Handbook and
Field Operations Guide
For CERT Communications

Version 1.1 – 1st Edition

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Contents

Change Log

Version	Date	Editor	Status	Change summary
1.0	20 AUG 2020	Roger Tobin	Approved release	First Edition released.
1.1	31-JAN-2021	Roger Tobin	Approved revision	Incorporating comments from Director of Emergency Management and editorial revisions.

Revisions to this document

The most current version of this document is available from Beaverton CERT Leadership or the Beaverton Communications Group. If you have any questions or suggestions about this document, please direct them to the leader of the Beaverton Communications group who will forward them to the current editor.

1. Introduction

This section outlines the purpose and organization of this document. It also specifies the typographic conventions used to indicate items or concepts that need to be learned and remembered.

1.1. Purpose of this document

This Handbook and Field Operations Guide (FOG) is meant to provide education, guidance, and reference resources for all CERT volunteers who must communicate with other CERT personnel and Emergency Management (EM) personnel during operations. This guide applies to all communication, oral, written, or radio.

This document does not provide absolute rules for all aspects of communication – it provides known best practices and recommendations. It is expected that users of this document will determine which methods for communication are needed based on operational circumstances.

This document is not a formal Incident Command System (ICS) document, but it does refer to a number of ICS practices and forms. The Beaverton Volunteer Communications Plan (VCP) is a formal FEMA document and this document is adjunct to the VCP. It is expected that readers have completed required ICS training and will comply with ICS procedures specified for a particular operation, whether during training or a real deployment.

For any topic addressed in this document, there are many other resources that may provide more detail. Some of this can be found in specific CERT training materials while others are available on the internet. Users of this Handbook and FOG should educate themselves on other topics where they feel they would benefit from more detail before attending a training exercise or participating in an actual real-world deployment. Please note that some information is repeated in multiple places in this document. This is intentional so that the information is shown in various applicable contexts, and also so that it will be learned!

Practice makes perfect, so it is highly recommended that you participate in field exercises, on-the-air nets, build your own go-kit etc., in order to expand and improve your skills in communications.

1.2. Content and Organization of this document

This document concentrates on how and when to compose clear and unambiguous messages and how to make sure they are transmitted accurately. While there is an emphasis on the use of radio, the basics of creating clear messages apply to ***any method of communication*** which will get a message from a source to its destination.

Recommendations (instead of rules) are presented for operating methods, including composing messages, care and operation of equipment, channels and frequencies to use, communicating point-to-point as well as in a formal directed net. These are based on best practices, but may be revised or modified for specific situations.

Given the constantly changing nature of the marketplace, we do not make recommendations as to what manufacturers or models of equipment you should purchase as part of your kit. Ask other CERT volunteers or Amateur Radio Operators (AROs) about their experiences and recommendations if you have questions.

Specific tables that may be useful for field operations are included in the appendices at the end of this document – they can be printed separately as a Field Operations Guide (FOG) so that they can be included in your go-kit.

Terms and concepts with which you should be familiar are underlined. Items with special emphasis are in ***italics and bold type.***

2. Communication and Messages

This section defines the basic concepts of CERT communications and the importance of clarity and completeness. It introduces types of messages and ways of sending them.

2.1. The importance of communicating clearly, quickly, completely and accurately

In any CERT operation, practice or real, there will be a need to communicate with other personnel to coordinate, provide status reports, and receive direction on tasks. These needs will occur in real time, and during a true emergency, speed and accuracy will be critically important.

The structure of communications will vary with the severity of the incident. At one extreme (e.g., between team members about a minor incident) they may be nearly as informal as ordinary conversation. At the other extreme (e.g., among teams responding to a major incident) the methods may be highly defined and formal.

There are four components to effective communication:

1) Composing a clear message,
2) Transmitting it from its source to its destination quickly and without error,
3) Receiving a message and validating its contents, and
4) Keeping a record of its transmission and reception.

If the content of a message is unclear or ambiguous, it doesn't matter how disciplined you are in following communication processes or how good your radio is. Time will be wasted and possibly serious mistakes may be made based on incomplete or misunderstood information.

2.2. Types of communications

There are several types of communications used in CERT operations. Each is bi-directional (two-way) and has its own characteristics and appropriate uses:

Intra-Team communications are those that occur within a single team of volunteers, and are essential for operations such as light search and rescue and when dealing with large crowds. This kind of communication is expected and encouraged in operations. It is not highly formal, but does work best when standard communication practices and protocols are used to insure clarity and efficiency.

Inter-Team communications are those where teams communicate with each other. This is more formal and provides efficiency if there is no need to go to a higher level to pass a message, such as to the Emergency Operations Center (EOC) or agency representative. Such communications may be directed and moderated by another party (like a Net Control Operator) to ensure order and discipline in the communication methods. Please note that direction to a team or individual needs to come through the chain of command, which may require the next type of communication.

Next-level communications are those between individual units and the next level up in the command or management hierarchy (as defined by ICS). An example would be where CERT volunteers are "eyes and ears" on the ground during an incident and are used to report conditions and resource needs up to an Incident Command Post (ICP) or EOC. These communications tend to be formal, following defined formats and practices and may also be may be directed and moderated by another party (like a Net Control Operator) to ensure order and discipline in the communication methods.

2.3. Types of messages

In all forms of communications, there can be a couple of different types of "messages".

A General Message is one that is composed in a highly structured and formal framework and potentially contains a lot of detailed information. This is discussed in more detail below, but is often used for next-level communications or where a situation, action or request needs to be formally documented.

A Quick Message is informal. It might be used to report something like being on location, or asking for a radio check. This is often used in intra-team communication.

2.4. Overall advice for messaging

Whenever you are composing a message, make sure you keep to the following guidelines regardless of how it is going to be sent to its destination.:

- Know ***who*** the outgoing message is for **and how to address the message to them.** Unless you need to send something to a specific person, you will generally be sending it to whatever person is in a particular role and location, and you will use a Tactical ID as the address (see section 5.1).
- ***Be brief and to the poin***t – know the goal of the message and keep the content short and simple.
- ***Stick to the facts*** – do not add information to a message that is hearsay or speculation.
- ***Think before you compose the message*** – is the message necessary? Does it support the mission?
- For completeness, make sure that you have addressed as many of the 5 W's below as needed. This will minimize additional requests for information that may occur and thereby delay the request (and other communications):
    - Who is the group or individual that has a need explained in the message?
    - What is it that they need?
    - Why do they need it?
    - When do they need it?
    - Where do they need it?

At all other times:

- Keep the airways free of unnecessary chatter.
- Be ready to record an incoming message on paper if need be.
- Acknowledge receipt of all incoming messages or ask for a repeat if any are garbled or unintelligible.
- If the meaning of a message is unclear, reply asking for clarification.
- Reply to messages and calls promptly if requested with the required information.

3. Methods for sending (and receiving) messages

This section introduces the various methods that can be used to send messages and also introduces best practices for communicating.

3.1. Methods and media

There are many ways to get your message from your location to the intended destination. The methods will generally be determined by incident leadership and actual field conditions, and may change during a deployment. Methods may also differ depending on whether the situation is an exercise or a real emergency.

These methods could include email, telephone, cellphone, various kinds of radio, text messaging, using a "runner" (sometimes called "sneaker net"), or perhaps even digitally using a computer attached to a radio.

Messages can also take several forms such as written, verbal, or pictorial. A message might be transmitted orally (by radio), manually (written on paper) or by electronic text, and may include photos or diagrams. A message (or some materials important to one) may even be sent in another physical form such as a USB key.

3.2. Best Practices for communicating clearly for all methods

- Be ***Accurate, Brief, and Clear (the ABCs)***. Keep messages ***simple*** and get ***to the point***.
- ***Use plain English*** – this is the key to working with other groups. Don't use lingo, jargon, or codes (like police 10 codes). Avoid the use of slang in your messages, as the recipient may not understand and get confused.
- Follow common methods for descriptions of locations, conditions, status, needs, etc.
- ***Use only established and agreed-upon terminology***. This includes the use of "prowords" (Procedure Words) for managing the transmission and reception of a message over the radio. If you are not comfortable with prowords, don't feel that you have to use them. Prowords are discussed in Appendix B.
- ***Avoid abbreviations*** unless they are in common usage and generally understood.
- If the message is in writing, ***print clearly*** (If in doubt, have someone else try to read it.)
- If using oral communication methods, ***speak slowly and clearly***. Enunciate all your words – especially those ending with a "d" or "t" sound!
- ***Where there is a possibility of confusion, use the phonetic alphabet to give exact spelling***. If in a noisy environment, or when using uncommon words such as street use the phonetic alphabet to spell items and read out numbers (see Appendix A.) Remember that Oregonians pronounce Glisan Street in Portland "Gleason". There is also a Gleason boat ramp off of Marine drive, and a Gleason Street in Oregon City.
- When communicating time, use the 24-hour time format. If the listener does not understand 24-hour time and asks for a clarification or repeat, use both 24- and 12-hour format, i.e. "13:30 hours, 1:30 PM."
- Depending on the assignment, special phrases or codes may be defined for a particular use so that eavesdroppers aren't made fully aware of what is going on. This is to ensure operational integrity and protect the safety of bystanders. If this is needed, it will be part of the incident briefing before you start working. ***Remember these terms and use them***.
- ***Remember that anything you say on the radio can be heard by everyone else on the same channel.*** Don't say anything misleading or false, lose your temper or use any profanity.
- Keep a message log of all messages as instructed during incident briefing.

4. How to talk about Date and Time

This section specifies the way to unambiguously specify time and date values in any message.

4.1. Time format — 24-hour time

Common 12-hour AM / PM format is subject to errors and misunderstandings, so we use 24-hour format to unambiguously specify the time of day. ***24-hour time is to be used in all communications when stating the time***. To use 24-hour time, simply continue counting the hours up after 12 noon – for instance 1:00 PM will become 13:00. There is no need to say AM, PM, noon, or midnight. Midnight is 00:00, and the minute before midnight is 23:59.

Military time is similar to 24-hour time with 2 differences: It uses a leading zero where needed to always have four digits and doesn't use a colon to separate minutes and hours. 24-hour time uses a colon but not a leading zero. For example, 8 o'clock AM is shown as 0800 in military and 8:00 in 24-hour time. 8 PM would be 2000 (military) and 20:00 (24 hour). Since the two forms are so close you should be familiar with both, as either may be used in operations.

For CERT purposes, all time is local time. Time Zone, Daylight Savings (or Standard) time are not stated.

When speaking a time value, there is no requirement to say “hours” or “minutes” or “o’clock”. However, if it is at the top of the hour, the word “hundred” is often added (playing on the two zeros.) Military users often add the word “Hours” at the end to avoid confusion with other numbers, but your communication should be clear if you are talking about a quantity of hours as opposed to a time value. In military usage, the leading zero (before 10:00 hours) is usually pronounced i.e. “0500” is spoken “zero fiver hundred (hours)”. The time should be read out using standard phonetics.

Some examples are:

Time	Pronunciation options	12-hour translation (see the confusion?)
00:00	Zero hundred (hours)	Midnight, 12 AM
0700	Zero seven hundred (hours) / Seven hundred (hours)	7 AM or 7 PM
1:15	One fifteen (hours) / One One Fife (hours)	1:15 AM or 1:15 PM
13:30	One tree tree zero (hours)	No such time (is equivalent to 1:30 PM)
20:08	Two zero zero ait (hours)	No such time (is equivalent to 8:08 PM)

4.2. Date Formats

Dates should be written and spoken in the format ***Day-Month-Year***, as opposed to Month, Day, Year. When written the date should always be given as two digits (leading zero if needed), the month as a 3-character abbreviation, and the year as a 4-digit number. The sequence can be separated by spaces, dashes, or nothing, and the month can be all caps or not. When speaking, read it out in the same order as written, but be sure to use the standard phonetics for the numbers in order to avoid error. If the year value is omitted (intentionally or by mistake,) then it is understood to refer to the current year. Here are some examples:

Written:	13 Jun 1959	23MAY2010	01-Jan-1999
Spoken:	One Tree June One Niner Fife-Niner	Two Tree May Two Zero One Zero	Zero One January One Niner Niner Niner

5. Identification of sender and receiver

This section introduces the concept of identifying the sender and receiver of the message using tactical IDs and callsigns.

5.1. Identification, Tactical IDs and Licensed Callsigns

There is a need to identify who is sending and who is supposed to be receiving a message. A Tactical ID (or Tactical Callsign) is generally used in CERT operations for this. They are assigned to you or your team when you check in with your Team Leader or Incident Command. They are used in both written and radio communication.

Tactical IDs are short, descriptive, unambiguous and identifiable. Examples would be "COMMAND", "YELLOW 2", "COOPER BASE", "NORTH ROVER", "NET CONTROL", etc. They should be used as ***THE*** only form of ID for all communications. If via radio, this is also true regardless of the radio service being used.

A Tactical ID describes the role to which it is assigned rather than the individual in that role. This role may be a function or a location or a combination. If there is a personnel change, or a change in the radio being used, the ***Tactical ID remains with the role***. The Tactical ID remains valid until the team or role using it is demobilized.

A Licensed Callsign is issued by the FCC to an individual or an organization which is part of a licensed radio service such as the Amateur service (Amateur Radio), or GMRS (General Mobile Radio Service), or the business band. They consist of letters and numbers such as "N1EYZ", "W7RPT", "KAA8142", "WQWU626", etc. *A Tactical ID is NOT the same as a Licensed call-sign*!

Licensed callsigns are only to be used on the radio bands for which the license was granted and per the FCC rules for identification. For instance, a licensed ARO (Amateur Radio Operator) should not use their licensed callsign on FRS channels where they are not required. However, ***use of Tactical IDs on Amateur radio frequencies DOES NOT eliminate the requirement to transmit your FCC call sign*** at the end of a communication or every 10 minutes. For GMRS users, this interval changes to every 15 minutes, or at the end of a communication.

If you are communicating in an unlicensed service such as FRS, you should use a Tactical ID. If one has not been assigned to you, identify yourself by Location (like nearest cross-streets) until another ID is assigned to you.

Under no case should made-up identification (like CB Handles) be used.

The terms callsign and tactical ID are sometimes used interchangeably – but make sure you know when to use each appropriately.

5.2. A quick note on Licenses and FCC-issued callsigns

Amateur Radio callsigns are issued by the FCC only after an individual has passed an examination covering topics in radio communications, FCC regulations, and radio technology. There are three different license classes (Technician, General, and Amateur Extra), with progressively more difficult exams and increasing privileges as to what bands can be used. The fee to take an exam is $15.00, and the cost of the license is zero (at this time). An Amateur Radio license is good for 10 years before needing to be renewed. There is no renewal fee (at this time).

A GMRS license is issued to an individual after applying and paying a $70.00 fee. The license covers not only the licensee but also their entire immediate family. There is no licensing exam. The GMRS license is good for 10 years before needing to be renewed. The renewal fee is $70 for an additional 10 years.

Use of an FRS radio requires no license, and therefore no formal callsign is issued or required.

6. How to Compose, Format, and Communicate Messages

This section illustrates how messages are composed, and what components each type of message should have. It will also describe the ICS-213 Form for General Messages, and how messages are logged and tracked.

6.1. Content of a Quick Message

A Quick Message is exactly what it sounds like. These are generally used only over the radio or other voice channel to relay a short message that doesn't contain a lot of details but is needed for operational effectiveness. It will contain the Tactical ID of the intended recipient, the Tactical ID of the sender, and the message. They should be acknowledged by the recipient, and are generally recorded in the message log. An example would be:

- "RED BASE this is ROVER THREE. We are in position at the City Library."
- "ROVER THREE, this is RED BASE. Acknowledged that you are in position at the City Library."

If either party does not receive or understand the message, they can ask for a repeat.

6.2. Minimum Components of a General Message

A General Message is more formal and contains defined components or fields, much like those in an email message. These are on a form that you fill out before sending. Here are the fields that are required for use:

To — This is to specify the intended recipient position (and location); i.e. who the message is for. In a General Message, you should address the recipient by their ICS position, and optionally their location (if required, and only if possible). A Tactical ID can be used for the position in almost all cases. There will be times when people rotate through an ICS position, so by using the position as the primary identifier, you will make sure it gets to the person in charge at the time. In some rare cases, you may need to use the actual name of a recipient if the message is for that particular person, not whomever is at the position at the time. If so, add the name of the person in the field.

From — This defines the sender position (and location); i.e. who the message is from. This is just like the intended recipient, except it identifies the sender.

Date and Time – Anywhere date or time is required, provide them in the format specified in this document.

Subject — A clear and short descriptive title for the message.

Message– this is where you put the content of the message. Make it complete, clear, unambiguous and sufficiently detailed such that you feel that clarifying questions will not be asked (even if they are). Again, keep it simple and straightforward – have someone else review it to see if they understand it.

6.3. Messages sent during training exercises

During training exercises, messages may be sent that would seem very realistic and could cause alarm to anyone listening in who doesn't know that an exercise is taking place. Therefore, the word "EXERCISE" is to be used at the beginning and end of every message transmission, regardless of whether the message is transmitted on the radio or via paper. You may also hear the words "EXERCISE" repeated three times at the beginning of a radio communication as an alternative. An example interchange might look like this:

- "RED BASE this is ROVER THREE with EXERCISE message.
- "ROVER THREE, this is RED BASE. Go ahead with message
- "RED BASE this is ROVER THREE with EXERCISE message (or EXERCISE, EXERCISE, EXERCISE) … we are at the City Library and have multiple casualties. EXERCISE, OVER

6.4. In case of an emergency during a training exercise

In the case of a serious Safety or Health situation arising during a training exercise that is outside the scope of the exercise and needs prompt attention and action by the exercise leaders***, the phrase "NO PLAY" is to be used both at the beginning and the end of any message regarding the situation.***

An example would be:

- "BLUE BASE this is ROVER ONE, NO PLAY there is a multi-vehicle collision with injuries at the intersection of Murray and Allen NO PLAY"

6.5. Additional General Message components (possibly optional)

Response expected - If you want a response to your message, you can say that in the message body if the form does not have a box to check for this. There is no guarantee that you will get a response if you ask for one, and you may get a response even if you did not ask for one. You should always request a response if your message is to a different agency, and you can also request a response by a particular time. Remember that an acknowledgement is not the same as a response.

Urgency/priority – This is used if the message needs to be expedited in transmission and handling. If there is no checkbox on the form to indicate level of urgency or priority, include the words "Urgent" or "Priority" first in the subject line when needed. This should be used if there is a situation of imminent harm or life or death danger to any person or group of people. When in doubt, do not use this designation.

Approvals — If your message form has a field for this, then it is supposed to be used as part of the process, unless you are directed otherwise during briefing. The person approving the message should have read the message once it is fully composed, and approve its content and readiness for transmission. Their name and position need to be included, and they should also sign the paper form for the records. The use of this field may be waived per instructions in the incident briefing.

Word Count — This is sometimes used in radio communication, and contains the count of words in the message body. This is used as a check to ensure that the message was received in its entirety. If your form does not have a field for it, then it is not expected. If you are including word count in a voice transmission, read from a script to ensure accuracy, and do not read punctuation marks unless necessary to convey information. This will rarely be used in CERT communications.

6.6. General Message Form (ICS-213)

A standardized form should be used for composing, recording, transmitting, and receiving general messages. This would include most of the items mentioned in the previous sections.

The ICS General Message form ICS-213 provides a standardized template for this purpose, but other variants of it may be used as well. We recommend this form, but if you need to use something else, make sure it contains all the same fields. A variety of templates for the ICS-213 form are available on the Internet. In some operations, this form may be used digitally, i.e. it would be on a computer and filled out on-line.

General Message forms are used to send messages and responses via "runner" if radio communications are not available. The sender (the "From" role) writes a message on the form and gives it to a runner. The runner takes the paper to the intended recipient (the "To" role), and they write a reply (if required) in the reply section. The runner then returns to the sender with the reply.

Where radio communications are available and being used, the form is filled out by the person sending the message (the "From" role), but kept by the sending operator and read to the receiving operator at the intended recipient's location over the air. Each field, including its prompt is read aloud. The receiving operator will write the message onto a copy of the same form, and give it to the intended recipient (the "To" role). That person will then compose a reply if needed and give it to the operator to transmit. The originating operator will then copy the reply onto the original form in the reply section and give it to the person who sent the original message. In other words, every message and reply sent by radio voice communication will have a written copy on the same form kept by each party to the message.

In all cases, the message forms are to be kept as part of the incident record, and will be turned in later through the chain of command and kept as part of the response record for the incident. Generally, any documents (including messages) created during or pertaining to an incident must be retained indefinitely for legal reasons.

On the next page is an example of an ICS-213 General Message form – Feel free to print it out and use it for your own needs. A copy is also in the Appendices.

GENERAL MESSAGE (ICS-213)			
1. Incident Number / Name (Optional)**:** <Assigned by Incident Command>			
2. To (Position, Location)**:**			
3. From (Position, Location)**:**			
4. Subject:		**5. Date:**	**6. Time**
7. Message:			
8. Approved by:			
Name:	**Signature:**	**Position:**	
9. Reply:	**Date/Time:**		
10. Replied by:			
Name:	**Signature:**	**Position:**	

6.7. Logging messages and recordkeeping (ICS-309)

Regardless of whether a message is hand carried or transmitted over the radio, ***a communication log must be kept by both sending and receiving operators,*** (i.e. one for each radio or position.) This log includes records of all general messages. It may also contain records of quick messages (all or important ones) if required by Incident Command. Often the log is kept by a "scribe" who is partner to a radio operator, and is responsible for all the recordkeeping.

The ICS-309 form provides a standardized template for keeping a communication log. It is meant to record each message, but not the full details of each. It is not the same as the ICS 214 Activity Log form. A variety of templates for the ICS-309 form can be found in many places on the Internet. In some operations, this form may be used digitally, i.e. it would be on a computer and filled out on-line.

Here is an example (compressed so that it fits on the page):

COMMUNICATIONS LOG (ICS 309)	
Incident # and Name <Assigned by Incident Command>	**Time Started**: <The time you arrived on location or began operations; use 24-hour clock and local time> **Date Started**:
For Operational Period # <Numbered sequentially and changes when the team leader changes>	**Task Name:** <This position's role in the response (e.g. Command Net, Red Cross Tactical Net)>
Operator Name: <Self-explanatory> **Callsign:** <The FCC assigned call sign of the operator, assuming they are an ARO, Tactical ID otherwise>	**Tactical ID**: <Tactical call sign of station, assigned by the Team Leader>. **Radio / Band:** <Identify the radio or band main frequency being used>

MESSAGE LOG			
Time	**From**	**To**	**Subject**
	<Callsign or Tactical ID of sending station>	<Callsign or Tactical ID of receiving station>	<Activity, or From, Date/Time, and Subject from the general message form, including message number if available>
Page ___ of _____			

Please note that there may be multiple pages to the ICS 309, so keeping the page number field at bottom of the form accurate is critical. For subsequent pages fill out only the header items that have changed (if any). All of these pages should be kept together. *When a new operational period starts, or a change of operator occurs, a new ICS 309 should be started with a new Page 1*.

The message log should also be turned in through the chain of command at the end of the incident.

A usable template for ICS 309 is in the appendices.

7. Processes for messages on the receiving end

This section describes how to deal with the reception of messages including acknowledging, replying or asking for repeats.

7.1. Acknowledgements and replies – these are different!!

An acknowledgement implies that a message has been transmitted and received completely and fully understood. It does not constitute a response to the message which may or may not be forthcoming. The acknowledgement is made as part of the radio transmission and is not entered into any log – A message is not considered to have been fully and properly transmitted until it is acknowledged. For hand carried messages, the delivery to the recipient is considered acknowledgement.

In radio communications, the proword ACKNOWLEGED is used to indicate that the message has been received and understood. If you have received a message, but do not understand it, ask for a repeat.

A reply is an actual second message in itself. It is good practice to request a reply in an originating message if one is needed or desired, but a reply may be forthcoming even if one is not expected. You may also indicate a time by which you would like to receive a reply. This does not obligate the receiver, but it does put them on notice as to when you will be checking back if you haven't heard anything. In the case of a message recorded on an ICS-213 form, a space for a reply is included in the form.

A reply may provide requested information, additional or new direction, or may ask for clarification of all or part of the original message.

A reply is also used to indicate that the receiving party is taking the specified action that was requested.

If the original message contains information critical to the operation, a reply should repeat back the understood meaning of the message to ensure clarity – this can be part of the reply indicating the action being taken.

For a hand-carried message, the reply should include the acknowledgement that the message is understood.

Acknowledgement prowords from other traditions including ***COPY, ROGER, and WILCO should not be used***.

7.2. Asking for a message to be repeated

If a message has been received but its meaning is unclear, the receiver must ask for clarification in a reply. This is a very important step and should take priority over handling other messages. The standard protocol for composing and sending a reply should be sufficient for this purpose.

However, if a message is garbled during transmission or is only partially received, then a more formal protocol should be used (Please note that this only applies to radio transmission of messages.) For this purpose, the proword SAY AGAIN may be used alone or in conjunction with prowords that identify the portion of the message that is unclear (e.g., ALL BEFORE, ALL AFTER, FROM, TO, WORD BEFORE, WORD AFTER, etc.) When complying with requests for repetitions, the originating station must identify the portion that is being repeated.

When it is necessary to ask for repetitions after a message has been received, identify the message being queried as well as the portion required.

If the communications channel is noisy or unreliable, the sending station may choose to repeat the message using prowords like I SAY AGAIN or WORDS TWICE.

8. Recommendations on methods for sending and receiving messages

This section reviews the different ways in which messages can be sent and received.

Listed below are a variety of methods for sending and receiving messages during CERT operations along with recommendations and notes on their usability. All these methods have advantages as well as disadvantages. There is no pre-defined priority for what methods should be used in any particular situation.

Method	Recommendation
FRS (Family Radio Service)	**Yes** – Simple to use and good for ***short*** distances.
GMRS (General Mobile Radio Service)	**Yes (if available)** – Simple to use and good for slightly longer distances. To be useful, these radios must be available to all team personnel. A license is required for GMRS and applies only to your immediate family.
Amateur Radio	**Yes** – This service is useful as some AROs are trained in emergency communications.
Public Safety Band Radio	**Yes (with limits**) – This can be used if the equipment is available during a deployment, and authorized for use by Incident Command.
Email	**Yes (with limits)** – If the recipients can be reached via email and if the internet is stable and reliable, this method can be used. However, timely delivery and quick turn-around is not guaranteed. It is not advised for field operations unless all participants have a smartphone that can receive email.
Computers / Internet	**Yes (with limits)** – Use these if they can be reliably powered and can communicate with other digital devices. Note that runners could also transport USB thumb drives between sites if needed.
Cellphones / SMS (Text Messaging)	**Maybe** – The actual cellphone network is apt to degrade quickly in the case of a real emergency like an earthquake. However, SMS (Text) messages may get through even if voice calls cannot. The cameras in cellphones can be useful for gathering information, as long as those pictures can be uploaded and sent. Note that SMS messages are not iMessages used on Apple iPhones. Apple users should turn off iMessage format and stick with SMS only.
Runners	**Maybe** – Use only if their safety can be assured. However, it costs headcount that may be needed at a post and is not recommended for that reason.
Satellite Phones	**Not recommended** – These are uncommon, and local CERT teams will not need this degree of connectivity.
Landline Phone	**Not recommended** – In an emergency, these will be unreliable and whatever portion of the system works should be reserved for emergency services to use.
CB Radio (Citizens Band)	**No** – Do not use unless no other methods are available.

If you need to get a message through and preferred methods don't work, use any means available, including the ones not recommended above. In a real emergency, the FCC allows unlicensed users to utilize Amateur Radio equipment. but it must be a situation where there is an immediate danger to life or property, all other communications methods have been tried and failed or are unavailable, and a licensed operator is unavailable.

In practice drills, items requiring infrastructure support (like cellphones and some computer messaging) could be used, but should be de-emphasized due to the likelihood of unavailability during an emergency.

The final decision on methods to be used should be based on the resources and equipment available at the time. GeoTeams should be aware of which members have what type of equipment and training.

9. Environments for radio communication

This section discusses the ways CERT volunteers will communicate via the methods above including radio, and describe the basic mechanics of net operation and discipline.

Radio communication generally takes two forms – peer-to-peer where two people communicate directly with each other without intervention, or in a Net (i.e., Network) where multiple people share the same channel and follow formal procedures for effective communication. In all cases, the expectation is for CERT volunteers to maintain proper radio communication discipline. Nets can be conducted on simplex channels or through a repeater for greater area coverage – more about these topics later in this document.

9.1. Tactical Net operation and disciple

A Tactical Net is used to handle the main on-site communication between members of a team. They are peer networks for informal or extended conversations. In this environment, there is no "traffic cop" managing the channel, so users must be careful not to talk over each other.

A tactical net may be established on a previously assigned common channel (such as an FRS tactical channel assignment for a GeoTeam), or on some other channel as directed by team leadership. They may also be established by the direction of a Network Control Station operator to have some team members take a conversation to a secondary channel in order to minimize primary channel traffic.

Tactical nets may also be nets for intra- and inter-team communications.

9.2. Directed Net operation and discipline

A directed net is used for communications between teams and up levels in the ICS structure. These nets are generally established on the primary channel assigned to a group.

The Net Control Station (Net Control) is the moderator of the group communication in the directed net. They ensure all participants follow the standard procedures for the net and determine and direct when each station may talk and to whom. They maintain a communications log and record participation in the net and movement of messages; (i.e. they always know who is on and off the net.)

In a directed net, no station other than Net Control can communicate with any other station without first obtaining the permission from Net Control. The only exception is for the transmission of urgent messages

The Net Control operator also maintains knowledge of what users are participating in the net and is responsible for allowing users to join ("checking in") or leave ("signing out") the net. When a station wishes to join the net, they broadcast "THIS IS <callsign or tactical ID> REPORTING INTO THE NET". When Net Control acknowledges this message, they are considered to have joined. Similarly, when a station needs to leave the net before it is disbanded, they broadcast "THIS IS <callsign or tactical ID> LEAVING THE NET".

If two or more stations on the net need to have an extended conversation about a topic, Net Control can tell them to go to a predefined Tactical Net channel or some other channel to do their work, and return to the directed net when they have finished by checking back in.

The Net Control operator may or may not be located at a command post, but often is, and is often assisted by a scribe who is responsible for record keeping tasks. These include transcribing messages sent to command, logging all messages, and keeping track of current stations participating in the net.

The Net Control operator can also disband the net when needed and "release" the channel for general use.

10. Introduction to Radios – How they work

This section contains a VERY BRIEF and simple explanation of how Radio works.

Picture the waves on the ocean – they have a certain amount of rise and fall (this is called Amplitude) and a certain distance between the crests (or troughs) that repeats (this is called Wavelength). The number of times a crest or trough passes a fixed point in a specified amount of time is called the Frequency. With a little bit of observation, you can see that the wavelength and the frequency are mathematically related to each other through a formula that also includes the speed that the wave moves (Propagates) through the water.

We can witness the same scenario when we drop a rock into a still pond – waves are generated and disperse outwards. One thing we notice is that the height of the waves decreases the farther they get from the center. This demonstrates that the effective power of the wave decreases the farther you get away from its source.

However, these waves by themselves don't help us transmit or receive any information. However, if we tweak their shape in order to impress some information on them then we can send a message! (This process is called Modulation.)

A radio works by creating, sending and receiving modulated electromagnetic waves that behave similarly. An alternating electric current in the antenna of your radio causes electromagnetic waves to be generated when you transmit, just like what happens when a rock is dropped in a still pond. These waves leave your antenna with a certain amplitude and wavelength. They travel outward (propagate) at the speed of light which is much faster in air than the waves on the water!

When your radio is receiving, the electromagnetic waves coming from the transmitting station cause another alternating electric current to be generated in the antenna with the same frequency. This is then fed back into your radio. Through a bunch of circuits in your radio, information can be placed on the electromagnetic wave transmitted by modulating it with the information, like the shape of the soundwaves of your voice. Similarly, the information on the received wave form can be extracted (demodulated) and then presented to you through your speaker, amplified (strengthened) so that you hear the sound of the sender's voice.

Modulation of any form requires a bit of space in the electromagnetic spectrum. This space is called Bandwidth.

There are many different types of modulation available to use. Changing the height of the wave is called Amplitude Modulation, and you know it as AM radio. We can also mess a little bit with the frequency and utilize Frequency Modulation, which you know as FM radio. Nearly all the types of radios we use in CERT use FM.

Your radio will have the best reception when its antenna is oriented the same way as the transmitting antenna, as the transmitted wave will then be able to cause the strongest current in the antenna. This effect refers to what is called the Polarization of the wave. Generally, you should hold your radio such that the antenna is vertical, as fixed stations that you may be communicating with will have their antennas vertical as well.

ALL OF THIS IS A VERY SIMPLE EXPLANATION. If you want to know more, there are plenty of resources on the internet, at the library, etc. You also will learn more if you study for and get an Amateur Radio license.

11. Your Radio

This section discusses what you need to know about getting a radio for yourself and how to care for it.

11.1. Getting a Radio

Depending on your need, desire, and the size of your wallet, you will have a variety of options regarding the kind of radio you get for your CERT work. There are very serviceable and economically priced FRS / GMRS radios that can be used by all CERT personnel. Only licensed AROs can and should purchase radios for the amateur bands.

When you are buying a radio, here are some of the things you should consider:

- Size and weight – will it be comfortable to use and carry?
- Durability and protection from the environment (water, dust, etc.) — is it going to hold up when it rains?
- Transmit power ranges – Does it have more than one setting? Can you change it easily? The batteries will last longer on lower power, but the ratio may transmit further on higher power.
- Power source – What batteries does it use? Are they rechargeable? Can they be replaced in the field?
- Accessories in the package – what are the "extras" that come with the package?
- Other accessories that you can buy for that model – can you get things like extra batteries, earphones, microphones, battery eliminators for your car's 12-volt accessory jack?
- Size of controls & readability of displays – can you comfortably operate the radio?
- Extra features – do your research as to what other features are included. Are they useful to you?

For specific recommendations on makes and models of radios, speak to other CERT volunteers who are knowledgeable on the subject. Whichever radio you get, make sure you can quickly and easily adjust its features (such as Channel, Squelch, PL tone, offset, Enable VOX, etc.) in the field.

Learn how to program your radio – Do this before you need to use your radio in an emergency.

11.2. How to care for and carry your radio

- Treat your radio with care even if it is supposed to be rugged.
- Keep your radio dry even if it is supposedly waterproof.
- Keep your batteries charged. If you don't use your radio for a while, be sure to plug it in periodically to top-off the battery. Do the same for any spares you have. If your radio uses AAA or AA batteries, take them out if you are not going to use the radio for a while.
- Keep your radio and accessories out of prolonged direct sunlight, especially inside a closed car – the heat can damage it. If your radio has an LCD display, prolonged heat can render it unreadable until it cools down.
- Do not carry your radio by its antenna or external microphone– these are components, not handles, and you can damage them as a result if you are not careful.
- Do not transmit while holding onto the antenna, as your hand will absorb the radio energy, and your signal will be attenuated (i.e. lose strength and not go very far). Receiving while holding onto the antenna will be similarly compromised. If transmitting at high power, you can give yourself an RF Burn, which will hurt!
- Never transmit on a radio without an antenna or with a severely damaged antenna – it can cause permanent damage to the radio itself. Longer antennas can flex, but if they crack and expose the metal inside you need to replace them.
- Don't swap antennas with other radios unless you are certain that it has the correct type of connector and is for the frequency band where you will operate.

11.3. What you might need with your radio

Here is a list of other things that you should consider to be part of your radio communications kit:

Extra Batteries – ***This is probably THE MOST IMPORTANT accessory you can take with you*** when operating your radio. Depending on the type of radio you have you may need different types of batteries. It is always a good idea to have at least one set of replacement batteries or battery packs. If your radio goes out because the batteries are exhausted, and you don't have any spares, then you are out of the game as a radio operator.

Be sure to carry the spare batteries safely so that they don't touch metal surfaces that may complete a circuit and cause them to drain.

If your radio can be charged through a USB port, you might be able to use a USB battery charge pack.

If you are not going to use a device for a while, we recommend that you take the batteries out so that they won't leak in the device and damage it. This is especially true for radios that use AAA or AA batteries.

Charging cradles or USB cables – your radio might be able to be recharged this way. If so, you should have the necessary charging equipment in your kit as long as it is portable. This includes charging accessories that can connect to your car's 12v outlet.

Antennas– if your radio has a detachable antenna, you may want to get another antenna, perhaps one with higher gain for use. This only applies to Amateur radios, not FRS or older GMRS radios.

Speaker Microphone – If your radio has a connection for this, it can be very handy and allow you to better transmit and receive. This is also known as a Speaker Mic. Some speaker mics also have keypads on them. If you intend to use those functions, you may have to lock out the keypad on the actual radio to prevent unintentional operation.

Headset with Microphone – This is an alternative to a speaker microphone and may provide a bit more privacy, and is helpful in a high-noise environment.

Earphone – These are handy for listening in noisy environments as well as keeping things private. These will also help to prevent accidental feedback. Sometimes they plug directly into the radio, or into the Speaker Mic.

Paper / Pencil / Forms – You should have these in order to assist in your communications efforts!

Belt clips – If your radio has a belt clip, that can be a handy way of attaching it to your clothes. But don't be afraid to clip it to your pocket as well if the radio is light enough. Be wary of flimsy belt clips if you will be physically active.

Holsters – For larger radios, a holster may be a better idea for carrying, as it will be easier to grab than to unclip it from your belt.

Carrying bag or Pouch – This can be separate from your general CERT go-bag or backpack and can be dedicated to carrying your radio equipment as well as pencils, paper, and forms. You can get custom bags for carrying your radio and associated gear, and some of these can be attached to your belt or worn over your shoulder.

Instruction manual – Depending on the radio that you purchase, you may need to carry along the manual or instruction sheet it came with in order to know how to use the features that are important to communication methods for your field operation. (Hint – make a one-page summary for yourself and laminate it for protection.)

Programming cable – (Very Optional) If your radio can be programmed with channel names, frequency lists, etc., it may be useful to bring your programing cable along, along with the programming software on a USB Drive as there is potential that someone with a computer can load your radio with useful settings. On more modern radios, these are usually USB cables (possibly with a micro connector on one end). This is very uncommon for FRS/GMRS radios. (Hint – do this programming at home in advance of a deployment or exercise.)

12. Radio Procedures and Best Practices

This section outlines effective procedures and best practices for radio communications. Please be familiar with these and follow them during CERT operations

12.1. General Procedures for Radio Communications

Getting Started:

- If your radio has memories that can be programmed, do so in advance before being deployed.
- Have your gear in order. If you have a speaker-microphone and an earpiece, get those attached before turning on your radio.
- ***Ensure that the correct frequency/channel is in use on the radio*** and that at least one person is assigned to monitor the radio, regardless of the circumstances. Know what alternate channels may be used.
- ***Ensure that any PL tones or offsets are set correctly for the channel*** if they are needed.

Making Contact:

- Hold the radio with the antenna vertical, away from your body, and away from metal.
- ***Initially, go to the primary channel*** for your group.
- ***Push the PTT button and hold it down, wait 1 second, then start talking to avoid having your first words cut off by the repeater or by slow circuitry in your radio.***
- ***Identify yourself*** with "THIS IS" followed by your location or tactical ID / callsign.
- If nobody responds, identify again every 10 minutes
- Once acknowledged, remain on that channel until directed to go elsewhere.

Paying Attention:

- Always have someone listening on your assigned channel(s) unless specifically directed otherwise.
- ***Answer all calls as promptly as possible***.

Communicating:

- ***Listen before transmitting*** to ensure that the frequency is clear and to accommodate stations that are having trouble sending or receiving, or stations that have high priority messages and need to break-in.
- Do your best to transmit from an area with low background noise.
- ***Initiate radio contact by using the callsign of the station you want to reach and your callsign as the sender***.
- After talking, release the PTT button promptly to ensure that the radio returns to the receive mode.
- Avoid standing near large metal structures or buildings or power lines.

Messages:

- ***Keep messages clear, orderly, and concise, brief and to-the-point.***
- Use callsigns, Tactical IDs and recognizable abbreviations or codes when referring to personnel or locations.
- As much as possible and practical, ***plan the message ahead of transmitting it. Use a message form*** for composing the message. Written notes reduce the risk of error.
- ***Clearly state the information you wish to convey and any action you would like to have taken as a result.***
- ***Use appropriate prowords for efficiency if you are comfortable in doing so***. (see Appendix B)

- ***Never transmit any sensitive or confidential information***– this would include identifiable victim names, phone numbers that should not be made public etc. Incident command will state how such information is to be communicated during deployment briefing. Medical conditions of victims can be transmitted.

Pausing and ending:

- After a transmission ends but it is apparent that the conversation is not over, do not break in before the other party to the conversation has a moment to mentally compose a reply and send it.
- ***End each transmission by saying the proword "OVER" when you are expecting a response, and "OUT" when a response is not expected or desired.***
- When you are leaving the channel entirely, say "THIS IS" Tactical ID "CLEAR".

12.2. Speaking clearly and Transmitting clearly

General:

- Always assume that the channel will be noisy at the receiving end, so speak clearly and slowly.
- Be calm -- if you are not, you may not be understood by the receiver.
- Always be polite in your communication. Do not lose your temper or use profanity. Others may be listening, and improper communications may violate FCC rules and get you in trouble.
- Know, understand and conform to the FCC regulations that apply to your radio and license.

Using the microphone:

- ***When transmitting, push the PTT button and hold it down, wait 1 second, then start talking to avoid having your first words cut off by the repeater.***
- ***Speak across the Microphone***. Hold the radio or speaker mic at an angle of 45° to 90° and about 2 to 3 inches from the side of your mouth.
- Holding the mic too close to your mouth will cause distortion making your voice unintelligible.

When speaking:

- ***Speak at a normal conversational volume.*** Shouting causes distortion.
- Be aware if you are a quiet or loud talker and adjust accordingly.
- ***Don't slur your words***; over-annunciate syllables if necessary.
- Don't cut off or allow your words to fade out, especially with words ending with the "D" or "T" sound.
- Avoid using single syllable words like YES, NO, YUP, or NOPE, which can become garbled over the air. Multi-syllable words prevent confusion. Utilize the appropriate prowords to aid in this.
- ***Use a natural rhythm***; this helps the person on the other end understand your message clearly.
- ***Speak slightly slower than for normal conversation.*** Slow down by increasing the length of pauses between phrases, especially if a message is to be written down by the recipients or if conditions are difficult.
- Never speak faster than the station experiencing the worst reception conditions can be expected to receive.

Transmission hints:

- Transmit from a place where you are not close to metal, as this may affect the strength and direction of your signal. This includes overhead power lines, metal clad buildings, vehicles, tent posts, etc. In general, if you can stand at least 12 feet away from such objects, you will be OK.
- When pausing during a longer message, say "BREAK" and release the PTT button to minimize transmission time and to permit other stations to break in as necessary. When you are ready to continue the message, start again by identifying yourself and your recipient and say "CONTINUING".
- Keep the antenna vertical, as this will ensure that it will have the best reception and transmission.
- Do not transmit while holding onto the antenna, as you hand will absorb the radio energy, and your signal will not go very far. Receiving while holding onto the antenna will be similarly compromised.
- Use the lowest possible power setting to get through. This will save your batteries and also make your signal clearer.

Receiving hints:

- A channel that is not being used will have a background of "white noise". This is normal.
- Adjust the squelch control (often marked SQL) just above where the white noise is cut off.
- Tune through the channels you might use and listen for interference (such as buzzing) beyond the regular white noise. Move your position if possible, to a place where the noise decreases or vanishes.

12.3. When to use the Phonetic Alphabet

The Phonetic Alphabet was designed to ensure that letters and numbers are clearly understood even when speech is distorted or hard to hear. Each phonetic alphabet word is chosen so that it sounds different from all the others and can be understood in noisy environments. ***We highly recommend that all users get familiar with and remember and use the Phonetic Alphabet***.

- When necessary, use the phonetic alphabet (See Appendix A) to spell out words or strings of characters or numbers.
- If any words are uncommon or are technical terms that might be misunderstood, spell them out.
- If needing to transmit addresses or coordinates, use the phonetic alphabet to ensure accuracy.
- If in a noisy environment, or when using uncommon words (such as street names e.g. Avocet, Inglis and Wolds) use the phonetic alphabet to spell items and read out numbers.
- Also use the phonetic alphabet to give exact spellings when there may be confusion. Remember that Glisan Street in Portland is pronounced "Gleason". There is a Gleason boat ramp off of Marine drive, and a Gleason Street in Oregon City.
- If symbols need to be transmitted like a dash, at sign, hashmark, etc., use the appropriate symbol pronunciation.
- If the channel is noisy, you need to default to spelling items out more often and speaking more slowly.
- It is good practice to preface the use of phonetic alphabet with the prowords "I SPELL".
- If you forget the proper phonetic alphabet word, use a common word starting with the letter you need such as "Adam" for A. Make sure that you start your message saying "I SPELL" so that those listening know that you are trying to spell something out and might not use standard phonetics.

12.4. Best Practices for operating your radio

Use of the channel – Only one person can talk at a time on a single channel, so please listen before you talk to make sure the channel is clear. When two stations transmit at the same time, neither station will be understood. This is called Doubling. When participating in a Net, the Net Control operator will be the one to call this out and then ask only one of the stations to proceed – the other will be asked once the first station is done.

Someone else thinks they own the frequency / channel – ***Be polite***. The airwaves are a shared resource, and as long as you conform to the FCC rules, everyone has equal access to their bands. If there are already users on a channel that we would normally use, we should explain our purpose on the channel and politely ask the uninvolved parties to move to another one. We would go to a backup channel the other parties refuse to accommodate us, or if a higher authority asks us to move.

Deliberate interference – Again, find a way to move if at all possible. Do not go on a hunt for the person behaving badly or take the time to chew them out. You have more important things to do. If the situation persists, you can report this to Incident Command.

Do not walk and talk (or drive and talk) – Avoid walking and talking (transmitting) at the same time. Stay safe, use your radio only when you are on secure footing. If driving, pull over to transmit, or let someone else in the car do the talking. There are legal exceptions for AROs but you still might get stopped by the police which will delay you from your assignment.

Do one thing at a time – Do not transmit or receive if you are also doing something else like holding a fire extinguisher, helping another team member support an injured person, etc. You need two hands and one mind on each task. If possible, communicate away from the crowd and the noise so that you can concentrate and hear and speak clearly.

Use only One radio at a time --Carrying more than one radio can be difficult. While you may think that you need to cover more than one band at a time (such as both the amateur and FRS channels) you run the risk of missing communications if both radios are active at the same time, and making your transmission more difficult if the other radio is making a lot of noise from an incoming transmission. You can also get distracted by having more than one incoming message in your ears at the same time. You will have to consider the extra weight, accessories, etc. Scanners count in this as well. As a rule, concentrate on using only one radio for one radio service at a time.

Note: It is illegal to use a radio in a service for which it has not been licensed. FCC regulations prohibit using non-Part 95 certified devices on Part 95 services (including FRS, GMRS, MURS, CB). This means that it is illegal to use ham radios to transmit on FRS / GMRS frequencies, even if they can tune to those frequencies.

Dealing with Noisy environments -- For reception, particularly in noisy or difficult conditions, the use of headsets is preferable to loudspeakers. You can also use an earphone. For transmitting, do your best to move to a (more) quiet area. Don't use VOX (Voice Activated Transmit), as it may accidentally start transmitting the surrounding noise.

Is my Signal good? -- Your reception of transmissions from other radio operators will give an indication as to your success in transmitting. To improve your reception, try increasing your elevation, moving to a different area, moving away from large metal objects or trees, and rotating your orientation. When transmitting, pay attention to what others say about your signal and adjust accordingly. Don't be afraid to ask for a Radio Check as defined in 13.8.

Operate only within your license privileges – For FRS users, you are restricted to the power levels and channels specified for FRS usage (See Appendix H). If you happen to have a Hybrid FRS/GMRS radio, you should read your manual to make sure you don't accidentally start using GMRS channels or power levels.

Dealing with technical problems in the field – If you feel your radio is not working properly, do not use it. Seek assistance from another radio operator, or switch radios.

Program your radio in advance – If you preload the memories in your radio with frequencies and channel names, it will be easier to talk about different channels by name with other operators.

Avoid High Voltage Power Lines – Don't stand under or close to them, as they may interfere with your signal and the operation of your radio.

Keep your antenna vertical – for instance, don't have the radio on the seat of the car while you are talking on the external microphone, as the seat will attenuate both transmitted and received signals.

Avoid standing in known dead spots when operating – Some areas are known to be in a "radio hole" and are not good for transmitting or receiving. This is true for both repeater and simplex operation. Ask others on your team about known locations, and if you run into one that is new to you, remember it.

13. Use of Channels and Frequencies

This section defines the terms and describes simplex and duplex operation, as well as how to communicate through a repeater and what channels and frequencies you should use during CERT operations.

13.1. What is the difference between Channels and Frequencies?

In radio terminology, the frequency is what you set your radio to transmit or receive. For instance, if I want to listen to KOPB on the FM Band, I will set my tuner to 91.5 MHz using the tuner knob or keypad. If I want to use my UHF Amateur Radio to talk to others in the Blue GeoTeam, I will set it to 431.0250 MHz. In both of these cases, the frequencies used are either assigned (like for the commercial FM band), or agreed to between users (like the suggested GeoTeam simplex frequencies).

For certain radio services like FRS or GMRS, the FCC has designated a specific set of frequencies to be used, and each is designated by a channel number. Channel numbers are easier to remember, and equipment that uses them does not allow the underlying frequency to be changed. For instance, if the Red GeoTeam chooses to use FRS channel 6 as a meet-up channel, they will actually be using 462.6875 MHz, but their FRS/GMRS radio will show channel 6, and not permit them to either see that frequency on the display, or change it.

13.2. Simplex and Duplex

Simplex operation means radio stations are communicating with each other directly on the same channel or frequency. This is the most straightforward method, and is the one you will use with FRS radios. With simplex operation, only one station in a given area can transmit at a time. For this reason, ***you need to listen to see if the frequency or channel is in use before you start transmitting a message.***

Duplex operation means that a radio transmits on one frequency and receives on a different frequency. Duplex communications in the VHF and UHF bands most often use special stations called repeaters which are described below. However, the same advice applies regarding transmitting -- listen to see if the channel is clear before you start transmitting.

13.3. Repeater Operation and Discipline

A Repeater is a radio station that retransmits signals by listening on one frequency and resending them on a different frequency. This can be used to extend the effective range of a user's signal, both by the repeater being located away from the user, and also due to the fact that repeater stations operate at higher power than a standard hand-held radio. Repeaters are found on amateur radio frequencies, and can sometimes be found for GMRS use. Repeaters are usually in a fixed location, have high efficiency antennas, and dedicated and emergency power available to support their availability in normal and emergency situations. Repeaters are also often located at higher geographical points in order to increase their range. This also allows two stations to communicate with each other who would otherwise be out of line-of-sight propagation range of each other. Repeaters can be used for both voice and digital communications. Portable repeaters may be deployed during an actual incident to provide needed coverage.

A repeater is always "listening" on its input frequency. When it detects a signal on that frequency, it rebroadcasts it on its output frequency. The difference between the two frequencies is known as the offset. Also, most repeaters now also listen for a specific sub-audible audio tone (known as a PL or CTCSS tone) as part of the incoming signal – this serves as a kind of authentication key, and if the incoming signal does not contain that tone, it will not be rebroadcast. It also helps prevent accidental rebroadcasting of noise or interference.

Repeaters also have timers that will cease retransmitting a particular signal if it goes on too long. If this occurs, it is referred to as "timing out". Repeaters are FCC licensed stations, so do have to transmit identification of their own periodically per regulations. These identifications are automatically sent by the repeater station in either Morse Code or voice.

To operate the repeater, make sure your radio has the correct input and output frequencies set as well as the correct PL tone for the repeater. Many radios will set the correct input frequency based on the output, and the standard band plan. Also, most radios will be able to store both the PL tone required as well as the input and output frequencies in memory slots, along with some sort of meaningful channel name that you can set when programming the memories.

Utilize standard transmission practices to access the repeater. If you have successfully managed to transmit your message, the repeater will often respond with a quick beep to indicate that it heard you.

Remember to pause for a second or two before speaking in order to make sure that the repeater has turned on completely so that your message doesn't get cut off.

Remember that the range of a repeater may be much larger than the service area of your team, so expect that anything you transmit on a repeater input will be heard by anyone listening in the repeater output range. Plan your message accordingly. Repeaters are a shared resource, so keep your transmissions short and to the point.

Do not key-up the repeater without identifying yourself. This is sometimes referred to as "Kerchunking" the repeater – This is technically illegal and considered rude by other users. If you need to know if you can reach a particular repeater, you can transmit a message like "THIS IS <tactical id or callsign> RADIO CHECK".

On occasion, operators may use the output frequency of a repeater as a simplex channel. This should only be done if the repeater is not responding, or perhaps is not working. Care should be taken when doing this, as the signal may get garbled by an actual output signal from the repeater itself, thus "doubling" and rendering both signals unintelligible.

For CERT, repeaters are used by AROs, and for the City-owned VHF Public Safety radios. GMRS Repeaters exist as well, although they are uncommon.

In general, CERT communications will take place on simplex channels, but certain AROs may be assigned to communicate on a designated repeater in order to pass messages over larger distances.

13.4. Choosing channels and frequencies for an operation

For CERT operations, GeoTeams have been pre-assigned specific FRS channels and simplex Amateur Radio frequencies for primary and secondary use. These are shown in the tables below:

FRS Channel assignments for GeoTeams				
GeoTeam	**Primary Channel**	**Frequency (MHz)**	**Secondary Channel**	**Frequency (MHz)**
Orange	1	462.5625	5	462.6625
Green	2	462.5875	6	462.6875
Blue	3	462.6125	4	462.6375
Red	4	462.6375	3	462.6125
Yellow	5	462.6625	1	462.5625
Teal	6	462.6875	2	462.5875
Grey	7 (or 2)	462.7125 (CH 7)	7 (or 6)	462.7125 (CH 7)

Amateur Radio UHF Simplex Frequency assignments for GeoTeams				
GeoTeam	**Primary Channel Tag**	**Frequency (MHz)**	**Secondary Channel Tag**	**Frequency (MHz)**
Orange	ORANG1	431.1250	ORANG2	431.0500
Green	GREEN1	431.2750	GREEN2	431.2250
Blue	BLUE1	431.0250	BLUE2	432.1250
Red	RED1	432.1500	RED2	432.1750
Yellow	YELLO1	431.1750	YELLO2	432.2250
Teal	TEAL1	431.0750	TEAL2	445.5000
Grey	GREY1	431.2750	GREY2	431.2250

These are all simplex channels / frequencies and do not require any PL / CTCSS tones. We strongly recommend that you don't use any tones for any of these simplex channels.

The Primary Channels will be used for the Directed Net for each team, and is where folks should check in during meet-up and initial deployment. The Secondary channels will be used for Tactical Nets, but if the number of people on radios in the team is sufficiently small, the Primary channel may be used for a Tactical Net until or unless it is needed to become the Directed Net.

During an exercise or actual deployment, different channels / frequencies may be dedicated to special purposes. Check with Incident Command to confirm that the channels you intend to use will not conflict with the channel allocations made in the Incident Plan. The Comms Unit may need to reassign allocations during the incident so be prepared to adjust accordingly.

Zone and GeoTeam boundaries may become irrelevant during an actual emergency, so flexibility is needed on the part of all radio operators. Ask Incident Command to mediate channel allocations if there are conflicts.

The radio spectrum is a shared resource, and as long as you conform to the FCC rules, everyone has equal access to their bands. If there are already users on a channel that we would normally use, we should explain our purpose on the channel and politely ask the uninvolved parties to move to another one. We would go to a backup channel the other parties refuse to accommodate us, or if a higher authority asks us to move.

Please note that the Beaverton Amateur Radio frequency list in Appendix D is one that all CERT AROs should use for consistency. It contains the simplex channels mentioned above plus more frequencies and repeaters that can be used.

13.5. City of Beaverton Public-Safety Radios

There will be certain CERT operations where we can use radios owned by the city. These are (hefty) hand held VHF or UHF radios that come with speaker microphones and are checked out at the Emergency Management (EM) office. These have their own set of frequencies programmed into them and utilize the frequency band reserved for Public Safety. If these are going to be used, the particular channels designated for an operation will be identified in the action plan and at the deployment briefing.

13.6. Other Devices for communications

There are a number of other options for team communication. Beaverton CERT is not adopting these for official use, but if local teams decide to use them, they can do so as long as their usage is only for intra-team (i.e., within the team) communications.

Cellular push-to-talk apps – There are several of these on the market that can be loaded onto your smartphone. One of the more popular ones is Zello. These depend on a functional cellular network, and can cause your battery to drain faster than normal, as well as eat up your data plan if used extensively.

"Network radios" – these are devices that blend the concept of an FRS-like radio and a cellular device, in that they utilize the cellular network for communications. There are some of these devices that also include a VHF / UHF transmitter to access the amateur bands. When those functions are used, an amateur radio license is required. Some of these also integrate applications like Zello.

Multi-Use Radio Service (MURS) -- this is a new class of short-distance VHF communications. It uses 5 channels and a number of manufacturers are now producing small, portable hand-held radios that function similar to FRS walkie-talkies. MURS, like FRS does not require an individual license.

Citizens Band (CB) – This is a radio service that has been around for many years. It operates at the high end of the HF radio spectrum and has 40 pre-defined channels. At one time it was very crowded and noisy, as other services and equipment were not yet available. Additionally, by being in the HF bands, propagation was occasionally influenced by sunspot activity which caused additional interference. No license is required, and truck drivers still use CB as an effective means of obtaining information about road conditions, construction zones, accidents and police speed traps. The FCC restricts channel 9 to emergency communications and roadside assistance. Most highway travelers monitor channel 19.

Remember that these other devices can be useful, but only if the team agrees on their usage, and a sufficient number of team users possess the equipment. Additionally, a documented plan regarding channels that will be used for team communication should be made and distributed before actual deployment.

Also, please note that handheld Marine VHF radios and Aeronautical Radios are not to be used in any CERT operations, as it is against FCC regulations to use them for ground-to-ground communication.

13.7. Other radio resources that may be of use

NOAA Weather Radio –The local frequency for this station (KIG98) is 162.550 MHz. Most FRS radios can access this via a special channel designator, and ARO radios can tune it directly. It broadcasts regional weather information as well as notifications of weather warnings, alerts or dangers. It broadcasts from Goat Mountain in Clackamas County and has coverage all over the greater Portland Metropolitan area and beyond.

City of Beaverton AM emergency radio – This station (WQWS230) will be active during an actual emergency and will transmit messages to the general public and CERT volunteers on a loop. This will be on 1610 kHz AM. It has limited range, so it might not be received everywhere in our service area.

Emergency Alert System – The EAS is a national public warning system that can be activated by government agencies to broadcast important official information over most all public broadcast systems including radio and TV broadcasters, cable television systems, wireless cable systems, satellite digital audio radio service (SDARS) providers, and direct broadcast satellite (DBS) providers. The system also may be used by state and local authorities, in cooperation with the broadcast community, to deliver important emergency information, such as severe weather information, AMBER alerts, and local incident information targeted to specific areas. A special alert tone precedes these messages, and they preempt any regular programming.

In our local area, (which includes Clark County, WA) two FM broadcast stations are the primary links to the EAS, and other stations have devices that automatically listen to them for messages, and then rebroadcast them. These primary stations are KXL-FM (101.1 MHz) and KOPB-FM (91.5 MHz), and both have hardened transmission facilities in order to help insure that EAS messages are broadcast to our area in emergencies.

Wireless Emergency Alerts -- Wireless Emergency Alerts, or WEAs, are free messages sent directly to your cellphone. They warn about severe weather, AMBER alerts for children, and threats to safety. WEA messages are sent to cellphones only in the area affected by the emergency. WEAs are designed to get your attention and alert you with a unique sound and vibration. WEAs will show: event type (what); area affected (where); recommended action; expiration time (when); and sending agency (who). WEAs are sent to you by state and local Public Safety officials, the National Weather Service, the National Center for Missing and Exploited Children, and the federal government. If you receive a WEA, get more information from other sources, such as radio or TV. All major cellphone providers are participating in WEA, including AT&T, Verizon, and T-Mobile. Some prepaid phone providers, like Metropolitan Personal Communication Service, also participate in WEA.

13.8. Radio Checks, Signal Strength and Readability

Whenever turning on a radio or when there is doubt about its performance, it is appropriate to test that it is in good condition and capable of successful operation. The simplest check that can be done is what is known as a "radio check" which tests both the receiving and transmitting functions. This can also be a two-way check between stations to ensure that each station can hear the other. Radio checks should be carried out periodically during periods of low traffic to ensure that the radio is continuing to work well.

The person initiating a radio check should say:

"THIS IS" <Requesting Tactical ID or Callsign> "RADIO CHECK"

This message may be directed to any stations listening, or to a specific station, in which case the message above should be preceded by the Tactical ID or Callsign of the specific station.

The responder should answer:

<Requesting Tactical ID> "THIS IS" <Observing Tactical ID or Callsign> "YOUR SIGNAL IS" <Signal Strength Proword> "AND" <Readability Proword>.

An example of this response would be

"BLUE 5 THIS IS NET CONTROL. YOUR SIGNAL IS LOUD AND CLEAR"

The accepted prowords for a radio signal check are as defined below:

Signal Strength	**Meaning**
LOUD	Your signal is strong.
GOOD	Your signal is plainly audible.
WEAK	I can hear you, but with difficulty.
FADING	At times your signal fades so much that continuous reception is not dependable.
NOTHING HEARD	I cannot hear you at all.

Readability	**Meaning**
CLEAR	Excellent quality.
READABLE	Good quality; no difficulty in reading you.
DISTORTED	Having problems reading you due to distortion.
WITH INTERFERENCE	Having trouble reading you due to interference.
INTERMITTENT	Having trouble reading you because your signal is intermittent.
NOT READABLE	I can hear that you are transmitting but cannot read you at all.

Please note that these are subjective measures, so don't agonize over your choice if it is difficult to determine.

If you receive a response back to a radio check that indicates the receiving station is having trouble receiving you, or if you get not response, then you need to do some troubleshooting to improve your transmission characteristics.

AROs are used to using a numeric scale for this kind of reporting, but this should be avoided during CERT operations for clarity.

15. Scenarios

The intent behind the scenarios is to provide a framework to cover a general situation that may require multiple options for communication. Here are some definitions for different types of scenarios along with roles, methods, best practices and applicable keywords.

15.1. Everyday Communication (Scenario 0)

Communication to CERT members from the GeoTeam leaders or central CERT leadership is by email. The CERT leadership email, phone and text contacts are published to CERT members and can be used, in that order, at any time. Phone/text information for CERT members is not published and will not be used routinely to contact CERT members.

15.2. Scenario 1 – Planned Exercises, Drills, Training and Meetings

Volunteer teams and sub-teams will routinely schedule meetings for verbal information exchange including training. For field exercises, training, and drills, they will use FRS and Amateur Radios for remote communication as determined by their communication plan and EAPs (See table in appendix for channel assignments.) For CERT team-wide events, teams will use Public Safety Radios for ease and consistency of communication.

15.3. Scenario 2 – Planned events (City and Community Service)

Teams will primarily use Public Safety radios for communication, with FRS as local backups if needed.

15.4. Scenario 3 – Incident – An unplanned Event where the City requests volunteer assistance (e.g. Incident Crowd management, Walkaways)

Radio communication will use Public Safety Radios. CERT members will be notified of deployment information and instructions via automated texting to mobile phone. FRS and ARO radios may be used for communication within sub-teams if needed.

15.5. Scenario 4 –Disasters – where most/all of the City is impacted by a major regional incident

Communication methods will encompass all methods used in Scenarios 0, 2, and 3 as they are available. It is most likely that communications will be done through FRS and Amateur Radios and supplemented as needed by Public Safety Radios.

15.6. Scenario roles, needs and methods

The following tables illustrate communication needs, responsibilities and methods for each role and scenario:

Role	Needs and Responsibility
Members	Contact GeoTeam Leadership or nearby members with situation reports, needs and receive deployment instructions.
GeoTeam Leaders	Assemble teams, provide situation report to command, receive deployment instructions.
Senior Leadership	Provides direction and coordination.
Operation Bases	Establish and maintain communications link between the remote base and command.
Leadership	To members: provide general status and deployment information. To deployed teams: establish and maintain status, resource and assignment communication to/from command.

CERT Communications Scenarios				
Scenario	**From**	**To**	**Method Priority**	**Comment**
Everyday (Scenario 0)	Member	Member	1) Email	
		Senior Leaders	1) Email, then 2) Phone, then 3) Text	
	Senior Leaders	Members	1) Email 2) Phone 3) Text	
Training/Exercises (Scenario 1)	GeoTeams	GeoTeams	1) FRS 2) ARO UHF Simplex 3) ARO UHF Repeater	
	CERT-wide	ALL	1) Public Safety radios	
Planned Event (Scenario 2)	Operation Base	ALL	1) Public Safety radios 2) FRS (if needed)	
Incident (Scenario 3)	ALL	ALL	1) Public Safety radios 2) FRS (within sub-teams) 3) ARO UHF Simplex (within sub-teams)	
	Senior Leaders	ALL	1) Text	Deployment Information
Disasters (Scenario 4)	Members	GeoTeam	1) FRS 2) ARO UHF Simplex 3) ARO UHF Repeater	
	GeoTeam Leaders	Command	1) ARO UHF Repeater 2) ARO VHF Simplex 3) Public Safety radios	
	Senior Leaders	Members	1) Text 2) AM Radio	
	Operation Bases	Command	1) Digital VHF	

15.7. Keywords specific to Scenarios

Here are some keywords that you may see or hear in a communication regarding a scenario:

- Activate – An incident or event has occurred that requires a CERT response.
- Alert – A situation is developing which may require a CERT response
- Availability check – Information is needed on the number of CERTs who are available to respond later.
- Call in – Report availability by phone to the number provided.
- Report to – Respond to the location provided.
- Stand-by – Be ready to respond; but response is not required at this time.
- Stand down –Activation is over. Return to normal day.

15.8. Initiating communications in a scenario

Tune in to your local team assembly frequency/channel. Announce your location and listen for others. Use the assigned channels chart. If part of an actual activation, call in on the assembly channel and see what assembly point is being used. Go there if you can or stay put and await instructions.

15.9. Exercises versus event, incident, or disaster deployment

There will be little difference in the protocols you use when doing exercises versus an actual incident or disaster deployment, although fewer methods may be available in an actual emergency. Remember to use the proword "EXERCISE" at the beginning and end of any transmission during an exercise.

If a true emergency occurs during an exercise, transmit the prowords "BREAK BREAK" to get the needed attention and then use the proword "NO PLAY" at the beginning and end of a message to indicate that there is a situation that is not part of the exercise and needs immediate attention.

15.10. Boundaries for communication

Please note that in all scenarios, all communications are to take place within the boundaries of the Beaverton CERT service area. Any messages that need to go to other agencies or outside these boundaries should be elevated to the EOC for handling.

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16. Measurements that you will run into regarding Radio

You are not expected to know the application of all of these terms to do communication work during a CERT operation, but it is good to be roughly familiar with them. More detailed understanding can be gained by studying for an Amateur Radio License.

Term	Symbol	Definition – what it is a measure of
Basic measures		
Hertz	Hz	Frequency (i.e. how often something repeats)
Meter (metre)	m	Length (a little over a yard)
Watt	W	Power or energy transfer
Ampere (Amp)	A	Electric current
Volt	V	Voltage (electrical potential)
Ohm	Ω	Resistance
Measure Prefixes		**These prefixes are often applied to a basic measure to provide a scaling factor, and to eliminate the need for writing a lot of zeros**
Kilo	k	1,000, i.e. one thousand,
Mega	M	1,000,000. i.e. one million
Giga	G	1,000,000,000, i.e. one billion
Centi	c	1/100, i.e. one hundredth
Milli	m	1/1,000, i.e. one thousandth
Combined measures		**These terms combine some of the measures and prefixes used above and tend to be used in specific circumstances**
Milliampere hour	mAh	A 1000th of an ampere hour (Ah). This measure is commonly used to describe the energy charge that a battery will hold and how long a device will run before the battery needs recharging.
Watt hour	Wh	A Watt Hour is another unit of measurement for power over a period of an hour, and can be used to specify battery capacity. One Watt-hour is equal to one Watt of average power flow over an hour. As an example, a 100-Watt light bulb powered by a 400 Watt-hour battery would theoretically remain lit for 4 hours.
Megahertz	MHz	1,000,000 Hz
Kilohertz	kHz	1,000 Hz

17. Glossary

Here are some terms that you will hear often when talking about CERT Radio Communications.

Amateur Radio – Also known informally as Ham Radio, this is a licensed radio service that allows users to transmit and receive on a variety of bands across the radio spectrum. Users must pass exams to show their knowledge of radio and electronics theory as well as good operational practices and FCC regulations. Ham Radio operators can use a variety of equipment to communicate locally as well as around the world. An Amateur Radio license costs nothing (at this time), although there is a fee of $15 to take one of the exams. There are 3 tiers of license (Technician, General, and Amateur Extra) that have progressively greater frequency access privileges in the amateur bands. The FCC assigns a unique callsign to each operator.

ARES – The Amateur Radio Emergency Service® consists of licensed AROs who have voluntarily registered their qualifications and equipment with their local ARES leadership for communications duty when disaster strikes.

ARO – An Amateur Radio Operator is an individual who carries an FCC Amateur Radio license and has the training and capability to operate a radio in the Amateur Service bands to facilitate communication.

Attenuation – This refers to the ways for a radio signal to lose strength. The primary contributor to attenuation is distance. The farther two stations are apart, the weaker the signals are. Higher transmit power can make up for this effect. It also refers to a signal being obscured by radio noise or signal power being partially absorbed by one or more obstacles between the transmitter and the receiver. Often there are combined causes for attenuation in real world situations. Some common sources of obstacle attenuation are: 1) Heavy foliage, 2) Rain and atmospheric moisture, 3) Flesh, and 4) Large metal objects that are close to the radio. In the case of heavy foliage or metal objects, try to get some distance from them to avoid their effects, and in the third case, don't place the antenna right next to your body. There is not much you can do about the rain.

Band – This refers to a defined range of frequencies that is designated for a particular type of radio use.

Band Plan – This refers to an agreed division of a range of radio frequencies and to assign a particular type of usage to each range. This is important to AROs.

Channel – This is the designation for a particular frequency. It is often easier to refer to a channel by name than a specific frequency.

CTCSS or PL or TONE – These terms refer to a method for controlling reception of signals by transmitting a particular tone before and / or during the main transmission in order to "open" the receiving radio. Most radios have a method for setting this tone to be associated with a particular channel or frequency. This has the benefit of not receiving unintended signals. This is generally used with Repeaters.

Dead Zone – This refers to an area that has either very poor or non-existent reception and therefore similar transmission difficulty. This may be due to terrain, shielding from local buildings or objects, etc. The way to resolve a dead zone is to either use higher power or to move to a better location. The latter is preferred, but if you have been assigned to a particular location, you should contact your net control if you need to move. This is sometimes also known as a "Hole".

Digital – This refers to transmitting voice and data by converting to/from digital signals. It often requires computer equipment to implement but better data integrity can be achieved with a less powerful signal.

EAP – An Emergency Action Plan is a written document to facilitate and organize organizational actions during an emergency or other activity under the Beaverton Emergency Management organization. It defines the parameters of an operation including its mission, deployment and demobilization guidelines, command structure, environmental parameters, risks, communications strategies, logistics and other items.

EOC – An Emergency Operations Center is a central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management, or disaster management functions at a strategic level during an emergency, and ensuring the continuity of operations for an effected organization or locale. An EOC is responsible for strategic direction and operational decisions and does not normally directly control field assets, instead leaving tactical decisions to lower commands. The common functions of EOCs are to collect, gather and analyze data; make decisions that protect life and property, maintain continuity of the organization, within the scope of applicable laws; and disseminate those decisions to all concerned agencies and individuals.

FEMA –The Federal Emergency Management Agency is a federal agency whose primary purpose is to coordinate the response to a disaster that has occurred in the United States and that overwhelms the resources of local and state authorities. While on-the-ground support of disaster recovery efforts is a major part of FEMA's charter, the agency provides state and local governments with experts in specialized fields and funding for rebuilding efforts. In addition to this, FEMA provides funds for training of response personnel throughout the United States and its territories as part of the agency's preparedness effort.

Frequency – This indicates the oscillation rate of an alternating electromagnetic field. This is used to tune a radio for receiving or transmitting.

FRS – The Family Radio Service is an unlicensed radio service that shares a subset of the GMRS channels, although with a lower allowed power, and less bandwidth. No license is required to operate, and no callsign is issued to a user.

Gain -- This refers to the degree of amplification (strengthening) of a signal. It may be adjustable with a knob on your radio, and also may be improved by using a better antenna.

GMRS – The General Mobile Radio Service is a licensed radio service that co-exists with the FRS service and uses some of the same channels, although with higher allowed power and wider bandwidth. It requires a license that costs $70. The License is good for 10 years and covers the licensee’s entire family. The FCC assigns a unique call sign to each licensee.

HT — This is an abbreviation for “Handheld Transceiver” which is an abbreviation for a hand-held radio.

ICP – The Incident Command Post is a temporary facility for tactical-level, on-scene incident command and management. It typically comprises the Incident Commander and immediate staff and may include other designated incident management officials and responders from Federal, State, local, and tribal agencies, as well as private-sector, nongovernmental, and volunteer organizations. Typically, the ICP is located at or in the immediate vicinity of the incident site and is the focus for the conduct of direct, on-scene control of tactical operations. Incident planning is also conducted at the ICP; and a communications center also would normally be established at this location.

ICS – The Incident Command System is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure. ICS is normally structured to facilitate activities in five major functional areas: command, operations, planning, logistics, Intelligence & Investigations, finance and administration. It is a fundamental form of management, with the purpose of enabling incident managers to identify the key concerns associated with the incident—often under urgent conditions—without sacrificing attention to any component of the command system.

Line-of-sight – This refers to the way in which radio waves travel in a direct path from the source to the receiver with no obstructions. Having a clear path from Point A to Point B will yield the best transmission, as there are no obstacles to reflect, deflect, or absorb the radio waves. Note: Specifications for FRS radios often show range estimates based on a clear, line-of-sight path between the sender and receiver. Some of the more honest ones will show decreased range as the line-of-sight path becomes more cluttered with trees, buildings, etc.

Memory – This refers to the capability of many radios to "remember" commonly used frequencies. Usually, these are programmable using a computer and a cable connecting the radio to the computer, but many amateur radios are also programmable through their keypad without a computer.

Morse Code – This is one of the oldest forms of radio communication, originally adapted from the earliest telegraph industries. It is still used both commercially and by some AROs. It has the simplest form of modulation, consisting of turning the transmitter on an off in a pattern of long and short durations. This is generally heard on the radio as a series of long and short tones that make up the message. It has the advantage of being able to get through the most noisy and difficult propagation conditions. It is almost never used in CERT communications, but can occasionally be heard as the station identification of a repeater station.

Multipath -- This is a kind of interference that refers to a radio signal taking more than one path from transmitter to receiver. This is often caused by a signal bouncing of off one or more radio-reflective objects such as a metal building. As a result, the receiver will get multiple signals, slightly out of phase with each other. The symptoms can include distortion or fading of the signal, and a rapid fluttering (called picket-fencing) particularly if the transmitter is mobile and moving (as in a car).

Open mic – This refers to the condition where a radio that was used for transmission does not return to receive mode when the user is done transmitting. This can be due to a stuck PTT button, or something pressing on the PTT button unintentionally. It is the radio equivalent of "butt dialing" but is worse as it ties up the channel with noise. It should be avoided at all costs.

Over modulation – This refers to another kind of distortion that can occur to a transmitted signal. For our purposes, it is caused by speaking too loudly into the microphone Overmodulation impacts the readability of the signal at the receiving station.

Part 95 – This refers to a part of the FCC regulations (47 CFR Part 95) that define the rules and regulations for the Personal Radio Service. This includes specific radio services such as the Family Radio Service (FRS), Citizens Band Radio Service (CB), General Mobile Radio Service (GMRS), and the Multi-Use Radio Service (MURS), among others.

Part 97 – This refers to a part of the FCC regulations that defines the rules and regulations for the Amateur Radio Service.

Phonetics – This is sometimes an abbreviation for the Phonetic Alphabet (see Appendix A.)

Propagation – as applied to radio, propagation is the way radio waves travel when they are transmitted from one point to another and affected by the medium in which they travel (in particular the way they propagate around the Earth in various parts of the atmosphere.) Signals transmitted at lower frequencies can follow the curve of the earth which is why you can hear distant AM stations at night. VHF and UHF signals tend to travel in much straighter lines and can't reach very far over the horizon.

Prowords – is a contraction of "Procedure Word". These are particular words that are used to facilitate communication by conveying information in a condensed standard form. They often are used to help manage the clear communication of the content of messages and manage the flow of communications to and from various stations. A listing of Prowords is given in Appendix B. They should be used where needed, but sparingly.

PTT – This is an abbreviation for "Push to Talk" or "Push to Transmit" and refers both to the button you push either on your radio or the microphone to transmit, as well as this mode of transmitting voice.

Relay – this is the practice where a station passes on a message to a destination that a sender could not reach on their own.

Rubber Duck – this is another radio slang term for a flexible antenna used with a hand-held radio.

Squelch – this refers to a control on most all radios that suppresses the sound of weak signals or unwanted white noise on the frequency when the radio is not receiving a transmission. This is adjustable and can be set to block out weak or non-local transmissions as well. It is sometimes identified by the abbreviation SQL

SWR – this is an abbreviation for Standing Wave Ratio. It is a measure of antenna efficiency at a particular frequency. It is usually expressed as a ratio such as 1.2:1. 1:1 is a perfect measure, but any value below 1.5:1 is considered acceptable. SWR can be theoretically calculated, but is generally measured by a device called an antenna analyzer, as real-world conditions usually influence SWR.

Talkaround – This refers to using the repeater output frequency as a simplex channel. This can be useful, but users should be prepared to be overridden if the repeater is being used.

UHF – this stands for Ultra High Frequency. This band covers frequencies from 300 to 3000 MHz with corresponding wavelengths from 1 meter to 10 centimeters. Similarly, some of the radios we use can transmit and receive in this band.

VHF – this stands for Very High Frequency. This is the name of a band in the radio spectrum that covers frequencies from 30 to 300 MHz with corresponding wavelengths from 10 to 1 meter. Some of the radios we use can transmit and receive in this band.

VOX – this stands for Voice Operated Xmission (i.e. Transmission). This is a capability that automatically puts the radio into transmit mode when the operator starts speaking. It is NOT RECOMMENDED for CERT usage, as it can accidentally turn on with sufficient background noise and may cut off the beginning of a transmission or turn on transmission during a conversation intended to be private with someone standing nearby.

18. Field Operations Guide

You may choose to make copies of these appendix pages to carry in your field kit for reference purposes.

18.1. Appendix A – Phonetic Alphabet

The Phonetic Alphabet is used to spell out words and numbers over voice channels on radio, when needed. Spaces in the pronunciation column indicate a syllable-like break in pronunciation.

Symbol	Code Word	Pronunciation
A	Alpha	AL FAH
B	Bravo	BRAH VOH
C	Charlie	CHAR LEE
D	Delta	DELL TAH
E	Echo	ECK OH
F	Foxtrot	FOKS TROT
G	Golf	GOLF
H	Hotel	HOH TELL
I	India	IN DEE AH
J	Juliet	JEW LEE ET
K	Kilo	KEY LOH
L	Lima	LEE MAH
M	Mike	MIKE
N	November	NO VEM BER
O	Oscar	OSS CAH
P	Papa	PAH PAH
Q	Quebec	KEH BECK
R	Romeo	ROW ME OH

Symbol	Code Word	Pronunciation
S	Sierra	SEE AIRRAH
T	Tango	TANG OH
U	Uniform	YOU NEE FORM
V	Victor	VIK TAH
W	Whiskey	WISS KEY
X	X-ray	ECKS RAY
Y	Yankee	YANG KEY
Z	Zulu	ZOO LOO
0	Zero	CE ROW
1	One	WON
2	Two	TOO
3	Three	TREE
4	Four	FO WER
5	Five	FIFE
6	Six	SIX
7	Seven	SEV EN
8	Eight	AIT
9	Nine	NINER

Often prowords will be used to indicate the use of these for spelling such as I SPELL, FIGURES, or LETTERS. Here are some examples of using the Phonetic Alphabet during a voice transmission:

> Western – I SPELL Whiskey Echo Sierra Tango Echo Romeo November
> N1EYZ – I SPELL November One Echo Yankee Zulu
> Part number is CZ7.4 – I SPELL Charlie, Zulu, NUMBER Seven, SYMBOL Period NUMBER Four."
> 706 – I SPELL FIGURES Seven, Zero, Six.

Punctuation or symbols – Do not use punctuation unless necessary for message clarity. Punctuation can be repetitive, consume valuable time, and increase the chance for errors. When using punctuation, speak it as stated below. Preface with the proword "SYMBOL".

Symbol		Pronunciation
Colon	:	COLON
Comma	,	COMMA
Decimal point	.	DAY-SEE-MAL
Hyphen	-	HYPHEN
Oblique stroke	/	SLANT or SLASH
Open Parenthesis	(	BRACKETS ON

Symbol		Pronunciation
Close Parenthesis	)	BRACKETS OFF
Period	.	PERIOD or FULL STOP or DOT
Question mark	?	QUESTION MARK
Semicolon	;	SEMI-COLON
At Sign	@	AT SIGN
Pound Sign	#	POUND SIGN

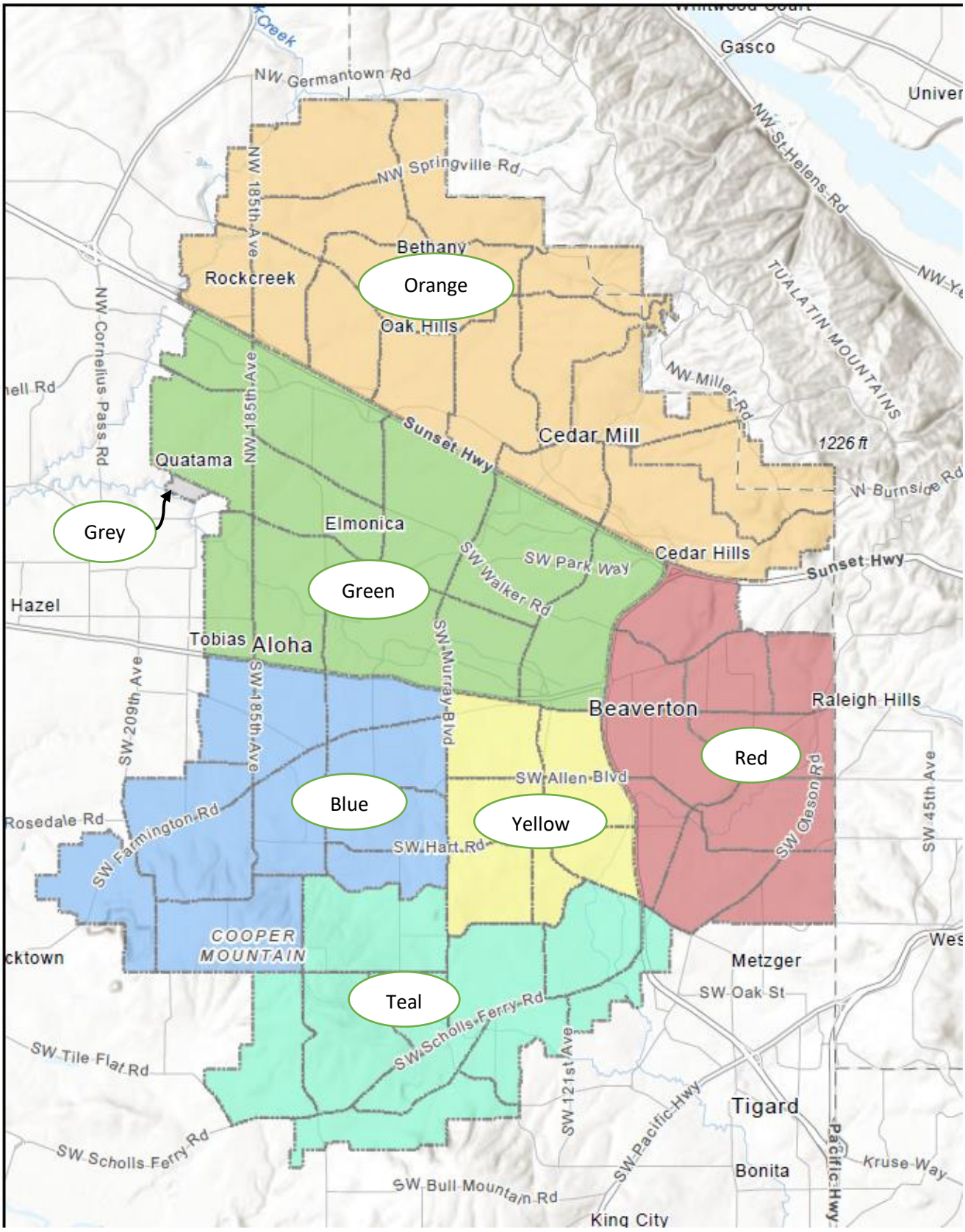
18.2. Appendix B – Prowords

Prowords are special procedural words or phrases used to promote efficiency in radio communications. Common ones for use in CERT communications are shown below:

Proword	When to use
ACKNOWLEDGED	The message is completely received and understood, and that you'll comply. It does NOT mean YES or NO.
AFFIRM	Use instead of YES or CORRECT. An alternate to "Affirmative" which sounds too much like "Negative"
ALL AFTER …	Everything that you (I) transmitted after …
ALL BEFORE …	Everything that you (I) transmitted before …
BREAK – BREAK	All stations will immediately cease transmission. The station breaking in has an urgent message. This should be used during practices if a real-world situation arises that requires immediate attention.
CLEAR	You are done with this communication - the channel is free for use by someone else.
CORRECTION	Means you are sending corrected information. ("Turn right at the corner. CORRECTION turn left at the corner")
CTCSS or PL or TONE	This is used to specify the sub-audible tone needed for access to a repeater or to another radio that is using an access tone. The receiving radio must receive a special tone or else it squelches the transmission. For FRS radios, the channel and "tone" must match on both FRS radios or else you won't hear each other!
DECIMAL	When you need to speak for the decimal point in a series of numbers. Not used for the period in punctuation.
DISREGARD	This transmission is an error; disregard it.
EMERGENCY	An EMERGENCY situation is imminent life or death/or imminent damage to property. Say during a pause to ask others to stand by.
EXERCISE	Use this at the beginning and end of all messages during an exercise.
GO AHEAD	Net Control tells someone it is their turn to talk.
FIGURES	Numerals or numbers, or a mixed group beginning with a numeral, follows.
I COPIED	I am repeating what I heard.
I SAY AGAIN	I am repeating what I have said.
I SPELL	Indicates you are using the phonetic alphabet to spell a difficult word or individual letters.
LISTENING	As in; "This is <tactical ID> LISTENING". This indicates that the station is listening on the particular channel or frequency
LETTERS	Letters follow using the phonetic alphabet
NEGATIVE	Use instead of NO or INCORRECT or WRONG
NO PLAY	Indicates that the content of the message refers to an urgent, actual real-world situation and is not part of an exercise.
OUT	You have finished your transmission and do not expect a response
OVER	You are done talking and expect a response.
RADIO CHECK	You are asking for anyone to confirm that your radio is working. "Loud and clear" means your signal is satisfactory.
SAY AGAIN	Use instead of "Repeat" as a question to ask a sender to repeat their last transmission.

Proword	When to use
SAY AGAIN…	Used with “ALL AFTER,” “ALL BEFORE,” or “BETWEEN” to ask a sender to repeat the designated portion of their last transmission
SILENCE – SILENCE –SILENCE!	Cease all transmission immediately and maintain until lifted. Used only by Net Control.
SILENCE LIFTED	Silence is lifted. Net is free for traffic. Used only by Net Control.
SITREP	Short for Situation Report
SPEAK SLOWER / FASTER	Adjust the speed of your transmission.
STAND BY	Not ready; tells other party to wait
SYMBOL	Phonetic Alphabet designation for one or more symbols follows
THIS IS	This transmission is from the station whose designator immediately follows. For clarity, the station called should be named before the station calling.
UNKNOWN STATION	The identity of the station calling or with whom I am attempting to establish communication is unknown.
URGENT	An Urgent situation is not an EMERGENCY but is time critical or denotes a correction needed. Say during a pause.
WAIT (or WAIT – WAIT)	I must pause for a few seconds (or longer).
WORD AFTER …	The word of the message to which I refer is the following …
WORD BEFORE …	The word of the message to which I refer was the preceding ...
WORDS TWICE	Communication is difficult, so transmit (“ting”) each phrase twice (Used as an order, request, or information.)

18.3. Appendix C -- Beaverton Cert GeoTeam boundaries



18.4. Appendix D – CERT Team Channels and Frequencies

These are the channels and frequencies to be used by CERT teams.

FRS Channel assignments for GeoTeams				
GeoTeam	**Primary Channel**	**Frequency (MHz)**	**Secondary Channel**	**Frequency (MHz)**
Orange	1	462.5625	5	462.6625
Green	2	462.5875	6	462.6875
Blue	3	462.6125	4	462.6375
Red	4	462.6375	3	462.6125
Yellow	5	462.6625	1	462.5625
Teal	6	462.6875	2	462.5875
Grey	7 (or 2)	462.7125 (CH 7)	7 (or 6)	462.7125 (CH 7)

Amateur Radio UHF Simplex Frequency assignments for GeoTeams				
GeoTeam	**Primary Channel Tag**	**Frequency (MHz)**	**Secondary Channel Tag**	**Frequency (MHz)**
Orange	ORANG1	431.1250	ORANG2	431.0500
Green	GREEN1	431.2750	GREEN2	431.2250
Blue	BLUE1	431.0250	BLUE2	432.1250
Red	RED1	432.1500	RED2	432.1750
Yellow	YELLO1	431.1750	YELLO2	432.2250
Teal	TEAL1	431.0750	TEAL2	445.5000
Grey	GREY1	431.2750	GREY2	431.2250

Note that the Amateur Radio UHF simplex channels for CERT GeoTeams are in the lower part of the 70 cm band, whereas the Beaverton CERT repeater is in the upper part of the band; the ranges are separated by a little more than 9 – 10 MHz. It is very difficult for a single rubber duck antenna to span that entire range without losses due to rising SWR.

Operators who live in locations with marginal simplex coverage (heavy vegetation, terrain issues) should consider having two different antennas for their radio optimized for different parts of the 70 cm band. The bandwidth and resonant frequency of any HT antenna can be checked with an antenna analyzer.

18.5. Appendix E — Beaverton Amateur Radio Frequencies

The Beaverton Communications group has standardized on the following set of frequencies for use by CERT AROs. It is recommended that all AROs associated with CERT program these frequencies into their radios, preferably at the beginning of their memory channel list. If your radio supports 16 channel zones, we suggest you put the repeaters and calling channels in one zone, and the CERT simplex channels in a second zone.

Channel	Alias	RX Frequency	Offset Direction	Offset (MHz)	Tone	TX Tone	RX Tone	Description
1	BCRTRP	444.7500	+	5	CTCSS	123.0	None	BCERT Repeater (Maverick)
2	BCRTTA	444.7500	None	None	None	None	None	BCERT Repeater Talk Around
3	BCRTS1	147.4800	None	None	None	None	None	Beaverton CERT Primary Simplex
4	BCRTS2	147.5600	None	None	None	None	None	Beaverton CERT Secondary Simplex
5	ORANG1	431.1250	None	None	None	None	None	Beaverton CERT GeoTeam Orange Primary
6	ORANG2	431.0500	None	None	None	None	None	Beaverton CERT GeoTeam Orange Secondary
7	GREEN1	431.2750	None	None	None	None	None	Beaverton CERT GeoTeam Green Primary
8	GREEN2	431.2250	None	None	None	None	None	Beaverton CERT GeoTeam Green Secondary
9	BLUE1	431.0250	None	None	None	None	None	Beaverton CERT GeoTeam Blue Primary
10	BLUE2	432.1250	None	None	None	None	None	Beaverton CERT GeoTeam Blue
11	RED1	432.1500	None	None	None	None	None	Beaverton CERT GeoTeam Red Primary
12	RED2	432.1750	None	None	None	None	None	Beaverton CERT GeoTeam Red Secondary
13	YELLO1	431.1750	None	None	None	None	None	Beaverton CERT GeoTeam Yellow Primary
14	YELLO2	432.2250	None	None	None	None	None	Beaverton CERT GeoTeam Yellow Secondary
15	TEAL1	431.0750	None	None	None	None	None	Beaverton CERT GeoTeam Teal Primary
16	TEAL2	445.5000	None	None	None	None	None	Beaverton CERT GeoTeam Teal Secondary
17	GREY1	431.2750	None	None	None	None	None	Beaverton CERT GeoTeam Grey Primary
18	GREY2	431.2250	None	None	None	None	None	Beaverton CERT GeoTeam Grey Secondary
19	NVCALL	146.5200	None	None	None	None	None	National VHF Calling Frequency

Channel	Alias	RX Frequency	Offset Direction	Offset (MHz)	Tone	TX Tone	RX Tone	Description
20	NUCALL	446.0000	None	None	None	None	None	National UHF Calling Frequency
21	WORC2m	145.4700	-	0.6	CTCSS	107.2	None	Western Oregon Radio Club (WORC) Sherwood Repeater 2m
22	WORC70	443.4250	+	5	CTCSS	107.2	None	Western Oregon Radio Club Sherwood Repeater 70 cm
23	WC1	147.3600	+	0.6	CTCSS	107.2	None	WCARES Primary Repeater
24	WC2	146.9000	-	0.6	CTCSS	127.3	None	WCARES Secondary Repeater
25	TGRDRP	440.1750	+	5	CTCSS	110.9	None	Tigard CERT Repeater
26	TGRDTA	440.1750	None	None	None	None	None	Tigard CERT Repeater Talk Around

The Grey GeoTeam will share the Green GeoTeam frequencies.

Channels 1 through 18 are the primary ones that Beaverton CERTs are expected to use. Please note that this encompasses both VHF and UHF frequencies, and also includes Frequencies used by the Washington County ARES (Amateur Radio Emergency Service) group, local ham radio repeaters, and the Tigard CERT team. All frequencies are simplex except for the repeaters.

For a more complete list of assigned Amateur Radio Frequencies in the area, please see one of the templates at

https://washcoares.org/?page_id=168:

18.6. Appendix F – CERT Communication Roles and Methods

The following table illustrates the communication needs and responsibilities for each role:

Role	Needs and Responsibility
Members	Contact GeoTeam Leadership or nearby members with situation reports, needs and receive deployment instructions.
GeoTeam Leaders	Assemble teams, provide situation report to command, receive deployment instructions.
Senior Leadership	Provides direction and coordination.
Operation Bases	Establish and maintain communications link between the remote base and command.
Leadership	To members: provide general status and deployment information. To deployed teams: establish and maintain status, resource and assignment communication to/from command.

This can be illustrated by the following table:

CERT Communications Scenarios				
Scenario	**From**	**To**	**Method Priority**	**Comment**
Everyday (Scenario 0)	Member	Member	2) Email	
		Senior Leaders	4) Email, then 5) Phone, then 6) Text	
	Senior Leaders	Members	4) Email 5) Phone 6) Text	
Training/Exercises (Scenario 1)	GeoTeams	GeoTeams	4) FRS 5) ARO UHF Simplex 6) ARO UHF Repeater	
	CERT-wide	ALL	2) Public Safety radios	
Planned Event (Scenario 2)	Operation Base	ALL	3) Public Safety radios 4) FRS (if needed)	
Incident (Scenario 3)	ALL	ALL	4) Public Safety radios 5) FRS (within sub-teams) 6) ARO UHF Simplex (within sub-teams)	
	Senior Leaders	ALL	2) Text	Deployment Information
Disasters (Scenario 4)	Members	GeoTeam	4) FRS 5) ARO UHF Simplex 6) ARO UHF Repeater	
	GeoTeam Leaders	Command	4) ARO UHF Repeater 5) ARO VHF Simplex 6) Public Safety radios	
	Senior Leaders	Members	3) Text 4) AM Radio	
	Operation Bases	Command	2) Digital VHF	

Here are some keywords that you may see or hear in a communication regarding a scenario:

- Activate – An incident or event has occurred that requires a CERT response.
- Alert – A situation is developing which may require a CERT response
- Availability check – Information is needed on the number of CERTs who are available to respond later.
- Call in – Report availability by phone to the number provided.
- Report to – Respond to the location provided.
- Stand-by – Be ready to respond; but response is not required at this time.
- Stand down –Activation is over. Return to normal day.

18.7. Appendix G — FRS and GMRS Frequencies

The channel assignments and their restrictions are listed here for FRS and GMRS. FRS is restricted to a 12.5 kHz bandwidth on all channels, and GMRS is restricted to 20 kHz except on channels 8 through 14

Channel	Frequency (MHz)	FRS Power	GMRS Power	Notes/Usage
01	462.5625	2 W	5 W	Shared Simplex
02	462.5875	2 W	5 W	Shared Simplex
03	462.6125	2 W	5 W	Shared Simplex
04	462.6375	2 W	5 W	Shared Simplex
05	462.6625	2 W	5 W	Shared Simplex
06	462.6875	2 W	5 W	Shared Simplex
07	462.7125	2 W	5 W	Shared Simplex
08	467.5625	0.5 W	0.5 W	Shared Simplex
09	467.5875	0.5 W	0.5 W	Shared Simplex
10	467.6125	0.5 W	0.5 W	Shared Simplex
11	467.6375	0.5 W	0.5 W	Shared Simplex
12	467.6625	0.5 W	0.5 W	Shared Simplex
13	467.6875	0.5 W	0.5 W	Shared Simplex
14	467.7125	0.5 W	0.5 W	Shared Simplex
15	462.5500	2 W	50 W	Shared Simplex as well as GMRS repeater output
16	462.5750	2 W	50 W	Shared Simplex as well as GMRS repeater output
17	462.6000	2 W	50 W	Shared Simplex as well as GMRS repeater output
18	462.6250	2 W	50 W	Shared Simplex as well as GMRS repeater output
19	462.6500	2 W	50 W	Shared Simplex as well as GMRS repeater output
20	462.6750	2 W	50 W	Shared Simplex as well as GMRS repeater output
21	462.7000	2 W	50 W	Shared Simplex as well as GMRS repeater output
22	462.7250	2 W	50 W	Shared Simplex as well as GMRS repeater output
	467.5500		50 W	GMRS Repeater Input
	467.5750		50 W	GMRS Repeater Input
	467.6000		50 W	GMRS Repeater Input
	467.6250		50 W	GMRS Repeater Input
	467.6500		50 W	GMRS Repeater Input
	467.6750		50 W	GMRS Repeater Input
	467.7000		50 W	GMRS Repeater Input
	467.7250		50 W	GMRS Repeater Input

18.8. Appendix H — ICS 213 General Message Form

<table>
<tr><td colspan="4">GENERAL MESSAGE (ICS-213)</td></tr>
<tr><td colspan="4">1. Incident Number / Name (Optional): <Assigned by Incident Command></td></tr>
<tr><td colspan="4">2. To (Position, Location):</td></tr>
<tr><td colspan="4">3. From (Position, Location):</td></tr>
<tr><td colspan="2">4. Subject:</td><td>5. Date:</td><td>6. Time</td></tr>
<tr><td colspan="4">7. Message:</td></tr>
<tr><td colspan="4">8. Approved by:</td></tr>
<tr><td>Name:</td><td colspan="2">Signature:</td><td>Position:</td></tr>
<tr><td colspan="2">9. Reply:</td><td colspan="2">Date/Time:</td></tr>
<tr><td colspan="4">10. Replied by:</td></tr>
<tr><td>Name:</td><td colspan="2">Signature:</td><td>Position:</td></tr>
</table>

18.9. Appendix I — ICS 213 Communications Log Form

COMMUNICATIONS LOG (ICS 309)	
Incident # and Name	**Time Started**: **Date Started:**
For Operational Period #	**Task Name:**
Operator Name: **Callsign:**	**Tactical ID**: **Radio / Band:**

MESSAGE LOG			
Time	**From**	**To**	**Subject**
Page ___ of _____			