Creating Emergency EOC Broadcasting Capabilities Near the AM Radio Band
Using 160M Band In Emergencies

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WARNING: DO NOT TAKE IT UPON YOURSELF TO BEGIN "BROADCASTING" IN A DISASTER SITUATION UNLESS GIVEN SPECIFIC INSTRUCTIONS PER LOCAL AUTHORITIES.

INTRODUCTION

At the 2018 Emergency Symposium hosted by Alachua ARES and the Santa Fe Amateur Radio Society, a short full scale exercise was held in which volunteer teams were challenged to complete a number of tasks in (simulated) support of local Emergency Management. The setting of the Exercise was a confusing and poorly-understood emergency in which local broadcast as well as public service communications had been severely damaged. These tasks as listed in the Table below and touch on a wide variety of radio skills and assets. The purpose of this article is to explain how to carry out Task #3 --- **creating a emergency broadcasting ability near the AM radio band to allow the EOC to provide bulletins and instructions to the general population in a massive disaster with loss of normal broadcasting stations in an area.** As recent hurricanes, power outages, and concerns over EMP have shown, it is indeed quite possible—and has happened more than once-- that all normal broadcasting facilities in an area might be knocked off the air, giving the EOC little means to quell rumors and direct the public toward life-saving actions, explain actions being taken, announce food / water / fuel / shelter and other resources, etc.

No.	Task	Usefulness
1	Establish and maintain a Command Net	Allows tactical communication between teams.
2	Monitor frequencies for reports from fire / police / utilities / hospitals	Scanning or other techniques to "pick up" volunteers and others desiring radio connections to local emergency efforts. Also – *always hunt for amateurs who are on some other frequency and haven't found your operation yet.*
3	Create broadcasting ability at bottom end of 160 m band, or top end of AM Broadcast band, for the EOC	Allows public safety officials to have a means of reaching the general population in the absence of working broadcasting stations.
4	Digital email to State EOC	Notification and connection to state

		emergency authorities who need situational awareness and may be able to give you the wider picture also.
5	Create a repeater for Interoperability Channel NC1	An example of assisting to create repeater facilities where requested for interoperability between different emergency services.
6	Survey/test all known amateur communication assets	Develop situational awareness of available assets which can be leveraged to serve the community.
7	Establish contact with any ARES or other amateur emergency net	Establish connections.
8	Creating broadcasting ability over local NWS ("weather radio") frequencies for the EOC	Allows public safety officials to have a means of reaching the general population in the absence of working broadcasting stations.
9	Utilize Message Pick Up stations to create digital connections in the absence of Internet functionality	Allows digital email connections between WINLINK-enabled communicators even without regional, national, or even international Internet functionality.
10	Maintain Activity Log and Communications Log for all actions	Keep a record of actions for both practical and legal purposes.

CAN HAMS EVEN MAKE THIS WORK AT ALL? (Futile?)

It turns out that ordinary AM broadcast receivers are reasonably sensitive. They don't need to be *very* sensitive because background noise is much greater as you move lower and lower in the medium frequency band, due to lightning crashes all around the world as well as man-made noise from vehicles, machinery etc. Background noise in the 160M and AM broadcast band is said to be much higher in cities than sparsely settled rural landscapes. In my town there is an AM broadcast station (presumably turning a profit) operating only with a 150 foot vertical tower and a 1 kW amplifier --- and I can receive that station within 10 mile radius. Most recent and current ham radio HF transceivers include the 160m band (https://www.universal-radio.com/catalog/hamhf.html). There are also plenty of kW and higher amplifiers that can work on the 160 M band, and while one will have to derate considerably to operate AM with its continuous carrier, it is quite possible that amateurs could in an emergency come up with something that would work around 1.6-1.8 MHz for the use of authorities. A ham radio system can create the equivalent of a Class C or D AM broadcast station.

What about EMP? Would the public still have working portable AM/FM receivers to which to transmit? The answer is YES. Simple handheld devices such as 2 meter handitalkies and portable battery operated AM/FM radios are expected by experts to have a good chance of surviving. By contrast, a non-hardened broadcast station might be rendered non-operative.

HOW TO SOLVE THIS TASK

Many amateur radio transceivers include the 160M band (1.8-2.0 MHz) and some will transmit even

below that band – and many include the AM mode as one of their options. Thus, one of the options for an EOC needing to broadcast to the public, is using an amateur radio band transceiver to do "broadcast" either just above or at the top of the AM broadcast band --- where it can be picked up by many consumer portable AM/FM radios.

AM is an unfamiliar mode to many amateurs today, but consumer AM radios cannot receive single sideband, so AM would be necessary for emergency broadcasts. ***Remember that AM transmissions have a far higher "duty cycle" than SSB –best to run your equipment at only about 40% of the rated power.....***

While the 160m band has been popular among many hams for its resiliency throughout the sunspot cycle for local ragchewing, and is also stalked by many DXer's as well, there are a lot of amateurs today who've never used this band and never thought of how to create an antenna for it.

Since vertical polarization is better for ground-wave signals, antennas with either partial or fully vertical polarization work better than a strictly horizontal antenna. A full-size 160 meter band vertical dipole would be 260 feet long (130 feet on each side of a center insulator) and a ¼ wave vertical (against ground) would be 130 feet tall. A shorter wire can be loaded inductively to match, but as the radiation resistance of a short-for-frequency antenna drops considerably, the efficiency drops as resistive losses in the matching system begin to predominate.

So the emergency antenna goal becomes

- get the longest wire possible
- get it as close to vertical as possible
- use a high quality tuner to match to the transmitter.

Several options in a real emergency:

1) Slingshot a fishing-weighted line through the open structure of any tall tower and put up a sloping dipole.
2) If a 20+ building is available, a sloping vertical from the roof downwards might also accomplish the task.
3) Pine trees can reach 90 feet and some trees even higher --- so a weighted line over a tree may allow for a near vertical sloping antenna.

And in an emergency, ANY workable antenna beats nothing --- so if the only practicable antenna is primarily horizontal – use it!

In a simulated exercise, a weighted line through a branch of a tall pine tree would allow for a sloping dipole or an inverted Vee antenna (which will have a component of vertical polarization at least in some directions).

WHAT ACTUALLY HAPPENED IN OUR EXERCISE

Our Symposium included hands-on session at making emergency antennas, both HF and VHF before the Exercise.. In the HF session, participants learned to use even lampwire, split apart to make a dipole or off-center-fed dipole, with the remaining lampwire acting as a makeshift transmission line. The characteristic impedance is in the range of 75 ohms (depends on manufacture). Since there is a *lot of plastic between the wires*, the losses in lamp wire aren't nearly as low as they are in real traditional window line (where more of the field is purposely in AIR), but at 1.8 MHz those losses aren't going to be very great. You can take a 500 foot roll of Home Depot lamp wire, and pull the ends apart (tape or tie to prevent further splitting) to make just about any emergency HF dipole antenna you wish, using some or all of the remaining intact lamp wire as your emergency transmission line!

At the start of the Full Scale Exercise, a large roll of lampwire was quietly placed on the table of the assembled team assigned this task. Unfortunately, this was overlooked by that team, and they couldn't come up with an antenna... Had the exercise timeframe allowed for a bit more time for this team, they might have realized how to build the necessary antenna.

YOUR INPUT

These are the best ideas I could come up with for solving each of these emergency radio tasks --- you may have much better solutions! If so, don't hesitate to email them to docvacuumtubes@gmail.com

REFERENCES:

Loss of communications in disasters
http://www.qsl.net/nf4rc/KatrinaComms.pdf
https://www.drj.com/articles/online-exclusive/when-communications-infrastructure-fails-during-a-disaster.html
Example of complex failures: https://arstechnica.com/tech-policy/2010/05/will-clear-channel-ever-live-down-the-minot-toxic-spill-disaster/
Broadcast station issues: http://www.nab.org/eyeOfTheStorm/Ten_Steps.pdf

160m band characteristics / Antennas
http://k9la.us/An_Introduction_to_Operating_on_160m.pdf
http://www.somis.org/add-160m.html

AM Commercial Station Information
https://www.fcc.gov/media/radio/am-clear-regional-local-channels

Examples of 160M Transceivers:
Yaesu FT-450 and FT-450D: https://www.universal-radio.com/catalog/hamhf/0452.html
ICOM IC-718 https://www.universal-radio.com/catalog/hamhf/0452.html

Examples of 160M Amplifiers
https://www.dxengineering.com/parts/ame-al-811h 800-watt output 160-15m amplifier
https://www.dxengineering.com/parts/ame-al-80b 1000-watt output (SSB) 160-15m amplifier

https://www.dxengineering.com/parts/ame-al-82 2000-watt output (SSB) 160-15m amplifier