Amateur Radio Monitoring System (ARMS)

In Eastern Oregon One of the greatest and most likely emergency scenarios where Amateur Radio may serve is in field discovery, where someone is mobile and comes upon a motor vehicle accident or a wildland fire. In order for this service to take place three things are needed:

1. Radio / repeater coverage must cover the area in question
2. The mobile operator must have equipment that is ready
3. There must be someone listening

Of these three requirements for early reporting of “field discover” the first two can be addressed through equipment and training. But the third requirement is a serious problem.

If we had an amateur radio community of 1000 operators we might be able to share the task of 24 hour monitoring without it becoming burdensome on any one person.

But we are volunteers and we don’t have that kind of manpower.

During waking hours, we could ask a few people to scan and monitor local repeaters, but what about at 2 AM?

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Most of us are not willing to leave our radios on all night only to hear a repeater ID itself or to hear a passing truck driver to chat with his or her spouse.

ARMS (Amateur Radio Monitoring System) provides a way to monitor local repeaters and frequencies while sleeping peacefully, only to wake up if there is an emergency.

How does it work?

ARMS uses a somewhat universal calling method of Long Press Zero (LPZ) to trigger an alert procedure. At other times the radios of those who monitor are completely silent.

Long Press Zero (also called Long Tone Zero) is sometimes referred to as a “wilderness protocol” where a person with a radio (such as an HT) presses the PTT and then holds the “0” key for about 10 seconds.

Without a system like ARMS this LPZ makes a lot of noise and is an attempt to alert those who may be monitoring that a call for help is about to follow.

ARMS automates this process.

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Before we present ARMS in a graphical form here are some acronyms and labels we will use:

- ARMS = Amateur Radio Monitoring System
- ARMS Server = The hardware that is the heart of ARMS
- Caller = a person calling for help
- Calling Channel = the frequency / repeater that a person calls on
- Alert Channel = a frequency used by ARMS to raise an alarm
- Monitor = a ham (trained in ARMS) who monitors ARMS
- ARMS Team = a team who monitors ARMS on a schedule
- Team Lead = ARMS facilitator who schedules the team
- Sys Op = ARMS Sys Op who configures and maintains ARMS
- ARO = Amateur Radio Operator

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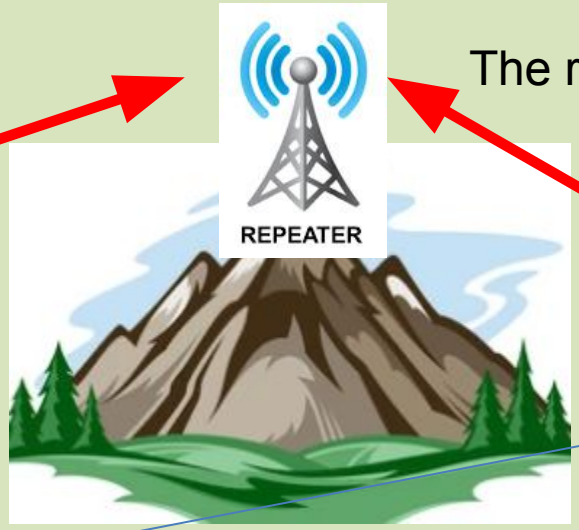

The repeater passes the DTMF tone

A caller in need uses LPZ on a repeater (or on a simplex channel).

ARMS Server

ARMS has been scanning different channels and detects LPZ. ARMS then calls out on the Alert Channel (using DCS) and wakes up an ARMS monitor and identifies the channel of the call.

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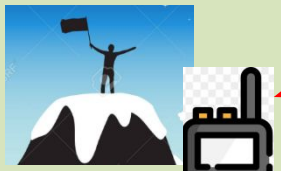

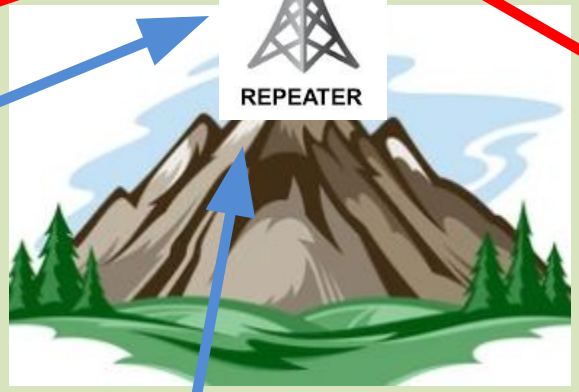

ARMS Server

Mary, wakes up and passes some prerecorded messages to the caller and to other monitors.

Mary, then communicates with the “caller”

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ARMS Functions (UI)

1. Listens for LPZ
2. Listens for testing by Monitors
3. When transmitting, IDs ARMS FCC callsign
4. In testing mode, identifies call sign of tester
5. In operations, identifies the station taking the incident (IC)
6. Passes “delay” messages if required
7. Tests system integrity on bootup

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ARMS Operator Codes

ARMS protects its operations against various errors. One such method is to use a limited set of numerical operator codes. There are 25 valid codes:

016	216	416	616	816
038	238	438	638	838
050	250	450	650	850
072	272	472	672	872
094	294	494	694	894

Sys Ops and Configuration

The system operator for any instance has some setup and configuration work to do. This is detailed elsewhere but it involves creating audio files (in .wav format) that identify each repeater (or channel) name and each member of the monitoring team by call sign. The task also involves creating connecting parts of sentences.

The wav files are added to audio file sequences that ARMS calls “paragraphs”, which are played at predefined points during ARMS operation so that if a system needs localized phrases for functions it can be done. It is recommended that originally a sys op follow the patterns of the default audio files – especially the length of “silence” at the beginning and end of audio files. A female voice is, in general better than the male voice.

Separator page

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UI – The ARMS User Interface

In most applications (programs) that run on modern personal computers like Windows, Apple, Linux or Android we see a system of menus. We select a menu and then perhaps a sub menu to get our work done.

ARMS does have a UI, but most of the work is done by sending DTMF tones to the ARMS server. The following slide will describe in “zones of operation” those UI areas.

UI – The ARMS User Interface – Zones of Operation

1. Configuration Mode – Linux OS mode – Sys OP:
   a) creates audio files (wav files)
   b) edits text in configuration files
2. Boot Mode – checks system integrity (radio on, wav files present etc.)
3. Scan Mode – normal operational mode - ARMS listens for LPZ and / or test mode request, quickly cycling through all the channels it monitors
4. Test mode - announces tester callsign, Calling & Alert Channel & FCC ID
5. Alert Mode – ARMS has detected LPZ
   a) advises caller he / she has been heard on Calling Channel
   b) ARMS does FCC ID (Calling and Alert Channel)
   c) On alert channel, ARMS announces call for help & channel heard on – repeats
      i. ARMS listens for repeat request & repeats info on request
      ii. ARMS listens for monitor taking charge of incident (IC) &
         - Announces call sign of IC
      iii. ARMS listens for request to announce delay (various lengths)
      iv. ARMS listens for canceling of Alert Mode

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Alert Channel

The alert channel is defined as the frequency and tone as found on channel #1 of the ICOM 7100. It can be any frequency. However there are questions that should be considered.

Example alert channel:

123.400 MHz Simplex
DCS 051 for RX and TX

This channel would be shared with a limited set of trained AROs who comprise the ARMS Team. They have a schedule for monitoring and testing and they have a “cheat sheet” with their own operator code (nnn) and the ARMS function commands.

Hardware

For a number of reasons we have chosen the ICOM 7100 and a Raspberry Pi 4 for the ARMS System. Though other radios may work, it may take other configuration and possible modification to the software running on the Pi. The system needs a dual band antenna (optionally an HF antenna) 13.8 VDC power, a low RF noise stepdown 12 VDC to 5 VDC converter and appropriate coax and cables.

It is possible that ARMS will work on HF also, but as of October 2021 it has not been tested.

Radio Settings

The ICOM 7100 should be programmed from channel 6 and up with the frequencies and tones that the Sys Op decides ARMS will monitor.

Channel 1 is for the “Alert Channel”

Channels 2-5 are reserved for future use.

The “DATA OFF MOD” setting on the ICOM should be set to “USB”. Look for this setting by navigating to SET->Connectors->DATA OFF MOD. For more information, see the SET MODE section of the full IC-7100 manual.

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Site

ARMS does not need to be on the highest point in an area to be covered. A 4000 to 5000 foot mountain should work well in most areas. ARMS wants to be in range of repeaters that are being covered, the simplex area of operation for callers and to be in simplex range of the ARMS monitoring Team. If the site has internet connectivity, then changes to the system can be done via the internet.

The ARMS Team

An ARMS team can be anywhere from 3 to 25 people. One member of the team needs to be the Sys Op and one needs to be the team lead. These roles can overlap.

Though monitoring 24 hours a day does not create a disturbance (except in an emergency) it does nevertheless require carrying an HT (or better) with you for the time you are one of the monitoring AROs. It is suggested that at any one time there be a primary and a secondary monitor. In that way there is some redundancy.

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A Sample Schedule With Only 3 AROs:

Week #	Primary ARO	Secondary ARO	Test ARO	Off
12	K7ABC	K7DEF	K7ABC	K7GHI
13	K7DEF	K7GHI	K7DEF	K7ABC
14	K7GHI	K7ABC	K7GHI	K7DEF

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