Grassroots Emergency Communications Operations

Sticky Notes

GECO Newsletter
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Ready to Serve and Sustain Our Community

The Value-Added Amateur Radio EmComm Operator

Getting an amateur radio license opens the door to a wider world. In the earlier days of amateur radio, it gave people a window to the world. They could venture to foreign lands while in the comfort of familiar surroundings. Technology has since put all of that at the fingertips of so many, and without the need of studying to get a license. In fact, for those willing to get licensed, especially in the US, the journey is one of relative ease. In some places, the requirements are not only strenuous, but the opportunity of sitting for an exam is also infrequent and involves more bureaucratic hurdles.

Amateur radio has a long history of emergency communications (EmComm) and public service. It continues today, although many seem to think it's been eclipsed by more advanced digital technology. However, no one system or method of communications technology is bulletproof. They all have advantages and disadvantages, capabilities, and limitations. In the US, it's a question of free choice.

Immediately upon getting licensed, some folks may get involved with a local amateur radio club. Mark N7YLA encouraged everyone in his study groups to join the American Radio Relay League (ARRL). Their catchphrase is aptly shown in the graphic on the right. However, after studying numerous disasters, we found the common showstopper for many EmComm operations was some kind of "unexpected event." These ranged from minor details to major complex issues. Combined with our experiences in rural northern Thailand, our corollary to the ARRL catchphrase (with all due respect) quickly became this graphic (see illustration on the right). This became our humorous reminder to keep things simple, be flexible, and recognize preparedness is not perfection but an ongoing iterative learning effort. But we digress.

…and when amateur radio fails to work

"Pull tighter on the string!"

For many new amateurs who are interested in EmComm getting Red Cross training in first aid, CPR, and AED is a good step to enhancing their capabilities as EmComm operators to deal with "unexpected" medical emergencies. Some may already have some or all of these. We call these enhancements to the basic amateur radio license. They add value to the EmComm capabilities of an amateur operator. Those newbies who are in close touch with more experienced amateurs might be drawn to either ARES or RACES. Both groups require an amateur radio

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license and give newbies ample opportunities to use and learn new communications and technical skills. Contacts in these groups, or independent action, can lead to other local opportunities such as CERT or the MRC. FEMA is another resource for learning more about EmComm and emergency training opportunities. Others just volunteer with their local police, sheriff, fire, public health, and various other community groups. A lot depends on the existing personal contacts and networking of the newly licensed individual. In this respect, America is a land of opportunity with many choices readily available for amateurs interested in EmComm and public service radio activities.

GECO grew out of the EmComm activities of the Rural Training Center-Thailand (RTC-TH). The experiences of being in a rural border Thai province shaped our perspective and mindset for amateur radio EmComm work. The Thai government bureaucracy for amateur radio is couched in concerns for national security due to a history of amateur radio used by insurgent groups within the Kingdom. This resulted in requiring radio amateurs to have an operator's license, an equipment license for each transceiver, and a station license for each location where amateur radio transceivers would be used. Regulations (some old and outdated) limited the type-approved equipment for import and use in the Kingdom. Although the list was long, only two transceivers listed were currently available in amateur retail stores globally! Also, outside the major cities, amateur radio resources were few and far between.

One year, in the span of a month, three helicopters crashed in the remote mountains of the province. They were all related; the initial crash resulted in a rescue mission that crashed, prompting another rescue flight. The unknown and changeable mountain weather was a contributing factor in all three crashes. There were only three government weather stations in the province (which was about the size of Mississippi). This caused the RTC-TH EmComm team to take the weather observation lessons it developed for the village elementary school and sustainable agriculture training to create the mobile emergency weather station (MEWS). The idea was to tap into the pool of licensed amateurs who are widely scattered to be able to make and report weather observations tailored to helicopter flight safety. This was the first conscious effort to add value to amateur radio operators. Helicopters are often the first outside help to arrive in remote areas. MEWS could be very useful for radio amateurs to have more impact, especially when reporting from disaster areas with no weather station or a weather station is destroyed.

Johnny 9M8DB, Seppo OH1VR, Choy 9W2PCK.

Mark NWØF (a SKYWARN volunteer) read a MEWS announcement, read the materials, and emailed a suggestion to present it to the MyGAREC 2012 meeting in Kuala Lumpur. We sent a proposal to present MEWS to the Kuala Lumpur hosts and organizers. Choy 9W2PCK and Johnny 9M8DB enthusiastically agreed and

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facilitated our attendance. We presented MEWS and were able to hold a training workshop. It was the first time a geographer and educator attended a GAREC conference. The organizers and participants said it was a positive, stimulating, and interesting experience.

The original MEWS prototype was developed and deployed on "Sparky, the Batt-mobile" (the RTC-TH EmComm all-electric vehicle). Taking to heart the lessons of "unexpected events" derailing EmComm efforts, we developed a lightweight backpack MEWS kit called a PWIS (Portable Weather Instrument Shelter).

We took PWIS to the MyGAREC meeting. Delegates were amused and intrigued by how a compact weather observing system could provide so much useful data. The PWIS consisted of an umbrella (temperature readings should be done in the shade), a tether with a step-tab (thermometer should be 1.5 m above the ground), a thermometer, a compass, and all necessary reference tables. The photos below (left to right) show 1) the PWIS kit displayed during the MEWS presentation, and 2 &3) GREG KI6GIG demonstrating and explaining PWIS during the workshop.

People were humored and intrigued by the compact portable MEWS unit

The amazingly compact PWIS (folded, left) and deployed (right).

PWIS was predicated on the no-cost/low-cost, no-tech/low-tech philosophy. It used readily available, off-the-shelf items commonly found around the home and farm. The idea was to make it easier to replicate for radio amateurs in remote or impoverished communities. Those communities may also be marginalized by the dominant society. Coupled with low population counts and densities, and poor education, these people have little to offer politicians for votes. They are also poor consumer markets for corporate profits. Amateurs living in those areas have little to no opportunity to get formal EmComm training. Our international contacts from international meetings and various radio/VOIP nets are the gateways for sharing the GECO materials. These contacts help bridge the language barriers within their respective countries. In some cases, they have translated GECO materials that we've posted on our website.

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The GECO Patch Quilt Community EmComm

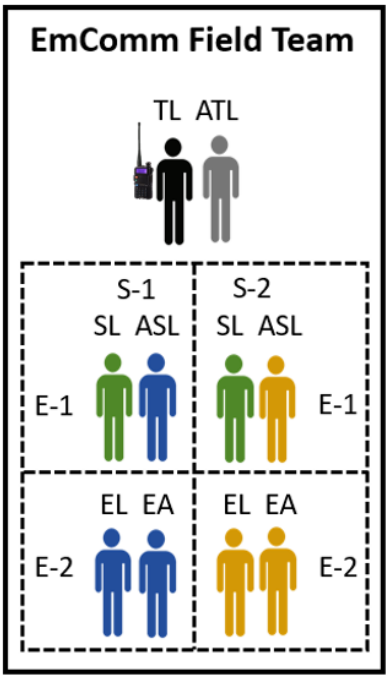
The US Federal Emergency Management Agency (FEMA) is making a major effort to improve serving the people by committing itself to be inclusive in its disaster relief efforts. In the past, marginalized groups and communities (e.g., the poor, ethnic minorities, Indigenous people, infirm, elderly, immigrants, non-English speakers, etc.) were under and unserved. To be more inclusive, GECO proposed the Inclusive EmComm Pyramid Plan. It is based on the following ideas about most communities:

- There are more communities without a licensed amateur radio operator or amateur radio equipment than with these.
- There are more people with portable electronic devices (PEDs; e.g., smartphones, tablets, laptops, and computers) who know how to use them than there are licensed amateurs.
- Many newly licensed amateur radio operators cannot afford to buy a transceiver (radio) immediately after getting their license.
- During and after a disaster, there is a great need for accurate information throughout the disaster area for making effective decisions for rescue and recovery.
- In a disaster, people who are more active in producing effective results are less likely to become depressed victims and survivors.
- During and after a disaster, there is a need for well-organized, effective, centralized communications throughout the disaster area. Organizing an EmComm network around a core of licensed amateur radio EmComm operators supplemented by teams of trained EmComm volunteer observers using PEDs with EchoLink and Zello (or other VOIP applications) can be done for no cost. These readily available free applications effectively multiply the scale of the traditional amateur radio EmComm network.

Basic EmComm Field Team

The GECO leadership guidelines set the optimal team size of ten people. This conforms to Sun Tzu's command structure of a 1:5 leader communication ratio. The GECO chain of command goes from Team Leader (TL, who must be a licensed amateur), The Assistant Team Leader (ATL) then to the Squad Leaders (in order, #1 then #2), and so forth. These may be a mix of licensed amateurs (with or without radios) or community volunteers.

Each TL should have a radio. Radios are allocated to licensed amateurs in order of the chain of command. Non-amateurs are welcome to join the team and may hold any position other than Team Leader. All



Field Team Key

TL = Team Leader (Ideally, a licensed amateur with a radio)
ATL = Assistant Team Leader
S # = Squad Number
SL = Squad Leader
ASL = Assistant Squad Leader
E # = Element Number
EL = Element Leader
EA = Element Assistant

Squad Leader is also E=1 Leader & Assistant Squad Leader is E = 1 Assistant Squad Leader

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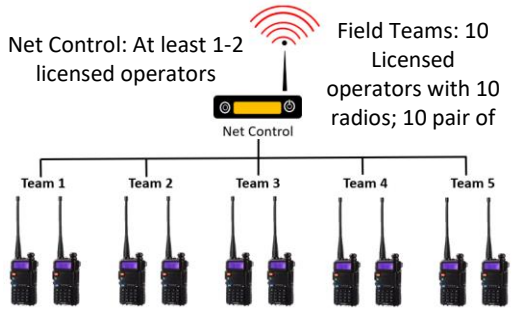
team members are encouraged to become licensed amateurs.

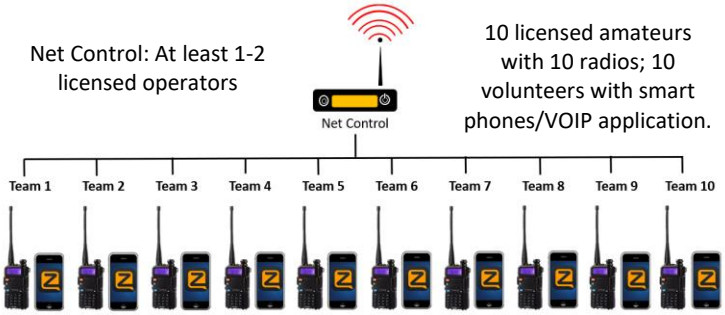


A Typical Local Amateur EmComm Net

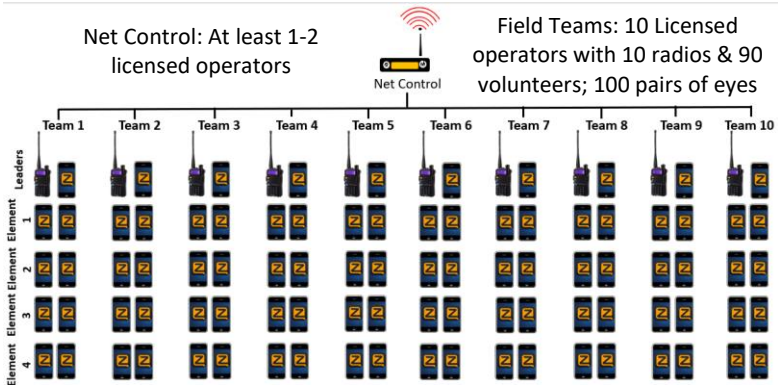
Imagine a local amateur radio group with twelve licensed amateurs with the club base station and ten portable transceivers (HTs). When a disaster strikes, the typical deployment is shown in the diagram on the right: Two amateurs are at the Net Control station, while the rest form five field teams of two persons. This is the minimum team size for safety and communications redundancy. They go out in the community to observe and report back to the two base station Net controllers. These five teams can cover five different sections of the disaster area. The more teams deployed, the faster the area could be covered. Emergency managers need timely and accurate information to conduct rescue and relief operations. There are a few options to get more field teams 1) use smartphones with a VOIP application (e.g., Zello or others) for unlicensed volunteers, 2) use EchoLink (e.g., add an EchoLink simplex link or repeater capability to the base station), and have licensed amateurs without radios to install the EchoLink app on a smartphone; 3) form blended teams using both licensed amateurs and community volunteers using amateur radio and VOIP technologies.

Smartphones & Unlicensed Volunteers

Using smartphones with Zello (a free VOIP app) lets s a no-cost option that lets EmComm groups tap into community members who have smartphones to help double the number of field teams (see diagram, below right). These volunteers with Zello on their smartphones pair up with licensed radio operators for operator safety. These volunteers get exposed to EmComm and amateur radio. It is known that disaster survivors who are active have a reduced the risk of suffering from depression. This scenario is possible IF the cell phone service is available. Many amateur radio operators assume a disaster automatically means the phone is out. But this is not always the case (e.g., the Telinipara Ghat pier collapse). You cannot assume there is no cell service or Internet in a disaster, no more than you can guarantee the amateur radio bands will always be clear and amateur operators, equipment, or power will be available.



Following the assumption there are more smartphone users than licensed amateur radio operators and radios, the diagram on the right shows how volunteers equipped with smartphones with Zello can be integrated into an EmComm group. Squads report to the ATL via Zello who relays the information to the TL who reports to Net Control. This is 5 times more field observers than before. An unlicensed volunteer starts with their smartphone with Zello as an EA. An EL is similarly equipped but with more training and experience to mentor the EA. These volunteers could rise to the



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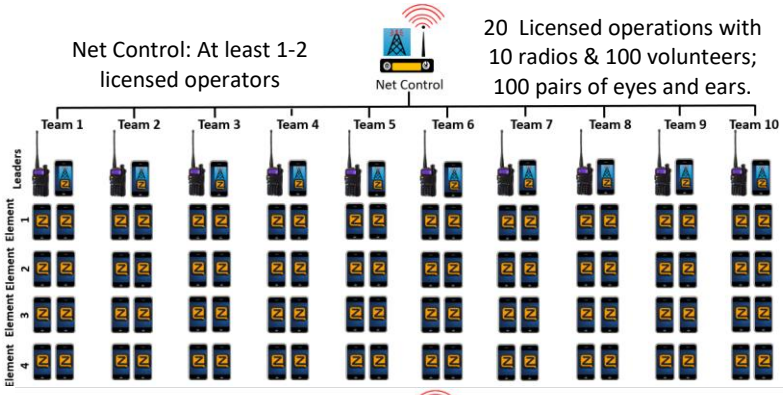
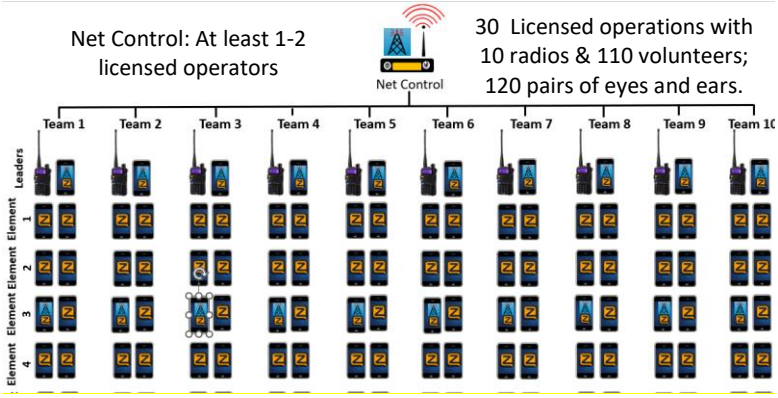
ATL position without needing an amateur license.

A variation of this option is to include a Zello "Net Control" operator in the base station. This way, unlicensed volunteers could get more training in EmComm (and maybe get motivated to become licensed). Having a Zello EmComm Net could be helpful in countries where it is difficult to get a license or radio equipment. But there must be cell phone service. Smartphone-VOIP EmComm volunteers are vulnerable if phone service is not available. In this case, runners would be used to relay messages. Another option is to use non-radio EmComm methods (see page 8).

EchoLink Enhancement

The addition of EchoLink to an EmComm operation provides some communication redundancy and lets licensed amateurs without radios communicate with Net Control. There is added cost for the base station: 1) a computer to run the free EchoLink program, 2) the EchoLink program, 3) the EchoLink interface unit to the radio, and 4) Internet service. The interface can be homebrewed to keep costs low. Commercial units can range in price from about $100 and up. EchoLink requires the Internet to work, thus it shares the vulnerability of smartphones with Zello. But, IF the internet is available, EchoLink provides a backup in case the TL radio goes out. The key differences with the earlier EmComm Team are 1) the TL and ATL must both be licensed amateurs; 2) the Net Control station is an RF-enabled EchoLink node (e.g., either a Link or Repeater station); 3) the TL installs EchoLink on a smartphone (if they have one), and 4) the TAL has both Zello and EchoLink installed on their smartphone. Should the team transceiver malfunction, contact with Net Control might be maintained using EchoLink installed on the TL's Smartphone. Ideally, this scenario needs 20 licensed amateurs and 10 radios. The primary advantage of this system is the conditional backup connection to Net Control IF the internet is available.





If more licensed amateurs without radios are available, they can put EchoLink on their smartphone and be assigned as an EL, and be groomed for the ATL position. [**Note:** Every disaster and emergency incident is unique. We cannot assume anything about the availability/unavailability of any communications infrastructure and resources.]

Past EmComm failures are often attributed to "unexpected" events. Consider the worst case: All 100 people are deployed and the Internet and cell services go down. There are still 100 pairs of eyes and ears on the ground. Reports from those observers may take longer to get to Net Control via runners, but it may be better than no information at all. In any case, EmComm organizers and participants should all be aware of needing to resort to manual message relays by runners. Consider being able to

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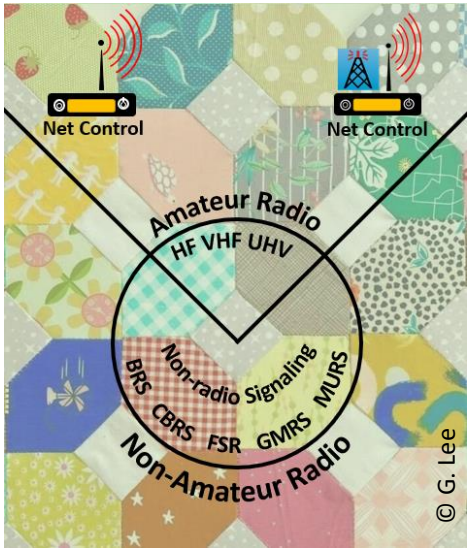
support message runners systematically when deploying field teams. This should be built into EmComm training. Know the area well and consider routing options for deployment and prepare "kits" to overcome the various anticipated obstacles (e.g., damaged bridges, flooded areas, war zones, etc.). Teams must periodically check in to Net Control. Loss of communication with a team should prompt a neighboring team to reconnect with them by runner to keep the information flow going.

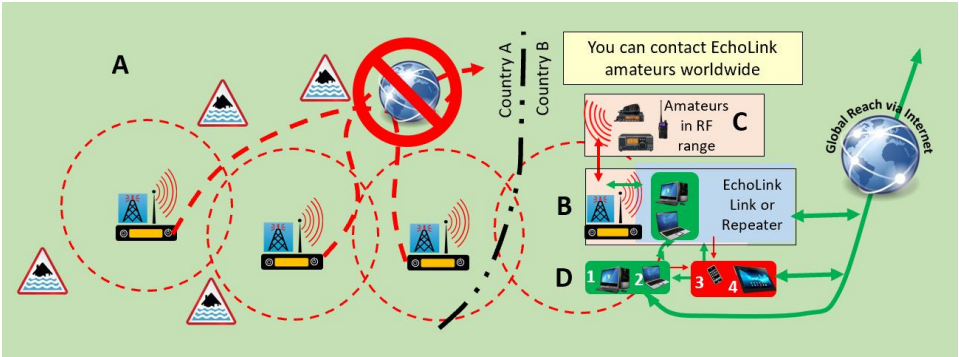
The GECO Patch Quilt Community EmComm



To cast a wider net for inclusion to match the FEMA Whole Community approach, GECO suggests encouraging the use of transceivers that do not require licenses (e.g., Citizen Band Radio Service (CBRS), and Family Service Radios (FSR)). Encourage businesses with radios to join the local EmComm effort. These include Business Service radios (BRS), General Mobile Radio Service (GMRS), and Multi-Use Radio Service (MURS). Check on licensing requirements in your country. These may or may not incur high costs, and older equipment might be received as donations or sitting idle in a closet. However, common people can volunteer with an EmComm organization, and get trained relative to the equipment available in the group. The key considerations are 1) knowing the range and capability of these units and where they will be used relative to the geographical area of the EmComm operations; 2) planning an interlocking network of stations within range of each other to get the word out; 3) making sure a volunteer from the group using that radio type is assigned to an EmCom team with a radio link to Net Control.

Expanding Network Resilience

For added resilience, we suggest laying out a network of RF-enabled EchoLink stations within RF range of each other. If the Internet is unavailable, the stations can pass emergency traffic by RF. Whenever possible, expand the RF-enabled EchoLink network to a neighboring county, state, province, or country. Once any relayed RF traffic reaches a station with Internet access, the news can spread globally very quickly. Communication in an emergency is critical.



***A** = disaster area in country A, with three RF-enabled EchoLink stations that have lost internet connectivity. They can relay emergency traffic by RF until it gets to a station with Internet connectivity. In country **B, B** is an RF-enabled EchoLink station in RF range of a station in Country A. **C** are RF amateur operators in RF range of **B**. **D (1-4)** are VOIP EchoLink stations in contact with **B** via the Internet. [**Note**: **B**, **D 1-2** can connect to multiple EchoLink computer stations at the same time; stations **D 3-4** can only connect to one EchoLink computer station at a time.]*

Increasing Operator Resilience

No emergency communications system or method is 100% bullet-proof and guaranteed to work all the time, every time. GECO EmComm teams should also have non-radio EmComm kits. Several of these non-radio methods can be

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homemade or use off-the-shelf parts incurring little to no cost. And of course, remember to prepare to manually run messages to Net Control or an RF station in radio contact with Net Control. The non-radio approach is open-ended in that communities have options to have some kind of EmComm methods suitable to their local conditions and culture.

Helicopters are commonly used in emergencies, but they use different frequencies than amateur EmComm operators. Knowing non-radio Ground-to-Air signals is another value-added skill set for amateurs (see links below).

[GECO Non-Radio Ground Signals]
[GECO Non-Radio GTA Signals Part 1: What a Spotter Looks For]
[GECO Non-Radio GTA Signals Part 2.2: Selected GTA Signals]
[GECO Non-Radio GTA Signals Part 3.2: Basic LZ / DZ Support]
[GLS-GECO Non-Radio GTA Signals]
[GLS-GECO Make a Heliograph for EmComm]

These lessons are created through the collaborative efforts of the groups shown above: Applied Geography for Sustainable Living, the GLS community group, the Grassroots Emergency Operations group, and the Wanderers Amateur Radio Club.

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