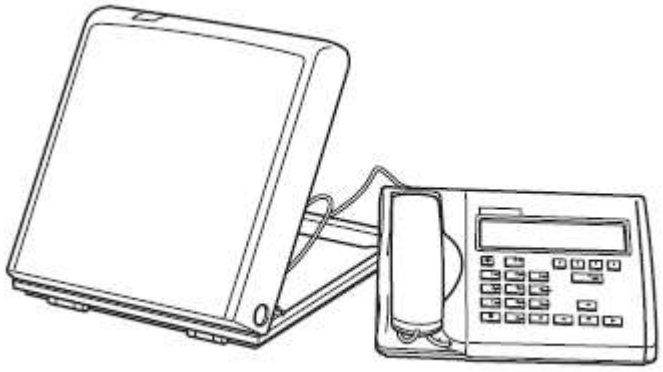


Fig 73 : Inmarsat Satellite Communications Terminal

Radio Pagers

Alpha-numeric pagers are in use by the teams. Like cell-phones, they provide limited area coverage at present, although this is improving constantly. Alpha numeric pagers can receive and store a maximum of sixteen messages of up to 69 letters or numbers each. They can therefore be used not only to recall team personnel, but to provide accurate tasking instructions or incident details.

In the absence of cell-phone or other means of contact, the ARCC will use the pagers to alert the team to an incident.

BT Phone Cards

Teams are also issued with BT Phone Cards, allowing “cash-free” calls to be made from any BT landline telephone. Each card has an account number and a unique Personal Identification Number (PIN), which must be entered correctly to make a call. If this number is entered incorrectly more than three times in succession, the card will automatically become invalid.
BT Phone Cards normally have a maximum call limit
of £10.00 per day.

Mountain Distress Signal

The International Mountain Distress Signal consists of 6 long calls, flashes or whistles in quick succession; repeated at one minute intervals. If required, the reply to this signal would be 3 long calls, flashes or whistles, also in quick succession and repeated at one minute intervals. Consideration should be given however, to the fact that the original sender of the distress signal may stop transmitting on receiving the first acknowledgement, therefore making their subsequent location more difficult to identify.

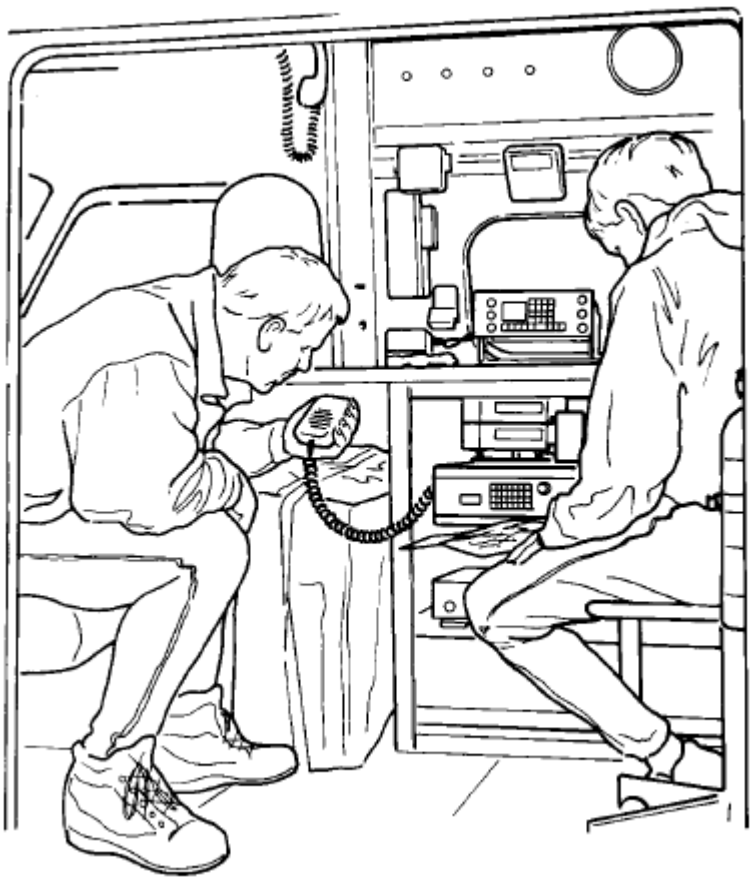


Fig 74: The Command and Control Vehicle is used for both Communications and Search Planning

Annex A:

VOICE / RADIO TELEPHONY (R/T) PROCEDURE NOTES

Ref A: Allied Communications Publication 125 (ACP125).

Purpose of R/T Procedure

The purpose of R/T procedure is to enable accurate, fast and structured voice communications between two or more stations.

While the following procedure may seem unnecessarily formal, it is the only one which can be used on HF and any other net and everyone should be able to understand it. This means only having to learn one procedure. It has the advantage of being brief when conditions are good, but clear and structured when they are poor.

No swearing or personal chat is permitted on our frequencies. That said, by the diverse nature of SAR and the need to work with several civilian organisations, there can be little harm in the occasional polite greeting, brief witticism or parting compliment when appropriate - particularly if initiated by the other party.

The basic procedure is that you call the other station first, - just like shouting for someone - followed by the connecting words **"this is"** and your own call-sign. Example. "Victor 5 **this is** Victor,
My ETA at your base-camp is 1000 local, **Over".**

Prowords

Prowords are words and short statements that would normally need a sentence to explain. They are brief, solve commonly occurring situations, are fairly universal and quickly understood. They do not deal with every situation, however and users should not be afraid to explain complex situations in normal language.

ITEM	PROWORDS	MEANING / EXPLANATION
1. Radio Check	RADIO CHECK	What is my signal strength and readability? (ie How do you hear me?) Various responses are below
	ROGER	In this context, “Roger” means that the signal is being received at least “Good, Readable” – See proword below. Usual meaning of “ROGER” - Item*
	NOTHING HEARD	No reply from the other station
	INTERMITTENT	Reception from other station is intermittent
1a. Signal Strengths	LOUD	Your signal is **very** strong
	GOOD	Your signal is good (Normal)
	WEAK	Your signal is weak
	VERY WEAK	Your signal is very weak. Great difficulty in reading you
1b. Signal Readability	CLEAR	Your signal is of excellent clarity
	READABLE	Clarity is good / No difficulty in reading you. (Normal)
	NEGATIVE READABLE	Preferable to “Unreadable” which can be interpreted as “And readable”
	DISTORTED	Signal garbled
	WITH INTERFACE	Interface is making reception difficult
2. General	OVER	Go ahead transmit. This is the end of this transmission to you; a response is expected and required. Nearly every transmission should end with either “Over” or “Out”
	OUT	This is the end of my transmission (or series of transmissions/conversation). No answer expected or required.
	OUT TO YOU	Finished with you and am about to call another station - Stops someone else trying to cut in.
	ROGER	I have received and understood your message. Also means “Good, Readable” in response to “radio check”. Does **not** mean “yes”, “affirmative” or “wilco”

ITEM	PROWORDS	MEANING / EXPLANATION
	WILCO	I have received your message, and will comply with your instructions.
3. Multiple call-signs	COMBINE **or** CONVOY **or** ALL STATIONS	Use an appropriate proword. Example:- "Kilo Combine, this is Kilo Control, Call-out terminated. Return to base, over". Kilo parties would then respond in **numerical order**, starting with Kilo 1. If a party doesn't respond, the next party waits **approximately 5 seconds** and then answers. Try this first for radio checking the convoy prior to leaving on a weekend exercise. Answer in convoy order. It does take perseverance to learn this one for hill parties, but can save a lot of valuable air time on a big call-out. "All Stations" is used when broadcasting information to a number of stations or teams and will normally terminate with "Out".
4. Unknown station	UNKNOWN STATION **or** STATION CALLING	Respond with this when: a. The calling station's callsign is unreadable or hasn't been given. b. On hearing a faint call, which you think is for you. c. If you think you can help the calling station but don't know his callsign.
5. Relaying messages	RELAY TO ……. (Call-sign or person)	You want the station that you're calling to relay the message to the call-sign or person
	RELAY THROUGH ME	If you hear a station having difficulty passing a message to another and you have contact with both, offer to relay the message
6. Passing messages	MESSAGE, OVER	This should mean the receiving party needs to messages get his pen and paper out
	WAIT **or** WAIT 2, **or** WAIT, OUT	Wait a few seconds. (To get the pencil out, etc) Wait 2 minutes (figure adjustable, in minutes) Wait for an indeterminate period - Not too long. Better to give a time if more than a few minutes.
	SEND, OVER **or** OVER	Send the message
	WORDS TWICE	Communications are difficult, transmit each word or phrase twice to aid reception - Can be used to inform the other station that you acknowledge that conditions are difficult and will voluntarily transmit words twice.

ITEM	PROWORDS	MEANING / EXPLANATION
	CORRECTION	I have just made a mistake. Here is the correct version - Repeat the last correct bit again so that the receiving station can make sense of the whole message.
	I SPELL	I shall spell the next part phonetically.
	FIGURES	Indicates that figures are coming up, can stop confusion with 'to/too' and '2' for example.
	I SAY AGAIN SAY AGAIN	I repeat a difficult bit of the message again for clarity. Repeat the message again ..... or the bit I ask for. EG. "This is Lima 1, say again grid, over."
	ROGER	I have received your message "Roger, copied" is heard but quite unnecessary.
	CORRECT **or** CHARLIE	Correct
	YES **or** AFFIRMATIVE	Yes
	NO **or** NEGATIVE	No
7. Helicopter winching	MINIMIZE WINCHING IN PROGRESS	Only vitally urgent messages should be passed so as not to interfere with helicopter winching operations. Preferably, use of this procedure should be by the helicopter crew (because any station hearing him can potentially interfere with him) but can be my any other responsible station. **If it has been imposed, it must be lifted when winching is complete.**
	MINIMIZE LIFTED, WINCHING COMPLETE	

THE PHONETIC ALPHABET AND NUMERALS

(Underlined parts have emphasis)

Letter	Phonetic	Spoken As:
A	ALFA / ALPHA	AL-FA
B	BRAVO	BRAH-VOH
C	CHARLIE	CHAR-LEE
D	DELTA	DEL-TAH
E	ECHO	ECK-OH
F	FOXTROT	FOX-TROT
G	GOLD	GOLF
H	HOTEL	HO-TEL
I	INDIA	IN-DEE-AH
J	JULIET	JEW-LEE-ETT
K	KILO	KEE-LOH
L	LIMA	LEE-MAH
M	MIKE	MIKE
N	NOVEMBER	NO-VEM-BER
O	OSCAR	OSS-CAR
P	PAPA	PA-PAAH
Q	QUEBEC	KWE-BECK
R	ROMEO	ROW-ME-OH
S	SIERRA	SEE-ERR-RAH
T	TANGO	TANG-GO
U	UNIFORM	YEW-NI-FORM
V	VICTOR	VIK-TOR
W	WHISKEY	HWIS-KEY
X	XRAY	ECKS-RAY
Y	YANKEE	YAN-KEY
Z	ZULU	ZOO-LOO

Numerical	Spoken as:
0	ZEE–ROH
1	WUN
2	TOO
3	THUR-REE
4	FOH-WER
5	FIFE
6	SIX
7	SEV-VEN
8	ATE
9	NIN-ER

When passing information containing numerals, the proword ‘FIGURES’ is to be used before transmitting the numerals. Numbers will be transmitted digit by digit, except that exact multiples of hundreds and thousands may be spoken as such (see examples opposite).

Examples:

a. WH504H Spoken as: Whiskey hotel, figures, five zero four, hotel

b. 44 Spoken as: Four four

c. 500 Spoken as: Five hundred

d. 7000 Spoken as: Seven thousand

e. 16000 Spoken as: One six thousand

f. 175000 Spoken as: One seven five thousand

The figure zero (0) should be written with a diagonal slant through it to differentiate between it and the letter ‘O’. The letter ‘Z’ should be written with a vertical line through it when mixed with figures to discriminate between it and the figure ‘2’.

Annex B:

FREQUENCIES & CALLSIGNS

HF

HF is used primarily as a means of operational communication with the ARCC and SAR assets. It is also utilised for the passing of weather information.

5680KHz/3023KHz	-	- MRT primary frequency for operational communication with ARCC and SAR Helicopters during day / night.
5695KHz/3085KHz	-	MRT Secondary frequency for use when the primary frequency is overloaded with radio traffic.
5699KHz	-	Frequency for morning weather reports from the ARCC.

When testing a HF installation or when carrying out numerous radio checks, it is best practice not to use the primary or secondary frequencies. In this instance, the ARCC radio room should be contacted to provide a frequency for use.

Station	Callsign	Station	Callsign
ARCC Kinloss	Kinloss Rescue	Valley MRT	Alpine 21
RAF Seaking	Sierra Romeo Golf	Leuchars MRT	Alpine 22
RAF SAR Nimrod	Rescue 11-20	Kinloss MRT	Alpine 23
		Leeming MRT	Alpine 24

RAF Seaking aircraft are further identified by a three-digit suffix. For example, a Seaking from Valley would be “Sierra Romeo Golf 122”. A full list of these numbers is listed in the PAM AIR 299 under Chapter 8 - Working With Search and Rescue helicopters.

VHF/FM

Stud	Channel	Frequency (MHz)	Bandwidth	Agency
1	0	156.000	25 kHz	Coast Guard
2	10	156.500	25 kHz	Coast Guard
3	16	156.800	25 kHz	Maritime Distress
4	24a	157.200	25 kHz	Ground to Air
5	24b	161.800	25 kHz	Local Teams
6	53a	158.650	25 kHz	Ground to Air (until 31 Dec 09)
7	54	153.600	25 kHz	Mil Discrete MRS
8	62a	156.125	25 kHz	Emergency Call Channel
9	62b	160.725	25 kHz	Local Teams
10	63a	156.175	25 kHz	Local Teams
11	63b	160.775	25 kHz	Local Teams
12	64a	156.225	25 kHz	Local Teams
13	64b	160.825	25 kHz	Local Teams
14	73	156.675	25 kHz	Coast guard (Ground – Air)
15	85a	157.275	25 kHz	RAF MRS / SARDA E&w
16	85b	161.875	25 kHz	Local Teams

Studs 5, and 9-13 are used for MRT's, with each MRT being allocated a specific frequency. This is to avoid breakthrough on each other's radios when operating in close proximity. If a RAF Team is deployed by the ARCC to assist a civilian team, then the civilian channel should be used.

MRT frequency allocations are as follows:

Frequency (MHz)	NWMRA	SWSARA	SWERA1	SWERA2	ALSAR1
161.800	OGWEN VALLEY MRO **C/S OGGI**	CENTRAL BEACONS MRT **C/S MORLAIS**	CORNWALL RESCUE GROUP **C/S KERNOW**		WILTSHIRE **C/S WILSAR**
160.725	LLANBERIS MRT **C/S PERIS**	LONGTON MRT **C/S BLACKS**	EXMOOR SRT **C/S EXMOOR**		MIDSHIRES SAR
156.175	OUTWARD BOUND WALES SART **C/S OSCAR**	BRECON MRT **C/S ZEBRA**	GLOUCESTER CRG **C/S GLEVUM**		BUCKS SAR **C/S BSAR**
160.775	S.SNOWDONIA SRT **C/S HARLECH**		AVON & SOMERSET CRT **C/S SCEPTRE**	MENDIP RESCUE ORGANISATION **C/S HUNTER**	SEBEV SAR **C/S SEBEV**
156.225	NE WALES SRT **C/S NEWSAR**	WEST BRECON CRT **C/S DRAGON**	DEVON CRO **C/S SPELEO**		HAMPSHIRE SAR **C/S HANTSAR**
160.825	NORTH WALES CRO	WESTERN BEACONS MSRT **C/S BRAVO**	SEVERN AREA RA **C/S SARA**		OXFORDSHIRE SAR **C/S**
161.875	ABERGLASYN MRT **C/S GLASLYN**	GWENT CRT **C/S GWENT**	DARTMOOR RESCUE GROUP **C/S DART**		

Frequency (MHz)	ALSAR2	YDP	MPSMRO	PMRO1	PDMRO2
161.800	SUFFOLK LOWLAND C/S SUFFOLK	CAVE RESCUE **C/S CRO**		OLDHAM MRT **C/S OLDHAM**	DERBY MRT **C/S DERBY**
160.725	SUSSEX SAR **C/S SUSSAR**		BOWLAND PENNINE MRT **C/S TROUGH**	KINDER MRT **C/S KINDER**	
156.175	NORFOLK LOWLAND SAR	UPPER WHARFDALE FRA **C/S FELL**		GLOSSOP MRT **C/S GLOSSOP**	
160.775	S.SNOWDONIA SRT **C/S HARLECH**		BOLTON MRT **C/S BOLTON**	WOODHEAD MRT **C/S WOODHEAD**	
156.225	ESSEX SAR C/S ESSEX		CALDER VALLEY SRT C/S CALDER	EDALE MRT C/S DERWENT	
160.825	KENT SAR C/S EKSAR		HOLME VALLEY MRT C/S HOLME VALLEY	DERBYSHIRE CRO C/S CAVER	
161.875			ROSSENDALE & PENDLE MRT **C/S ROSSENDALE**	BUXTON MRT C/S BUXTON	

Frequency (MHz)	LDSAMRA1	LDSAMRA2	NESRA1	NESRA2
161.800	PATTERDALE MRT **C/S PATRICK**			
160.725	KESWICK MRT **C/S KESWICK**		SWALEDALE FRO **C/S SWALE**	
156.175	LANGDALE & AMBLESIDE MRT **C/S LANGSDALE**		TEESIDE & WEARDALE SRT **C/S TEESIDE**	
160.775	KENDAL MSRT **C/S KENDAL**	COCKERMOUTH MRT **C/S COCKERMOUTH**	NORTH OF TYNE SRT **C/S KEY**	SCARBOROUGH & DISTRICT SRT **C/S MOORJOCK**
156.225	CONISTON MRT **C/S CONISTON**		N'THUMBERLAND NPSRT C/S CURLEW	
160.825	PENRITH MRT **C/S PENNINE**	DUDDON & FURNESS MRT **C/S MIKE**	CLEVELAND SRT **C/S VIKING**	
161.875	WASDALE MRT **C/S WASDALE**	KIRKBY STEPHEN SMRT **C/S BOGTROT**		

Frequency (MHz)	MRC of S1	MRC of S2	MRC of S3	MRC of S4	MRC of S5
161.800	MOFFAT MRT **C/S MOFFAT**	ARROCHAR MRT **C/S ARROCHAR**	TAYSIDE MRT & TAYSIDE POLICE **C/S TAYCIV**	DUNDONNELL MRT **C/S DUNDONNELL**	
160.725	TWEED VALLEY MRT BODERS SARU **C/S TWEED/REIVER**	KILLIN MRT **C/S KILLIN**	TORRIDON & KINLOCHEWE MRT **C/S TORRIDON**		
156.175	GALLOWAY MRT **C/S GALLOWAY**	LOMOND MRT **C/S LOMOND**	CAIRNGORM MRT C/S CAIRNGORM	GLENMORE LODGE MRT **C/S GLENMORE**	CAIRNGORM SKI PATROL **C/S CAIRNGORM**
160.775	OBAN (MULL OF KINTYRE) MRT **C/S OBAN**	GLENCOE MRT **C/S GLENCOE**	KINTAIL MRT **C/S KINTAIL**	GLENELG MRT **C/S GLENELG**	
156.225	STRATHCLYDE POLICE MRT C/S STRATHPOL	SKYE MRT **C/S SKYE**	ABERDEEN MRT **C/S ICE DELTA**	GRAMPAIN POLICE MRT	BRAEMAR MRA **C/S BRAEMAR**
160.825	ARRAN MRT **C/S ARRAN**	OCHILS MRT **C/S OCHIL**	LOCHABER MRT **C/S NEVIS**	ASSYNT MRT **C/S ASSYNT**	
161.875	RAF KINLOSS & RAF LEUCHARS **C/S KILO/LIMA**				

Station	Callsign
Kinloss MRT	Kilo
Leuchars MRT	Lima
Leeming MRT	Tango
Valley MRT	Victor
RAF SAR Training	Sierra Romeo (***)
RAF SAR Ops	Rescue (***)

VHF / AM

123.1 MHz	-	Scene of Search

UHF / AM

243.0 MHz	-	International distress

282.8 MHz	-	Scene of Search
252.8 MHz	-	NATO SAR training