

# Introducing a New Cave Radio for Rescue Use



**Mike Bedford** provides background information on the new cave radio which is about to be issued to the UK's rescue teams.

## Introduction

For more than 15 years, the majority of British cave rescue teams, plus a number in other countries, have relied the Molefone for cave-to-surface communication. Developed by Bob Mackin of Lancaster University, this cave radio has proved extremely reliable and has provided a good level of service. Unfortunately, though, the Molefone is now approaching the end of its useful life and, for various reasons, units which have failed cannot be repaired or replaced. With the prospect of the loss of a communication capability looking ever more likely, a couple of years ago the British Cave Rescue Council (BCRC) starting looking into the possibility of producing a replacement cave radio. After investigating various other options, a decision was made to base the new radio on a design by John Hey. A design team was set up at the joint BCRC/CREG meeting on rescue communications which was held in March 1999 and the resultant radio is now approaching completion.

This article describes the new radio from a user perspective, and other articles in this and forthcoming issues concentrate on other aspects of the design. Specifically John Hey (2000) describes the electronic design, Pete Allwright (2000) outlines the field tests which have been carried out, and a future article will look at the mechanical design.

## Compatibility

One of the primary requirements of the new radio is compatibility with the Molefone. However, different rescue teams had different views on what constituted compatibility. The most fundamental requirement is that the new radio must be able to communicate with the Molefone so the frequency (87kHz), modulation method (SSB) and sideband (upper) are all the same.

Some rescue teams were insistent that the new radio must also be compatible with the Molefone at a "look and feel" level. This requires, for example, that batteries are external to the unit and that the microphone doubles as an earpiece rather than using a speaker. Other teams, however, felt that it was unrealistic to suggest that every design decision taken 15 years ago was optimum

and that some of the new ideas which have been tried out over the last few years should be investigated. In most cases, the design has managed to encompass the wishes of both parties.

So, for example, an internal speaker is provided so that the radio operator can work away from the radio yet hear if he's being called (this was the main argument for the speaker). However, a secrecy switch is also provided to mute the speaker and restrict the audio to the microphone / earpiece (the argument for no speaker). And on the subject of the power source, the battery is external to the main radio box but is carried in the same Peli-case which holds the radio and earth electrodes. This means that the battery can easily be changed when it's exhausted (the argument for external batteries) yet the radio is ready for use as soon as the Peli-case is opened (the argument for an internal battery).

## Earth Electrodes

The main respect in which the new radio is different from the Molefone is that it's intended, primarily, for use with earth electrodes rather than loops. Although the Molefone could – indeed has been – operated with earth electrodes, only loops were provided with the units. Furthermore, to use earth electrodes most efficiently an external matching transformer would be required. A transformer is integral to the new radio.

Recent tests in the UK, France and Switzerland have shown that a vast improvement in performance can be achieved using earth arrays. Specifically the range is increased and the need for a high degree of accuracy in aligning the surface and underground parties is relaxed. So in addition to supporting earth arrays by including the integral matching transformer, the radio is equipped with earth electrodes arrays for use both on the surface and underground. The surface arrays use spikes as earth electrodes and the underground arrays use electric fence tape.

Despite the major improvement in performance which earth arrays offer over loops, they do take longer to deploy them than loops. So, for use in shallow caves, a loop is also provided. The loop is equipped

with an umbrella-type set of spreaders which will collapse to a compact size for transportation.

## Other Features

Other new features which have been added to this radio are SOT & EOT tones, and a confidence beep.

The SOT (start of transmission) and EOT (end of transmission) tones are audio signals, differentiated by their pitch and duration, which are transmitted as the press-to-talk button on the microphone is pressed or released respectively. Use of these tones should reduce the likelihood of both ends talking at the same time, even if good operating practice (such as saying "over" at the end of a transmission) isn't adopted.

The confidence beep is a short signal, transmitted at a regular interval, which other radios within range will receive as a beep. This indicates to the operator that the link is live, in other words the radio at the other end of the link is within range and operational.

There is also the provision to send a continuous stream of tones, either as a wake-up call or for radio-location purposes. This is the same as the Molefone's tone feature.

## Documentation

The design team are keen to ensure that the new radio is fully documented. So, starting in this issue of *CREGJ*, the electronic and mechanical design of the radio will be described. With the design in the public domain, units can be maintained and upgraded in the future, even if the people who designed it are no longer willing or able to provide ongoing support.

Various handbooks will be supplied to the rescue teams along with the radios. Specifically, a user handbook and a maintenance manual are to be produced. Training material will be made available too.

## References

Hey, John (2000) *A New Rescue Radio – the Electronic Design*, CREGJ 41, pp4-10.

Allwright, Pete (2000) *The Cave Radio Roadshow*, CREGJ 41, pp11-15.

