

# Radio Communications

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## Introduction

Radio communications technology is progressing in leaps and bounds. Devices are becoming more capable, multi-functional and less costly. That is good news for backcountry travellers. But it is still important to realise the importance of being well prepared, letting someone know your intentions, and knowing how to use a good old fashioned map and compass.

The various forms of backcountry radio communications are discussed here. It is a good idea to carry two different forms so that you have one as a back-up.

## Mountain Radio Service



*MRS 1*



*MRS 1 with Selcall and Telcall*

### What is MRS?

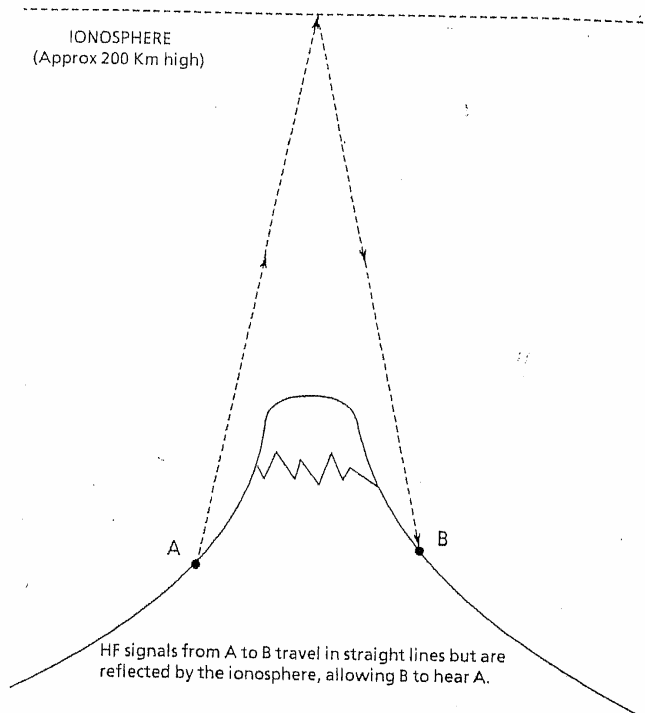
A high-frequency (HF) radio service that enables backcountry communication for the user via a volunteer base station operator.

It is recognised as one of the best forms of backcountry communication because of its ability to transmit from many areas of New Zealand that are unreachable by other communication devices.

You cannot buy a mountain radio – it is a service that is hired out from various depots. Users are supplied with a radio transceiver and an aerial, which must be set up before

using. The MRS operates on two frequencies – 3345kHz in the North Island and 3261kHz in the South Island.

### How does it work?



#### *Basic principle of HF communication using ionospheric reflection*

At the time of hiring, daily `scheds' (scheduled contact times) are established. At these times the base operator calls the user to discuss information such as weather forecasts, location and intended route. Important messages can be taken and passed on by the operator at this time.

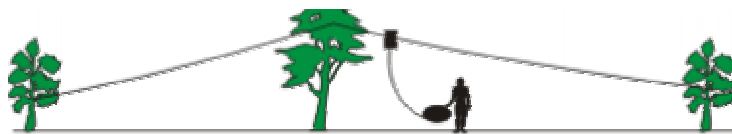
#### **Examples of scheds in two areas:**

Canterbury MRS operates scheds at 8.30am, 12pm and 7.30pm.

Wellington MRS operates at 8am and 8pm (summer) or 6.30pm (winter).

In some areas further options may be available. Times may vary according to season.

Before the MRS can be used, the radio transceiver and aerial must be set up correctly. This involves setting up a 40 metre aerial which could be difficult if injured. The signal is generally better at night.



*How to set up a Mountain Radio*

**Emergencies:** Base stations are not guaranteed to be staffed outside sched times, but there is a good chance emergency calls could be picked up by another service.

<b>Advantages</b>	<b>Disadvantages</b>
Compact, lightweight, and cheap to hire.	Long aerial needs to be erected - difficult if injured.
Two-way communication available in most mountain areas.	Communication may only be possible at scheds.
Route details are recorded, which can speed searches.	Affected by static from thunderstorms.
Long range.	Can be subject to interference from overseas, but not usually a problem.
They work by reflecting signals off the ionosphere, not by line-of-sight, so reception is not obstructed by mountains etc.	Suffers from fading, but this is also not much of a problem.

### **Cost, availability and specifications**

- Low cost hire for around \$40/week (could vary, check with individual services).
- Available from MRS depots in: Northland, Hawkes Bay, Central North Island, Wellington, Marlborough, Canterbury and Southland. Check with regions because they may have additional depots.
- Two types available that include radio, antenna, spare batteries and bag.  
Small - 19cm x 16cm x 8cm, 1.2kg.  
Large - 30cm x 16cm x 10cm, 1.8kg.

### **Before leaving**

- Check with the MRS that covers the area you intend to travel.
- Agree with base station on sched times.
- Know listening times of nearby base stations.
- Know what channel to use and how to use the mountain radio.
- Set up the radio to ensure it is functional.
- Carry spare batteries, pen and paper (to plan messages).

### **Recent developments**

Canterbury MRS have Selcall and Telcall capable radios. These are calling systems that enable the Mountain Radio to be used as a telephone. Telcall is a full keypad that enables calls to be made directly from the radio. Selcall is a four-digit keypad that enables numbers to be programmed into it, or you can call the base station, and be forwarded to the required number. The advantage of these calling systems is that 'help is just a phone call away'. For more information, see the Canterbury MRS website.

## Where to go for more information

- Click here for MRS contacts.
- <http://www.nzlsar.org.nz/mrs/wmrs/nzmrs.htm>  
- NZ Land Search and Rescue site with Wellington MRS information.
- [www.mountainradio.co.nz](http://www.mountainradio.co.nz)  
- Canterbury MRS (most of South Island).
- <http://www.nzlsar.org.nz/news/news0202.pdf>  
- NZLSAR News, February 2002 - HF (mountain radio) now and in the future.

## Personal Locator Beacons

### What are they?

Small, emergency distress beacons that emit a VHF radio signal when activated. Search and Rescue operations use the signal to 'find' the beacons, as detailed below.

**Note that personal locator beacons must only be used in life threatening situations.**

### *Terminology*

- Also known as emergency locator beacons (ELBs).
- Emergency locator transmitters (ELTs) are used on planes.
- Emergency position indicating radio beacons (EPIRBs) are used on boats.

Though the terms are often used interchangeably, they are not strictly the same thing.

There are two frequencies available – 121.5MHz and 406MHz. However, the 121.5MHz type is being phased out, and it is recommended that the 406MHz beacon is purchased.

### *406MHz beacons:*

- Recommended because satellite reception for 121.5MHz beacons is planned for deactivation in 2009.
- Gives location to within 6km.
- If GPS (global positioning system) capable, gives location to within 120m.
- Faster detection time.
- Sends a digital signal which is encoded with the owner's details. Can save time in a search by allowing RCCNZ to contact the family of the beacon owner.
- World-wide coverage.
- More expensive than 121.5 beacons, but are becoming cheaper.
- Most 406MHz beacons are equipped with a 121.5MHz homer to enable detection by aircraft, as planes are not equipped to receive the 406MHz signal.
- UHF.

### **121.5MHz beacons:**

- Satellites will no longer receive these signals after June 2009, so 406MHz beacons are recommended.
- Gives location to within 20 km.
- Sends an analogue signal with no other information.
- Prone to false activations by planes.
- Reasonably cheap to buy.
- VHF.

### **How do they work?**

Once activated, the signal is picked up by satellite and/or aircraft. An alert message is relayed to the nearest Local User Terminal (LUT, ground station), which calculates the beacon's position and sends the data to the Mission Control Centre (MCC). The MCC then sends the information to the Rescue Coordination Centre of New Zealand (RCCNZ), which in turn initiates a class III rescue operation.

Operate with a clear view of the sky; avoid gorges or heavy foliage. Do not turn off once activated. Stay put.

If it is a false alarm, get a message to RCCNZ (0508 RCCNZ) or Police *as soon as possible*. Failure to do this may divert SAR resources from genuine emergencies and in doing so may endanger lives.

<b>Advantages</b>	<b>Disadvantages</b>
Compact, lightweight and cheap to hire.	For use in life-threatening situations only. False or non-urgent activation increases emergency response time, which may put people in life-threatening situations at risk.
Good for solo trampers because no set up required.	Requires line-of-sight to satellite – less effective in valleys and gorges.
Some units are GPS capable, enabling a more specific location to be established.	Alert signal is transmitted only one way so there is no way of knowing that your call has been received.
Activation and detection is possible 24/7.	No capacity for two-way communication.
Some/one 121.5MHz model can be remotely activated from a base if someone is overdue.	
World-wide coverage.	
Not affected by solar activity.	
Free of noise and interference.	

**PLBs are banned in some countries because of high proportion of false alarms.**

## Information and where to buy/hire

### 406MHz beacons

<b>Model</b>	MT400 EPIRB	McMurdo Wessex Fastfind beacon	Kannad 406 XS-2	Kannad 406 XS-2 GPS	Kannad 406m -available in both EPIRBs and PLBs
<b>Suppliers</b>	Mapworld 0800 627 967 www.mapworld.co.nz		Safety At Sea (Australasia) 0800 809 911 www.safetyatsea.com		
<b>Price to hire</b>	N/A	\$25/day	N/A	N/A	N/A
<b>Price to buy</b>	\$739	\$2000approx	\$1795	\$1995	\$1795
<b>Weight</b>	535g	321g	315g	380g	490g
<b>Size</b>	260mm x 102mm x 83mm	146mm x 78mm	154mm x 70mm x 34mm	150mm x 70mm x 34mm	160mm x 55mm x 90mm (PLB)
<b>Activation</b>	Manual	Manual	Manual	Manual	Manual
<b>Transmission duration</b>	48 hours min	24 hours min	24 hours min	24 hours min	24 hours min
<b>Battery type</b>	Lithium	Lithium	Lithium	Lithium	Lithium
<b>Battery shelf life</b>	5 years	5 years	4 years	5 years	4 years
<b>Sealed unit?</b>	Yes	Yes	Yes	Yes	Yes
<b>Can user replace batteries?</b>	No	No	No	No	No
<b>Self-test?</b>	Yes	Yes	Yes	Yes	Yes
<b>Position accuracy</b>	5km	30m		600m	
<b>Power output</b>	50mW on 121.5 frequency, 5W on 406	5W	25mW	25mW	5W
<b>Warranty</b>	Extended 5 year GME warranty	5 years - for the life of the batteries	12 months	12 months	12 months
<b>Certified</b>	AS/NZS 4280 approved	COSPAS-SARSAT T. 007 Class 1	COSPAS-SARSAT 138	COSPAS-SARSAT 138	COSPAS-SARSAT 092 class 1
<b>Other features</b>	Zero time warm up technology (warms up straight	Built in GPS. Waterproof to 5m immersion.	Can be re-programmed to change encoded details.	Built in GPS Waterproof. Will float. Compact.	Waterproof. Compact.

	away).		Compact.		
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### ***121.5MHz beacons can be hired from:***

- Southland Locator Beacons Ltd – hire out H.E.L.P beacons from anywhere in New Zealand. Contact John Munro (03) 226 6341, email [jwdmunro@ihug.co.nz](mailto:jwdmunro@ihug.co.nz).
- Mountain Safety Council Hawkes Bay hires out two beacons for \$2.50/day. Contact John Wuts (06) 844 4751 or Gilbert Adlam (06) 878 8625.

### **406MHz Beacon registration**

When a 406MHz beacon is purchased, the buyer and seller fill out a form, which is faxed to the RCCNZ. A database of this information is held by the RCCNZ. If a traveler with an overseas registered beacon is likely to be in this country for any length of time, it is highly desirable to register the beacon in New Zealand.

### **Before leaving**

- Know how and when to activate the beacon.
- Check the batteries and carry spares if user-replaceable type.
- Check the beacon is operational (some have functions to allow you to do this).

### **Disposing of old beacons**

If you discard an unwanted beacon ensure it cannot be activated by mistake. Render it useless by:

- Removing the battery
- Removing the aerial
- Crushing the case

Failure to do so has resulted in wasted Search and Rescue resources – other's lives have been endangered.

### **Where to go for more information**

- <http://home.vicnet.net.au/~vicwalk/epirb/intro.html>  
- easy to read information about distress beacons
- [http://www.rfd.co.nz/page\\_epirbs.htm](http://www.rfd.co.nz/page_epirbs.htm)  
- supplier and distributor information
- <http://beacons.amsa.gov.au>  
- useful Australian Maritime Safety Authority site - contains information on beacons, maintenance and changes to the distress beacon system
- [www.kti.com.au](http://www.kti.com.au)  
- manufacture, design and information
- [www.safetyatsea.com](http://www.safetyatsea.com)  
- supplier
- <http://www.mapworld.co.nz/>  
- supplier and rental
- [http://www.equipped.org/406\\_beacon\\_test\\_toc.htm](http://www.equipped.org/406_beacon_test_toc.htm)

- report on tests and experiments done on 406MHz beacons, with good background information about them
- [http://www.nzsar.org.nz/newsletters/aug04/aug04\\_2.html](http://www.nzsar.org.nz/newsletters/aug04/aug04_2.html)
- information about 406MHz beacons
- [http://www.amsa.gov.au/Search\\_and\\_Rescue/](http://www.amsa.gov.au/Search_and_Rescue/)
- Australian Search and Rescue site with information on distress beacons

## Cell phones

### What are they?

No explanation needed here – cell phones are extremely widespread. The importance of not relying on a cell phone as your only form of communications device in the outdoors can not be stressed enough. Cell phones need to be in close proximity to a cell site to get reception. So it may not be possible to get cell phone coverage in many backcountry places – even you are on top of a hill. However, they can be useful as a back-up to other radio communications devices.

### How do they work?

They work by sending signals to the nearest cell site, which then relays the signals to the number you wish to talk to. Cell sites only cover a certain area, and are mainly clustered around urban areas, so there is limited reception in the backcountry.

**Emergencies:** Use the free 111 service. Give your phone number, as the Police and SAR may need further information. Arrange suitable contact times during the initial call for assistance and turn phone off at other times. Keep your phone and battery warm. Ensure you remain in an area with reception.

<b>Advantages</b>	<b>Disadvantages</b>
Compact, lightweight and relatively cheap.	Extremely limited coverage area – not recommended to rely on cell phones.
Allows two-way communication with unlimited choice of contacts.	Requires line-of-sight to a service providers' cell site antenna.

### Cost/Availability

From \$150 plus rental. Readily available from communications stores.

## Satellite phones

### What are they?

Similar to cell phones, but with a much wider coverage area. This is because they use satellites to transfer information instead of cell sites. Satellite phones are reasonably new to the market. Generally seen to be reserved for enthusiasts as they are costly.

### How do they work?

Use like a cell phone.

**Emergencies:** Use the free 111 service. Give your phone number, as the Police and SAR may need further information. Arrange suitable contact times during the initial call for assistance and turn phone off at other times. Keep your phone and battery warm.

<b>Advantages</b>	<b>Disadvantages</b>
Allows two-way communication	Expensive.
Coverage available most areas of New Zealand (and world-wide).	Need to pay for outgoing calls.
Unlimited choice of contacts – easy to get help. It is important that emergency services are only called in genuine emergencies.	Requires line-of-sight to satellite - coverage may be poor in dense bush or confined gorges.
Compact.	Reception may be reduced by damp trees/rain.

### Information and where to buy/hire

<b>Suppliers</b>	Rocom 0800 762 661 www.rocom.co.nz	Mapworld 0800 627967 www.mapworld.co.nz
<b>Type</b>	Iridium	
<b>Model</b>	9505a	
<b>Price to hire</b>	\$25NZ/day + \$2.50US/minute for outgoing calls	\$30/day
<b>Price to buy</b>	\$3100NZ + GST	N/A
<b>Call cost</b>	\$1.50US/minute + GST	\$3.50/minute (to and from phone)
<b>Weight</b>	Under 375g	
<b>Size</b>	158mm x 62mm x 59mm	
<b>Battery type</b>	Lithium	
<b>Battery shelf life</b>	Depends on usage	
<b>Battery talk time</b>	3 hours	

<b>Battery standby time</b>	30 hours	
<b>Warranty</b>	1 year	
<b>Other features</b>	Water, shock and dust resistant. Data capable (can plug into laptop). Can send and receive text messages.	

## Extra stuff

### Other services

The Department of Conservation runs a radio service from some huts around the Aoraki / Mt Cook and Aspiring national parks alpine areas. These radios are monitored 24 hours a day by a duty officer. They can be used to raise an alarm in emergencies. The radios are also used for 7pm scheds, to provide forecasts, pass on messages, and find out who's in the hut. For more information, contact the DoC branch in the area you intend to travel. Some DoC centres also hire out PLBs.

### About batteries

- Ensure batteries are new or fully charged.
- Spare batteries are a must for any vital equipment taken into the outdoors.
- Keep them warm, as they drain up to three times faster in the cold.
- Conserve batteries – don't make unnecessary calls and turn on for short periods only.
- Remember that you cannot recharge batteries when in the outdoors.

### *Types*

- Rechargeable batteries such as nickel-cadmium are not recommended.
- Lithium - becoming widespread.
- Alkaline -

### Where are radio communications heading?

It is an exciting time for outdoor enthusiasts as radio communications devices are becoming more capable. Technology is constantly changing and improving. Some recent developments and future trends are discussed here.

- Selcall and Telcall are recent developments to the Canterbury MRS They enable the radio to be used as a telephone. The advantage of this technology is that 'help is just a phone call away'. See Canterbury MRS for details.

- 406MHz beacons are becoming more widespread and less expensive as they slowly take over their 121.5MHz counterparts.
- Satellite phones are a bonus for people in the outdoors. They provide the advantage of having a two-way communication device not limited in reception area. They are currently quite expensive, but are expected to become more popular because of their ease-of-use and wide coverage area
- Technology advances may render some radio communications devices such as the Mountain Radio Service obsolete. This form of communications is constantly changing and improving.

## Articles

- [http://www.mountainsafety.org.nz/assets/images/is\\_there\\_anybody\\_there.pdf](http://www.mountainsafety.org.nz/assets/images/is_there_anybody_there.pdf)  
- New Zealand Wilderness Magazine, June 2004 – informative article about radio communication in the outdoors. Reproduced with permission from NZ Wilderness Magazine.
- <http://www.nzlsar.org.nz/news/news0403.pdf>  
- NZLSAR News, April 2003 – report on Cospas-Sarsat system. Contains statistics and phasing out of 121.5MHz emergency beacons.
- <http://www.nzherald.co.nz/index.cfm?ObjectID=3567096>  
- The New Zealand Herald, May 18, 2004 – locator beacon saves trampers.
- [http://www.nzherald.co.nz/index.cfm?c\\_id=84](http://www.nzherald.co.nz/index.cfm?c_id=84)  
- The New Zealand Herald search and rescue page.
- “Tramper chose to omit beacon”, The Southland Times, May 13 2004. *Refer to end of this document.*
- “Locator proves its worth after five years lying idleworth after five years lying idle”, The Press, May 19 2004. *Refer to last page of this document.*

## Links

- Click here for SAR emergency form
- Federated Mountain Clubs of NZ [www.fmc.org.nz](http://www.fmc.org.nz)
- New Zealand Land Search and Rescue <http://www.nzlsar.org.nz>
- Cospas-Sarsat satellite system [www.cospas-sarsat.org](http://www.cospas-sarsat.org)

## Glossary

**Analogue** – A method of transmission that is a continuous wave cycle. Used to be the norm for cell phone transmission.

**Base station** - The central radio transceiver that maintains communications (location of mountain radio operators).

**Cell site** – Receiver tower that is usually placed on high hills.

**Channel** - In radio, the designated frequency that is used by the receiver and transmitter.

**COSPAS-SARSAT** - Global search and rescue satellite system.

**Coverage** – The area that a mobile phone can get a signal.

**Digital** – A binary signal that transmits using bits of information which is then pieced together. In 406MHz beacons, this signal is encoded to give information of user.

**ELB** - Emergency locator beacon.

**ELT** - Emergency locator transmitter (air).

**EPIRB** - Emergency position indicating radio beacon (boat).

**Frequency** - The number of wave cycles per unit of time, measured in hertz (Hz).

**GEOSARS** – The satellite system that stays in a fixed position relative to the Earth.

**GPS** - Global positioning systems that use receivers and satellites to determine position on Earth.

**HF** - High frequency e.g. Mountain Radio Service. Signals are reflected by the ionosphere (upper region of Earth's atmosphere) and bounce back down. Advantage because line-of-sight is not needed for transmission as the signal can 'jump over' objects.

**ICAO** - International Civil Aviation Organisation.

**IMO** - International Maritime Organisation.

**LEOSARS** - Low-altitude Earth orbit satellite system.

**Line-of-sight** - Radios that work by line-of-sight require a clear path between the transmitter and receiver before they can work e.g. UHF, VHF.

**LUT** - Local user terminal. Receives and processes and / or transmits beacon signals from satellites, and determines location of beacon.

**MCC** - Mission control centre. Accepts information from LUTs, and forwards alert and location data to appropriate SAR authorities and exchange system information messages with other MCCs.

**MSA** - Maritime Safety Authority.

**NZLSAR** - New Zealand Land Search and Rescue.

**PLB** - Personal locator beacon (used by bushwalkers).

**RCCNZ** - Rescue Coordination Centre of New Zealand.

**Receiver** - Receives information from a transmitter.

**Repeater** - Receives, amplifies and re-transmits radio signals.

**Rx** – Receiver.

**SAR** - Search and Rescue.

**Sched** - Two-way voice link with a base via the Mountain Radio Service.

**Selcall** - An abbreviation of selective calling. Radios that are Selcall capable can be programmed with numbers to dial and mean the radio can be used as a telephone. Canterbury MRS has Selcall capable radios.

**SSB** - Single sideband e.g. mountain radio.

**Telcall** - Allows telephone dialing from a radio in the normal manner. Canterbury MRS has Telcall capable radios.

**Transceiver** - Combines a transmitter and receiver, so can both transmit and receive signals e.g. mountain radio and avalanche transceivers.

**Tx** – Transmitter.

**Transmitter** - Sends information to a receiver.

**UHF** - Ultra high frequency e.g. cell phones. Signals pass through Earth's atmosphere, so line-of-sight is needed for transmission.

**VHF** - Very high frequency e.g. personal locator beacons. Signals pass through Earth's atmosphere, so line of sight is needed for transmission.

## PRESS ARTICLES

### Personal Locator Beacons

ARTICLES BELOW MADE AVAILABLE WITH CONSENT FROM FAIRFAX NZ LTD.

## The Southland Times

[www.southlandtimes.co.nz](http://www.southlandtimes.co.nz)

### Tramper chose to omit beacon

Thursday, 13 May 2004

By LIN FERGUSON

**The English tramper who died after a fall in MT Aspiring National Park in March had made a conscious decision not to take a personal locator beacon, the Queenstown Coroners Court was told yesterday.**

He had also decided to carry minimum food, clothes and equipment.

Sergeant Aaron Nicholson said 37-year-old Michael Andrew Johnson had discussions with a friend in Christchurch before his trip about carrying a locator beacon.

"But he (Mr Johnson) decided not to carry one and a personal locator beacon would have made all the difference," Mr Nicholson said.

Mr Johnson had set off on his three to four-month solo traverse of the Southern Alps from south to north on February 14 at the Hump ridge Track in Tuatapere, moving north along known walking tracks to reach the Matukituki Valley by March 15, Mr Nicholson said.

By April 8 Mr Johnson had not been heard from or seen for 24 days, Mr Nicholson said.

He had fallen 60 – 70m down a steep, rocky slope of Lois Peak ridge towards the base of Waterfall flat.

He seemed to have moved himself down the slope to a flat piece of ground where he had removed his boots and got into his sleeping bag, Mr Nicholson said.

A camera and dictaphone found at the accident site had helped confirm Mr Johnson's identity, Mr Nicholson said.

In his report, Dunedin pathologist Alex Dempster said scalp lacerations indicating a blow to the top of the head from fall had probably caused a period of unconsciousness, during which pneumonia had set in.

"Findings suggest that the deceased had survived for a period of up to two days following the fall," his report says.

Mr Nicholson said the seriousness of his expedition as a solo tramper attempting a traverse like this with the minimum amount of clothing, food and equipment meant basic safety options were overlooked. The arduous nine-day search and rescue through steep and difficult terrain using a helicopter and ground searchers had cost police \$35,000 and logged up to 138 man hours, Mr Nicholson said.

In his findings, coroner Alan MacAlister said carrying a locator beacon would have probably saved Mr Johnson's life.

Fairfax New Zealand Limited

## Locator proves its worth after five years lying idle

WEDNESDAY, 19 May 2004

By AMANDA SPRATT

**A Christchurch couple rescued from the dense West Coast bush are urging all trampers to carry locator beacons after what they describe as an "eye-opening" experience.**

Robert and Ann Sherlock have carried the tiny device through kilometers of bush since they bought it for about \$200 five years ago. Their three-day tramp through the Taipo Valley was no exception.

They had never used it, and always wondered whether it worked.

They got a chance to find out after Robert Sherlock 62, slipped and dislocated his shoulder on the overgrown track on Monday night.

The nearest hut was frustratingly close – just one kilometer away – but the couple knew making their way down the steep slope where solid scrub grew to head-height was asking for more trouble.

For hours later, the whirr of helicopter blades proved the locator's worth.

"it was just a wonderful sound to hear. For the money it's really worth it, it really is the difference between life and death," Ann Sherlock said.

"it just saves the search and rescue people so much time if they have a location," her husband said.

The helicopter did an initial survey of the area, then disappeared.

With the beacon only able to give a general location, it took the helicopter time to pin point where the couple were.

But by 6pm, the helicopter returned and spotted the Sherlock's bright head torches.

But the beacon was not the only thing the Sherlocks were praising .

With the evening settling in, they believed it was too dark for search and rescue team to be sent in.

Happy in the knowledge they had been spotted, the well-prepared Sherlocks prepared for a night in the bush, wedging themselves between the rocks to stop them sliding down the steep slope if they fell asleep.

However, the dedication of the three-strong Greymouth Police search and rescue team, whom the Sherlocks know only as Mike, Josh and Don, surprised them.

Picking through tricky terrain, the searches found the couple and gingerly escorted them to the nearest hut.

"we were just utterly amazed when they started up the hill in the dark. We didn't even know they had dropped these guys off ... and the next thing we heard was yahoo-ing and we saw their torches and eventually they picked us up," Ann Sherlock said.

"They were just amazing blokes."

**THE PRESS**

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