

Prepared for the House Committee on Veterans and Emergency Preparedness

Workgroup On Amateur Radio

Representative Bill Post, Chair

By John Core, ARRL Oregon Section Manager

May 16, 2017

Workgroup Purpose: “Review possible policies and investments utilizing workgroups to find “ground-truths” about critical factors related to our overall state of resilience in Amateur Radio structures/systems for response and recovery efforts”¹. The Workgroup is charged with “(1) identification of stakeholders; (2) evaluation of existing capabilities; (3) Identification of priority actions and/or investments; (4) establishment of a timely conversation about areas for further study – further action/s.”

Representative Evans commented on February 28th, 2017 meeting of the House Committee noted that the Workgroup needs to get the “ground-truth” on needs for training and resources to support Amateur Radio.

¹ 79th Legislative Assembly House Committee on Veterans and Emergency Preparedness, Rep. Paul Evans, Chair. Letter of February 2, 2017.

Contents

Evaluation of Existing Capabilities	2
Governance	2
Amateur Radio Volunteers.....	3
Amateur Radio Trends in Oregon	4
State Coordination	4
Identification of Priority Issues: Governance.....	5
Training	5
Identification of Priority Issues: Training	6
Radio Systems	7
Winlink Radio Email	7
High Speed Mesh Networks.....	7
SHARES.....	7
Portable Stations (“Go Kits”).....	8
Emergency Power	8
Identification of Priority Issues: Radio Systems.....	9
Appendix 1: High-Speed Data via Amateur Radio	10

Evaluation of Existing Capabilities

Oregon ARES and other Amateur Radio groups are intended to provide “backup” emergency communications for short periods of time, typically a few days. Existing capabilities are based on experience from past, pre-scheduled drills. If/when a major disaster occurs, few Amateurs may or may not be able to travel to their assigned EOC for several days.

This evaluation is based on Oregon ARES Simulated Emergency Tests (SETS) for our participating units held twice each year for the past 6 years. We attempt to simulate real-world disaster communications using scenarios that have ranged from solar storms, volcanic eruptions, cybersecurity attacks and of course, a major Cascadia Subduction Zone earthquake event. These SETS typically include 20 Counties operating from EOCs, trailers, tents and RVs. These are pre-scheduled, 4-6 hour exercises and have successfully shown that Amateur Radio auxiliary communications has been used very successfully.²

Prior to the June, 2016 Cascadia Rising FEMA exercise, ARES ran a 24-hour activation/communications drill. These SETS have sharpened skills and were well received. But they do not represent what conditions would be like in a real world event when volunteers may not be immediately available to staff EOCs around the state.

OEM’s Cascadia Rising After Action report (p. 14) noted that:

- “Many jurisdictions and state agencies were unable to communicate with external partners because of limited access to contact information and knowledge of back-up capabilities”.
- “Several jurisdictions indicated their amateur radio teams lacked knowledge of which frequencies to use and others indicated the “communications out” period illustrated a lack of planning for prioritized back-up methods of communications”.
- The OEM recommendation is that “Greater emphasis is needed to develop capable, sustainable, effective and dependable alternative communication systems and operating protocols. Assigned and volunteer personnel should be trained to effectively activate and utilize alternative systems in support of emergency communications.”

Governance

The Amateur Radio Emergency Services (ARES) is a field division of the American Radio Relay League (ARRL), the National Association for Amateur Radio. This is an entirely volunteer, unfunded program. In Oregon, the ARES program dates back about two decades when small group of Amateur Radio operators began using their own equipment to help in Public Service events such as parades and bicycling events.

Over the years, the program has grown substantially, Emergency Managers have funded equipment installed in their EOCs and worked with the County units. In about 2005, Oregon Emergency Management began issuing OEM ARES/RACES “Red Cards” to ARES members as a complimentary service and began running background checks as a part of the credentialing program. Shortly thereafter, requirements for ICS 100, 200 and 700 certification were added.

The County ARES programs are intended to be a partnership between the County Emergency Manager, volunteers to serve the County Emergency Manager in the event of a unit activation. At that time the

² Oregon Emergency Management Cascadia Rising After Action Report, page 14.

Manager takes operational control of the unit but may still rely on the EC for assistance. The ECs and volunteers build repeaters, communication trailers, radio “go-kits”; provide training and hold monthly meetings (in most cases) to keep the membership involved and active. The County ECs are encouraged to participate in the ARES state-level sponsored simulated emergency tests, ARES state-level training and overall coordination efforts, including frequency plans and ARES sponsored state-level radio nets. Coordination of the technology used, the frequency plans, and training as well as membership issues is important in sustaining a communications system for Oregon. Our website is www.oregonaresraces.org

The structure of ARES is one in which the County ECs report to a District EC and/or Section Emergency Coordinator (SEC) if the District and others position is vacant. The SEC is appointed by the Oregon Section Manager which is an elected position. The Section Manager reports to the Northwest Division Manager who sits on the National ARRL Board of Directors. The SEC and Section Manager work with Oregon Emergency Management, Oregon Association of Emergency Management.

There exists today a number of organizational structures that cover Amateur Radio volunteers. These include direct, “non-affiliated” volunteers that work directly for the county and groups that identify with the Auxiliary Communications Service (ACS). Some managers have adopted an Auxiliary Communications (AuxComm) structure that incorporates ARES, Community Emergency Response Teams, non-ARES volunteer amateurs, church groups and others all under the direction of the Emergency Manager. There are also Radio Amateur Civil Emergency Service (RACES) groups that work with Oregon Emergency Managers. Several Tribal Nations have developed Amateur Radio groups as have hospitals, fire departments, utilities and colleges. The tremendous growth of Amateur Radio in disaster communications raises the questions of how all of these groups can best work together to maintain a coordinated emergency radio system.

ARES gets many requests from important organizations for help building amateur radio backup systems. These include Providence and Legacy Health hospitals as well as Oregon Dept. Transportation. We have difficulty meeting all of these requests for volunteers, equipment and communications system design help. There is a big demand for service and too few dedicated volunteers.

Amateur Radio Volunteers

As of March, 2017, there are over 18,000 FCC Licensed Amateur Radio Operators in Oregon. The license class breakdown is shown below. Novice and Advanced licenses are no longer issued.

Novice	Technician	General	Advanced	Extra	Total
165	9746	4397	907	3124	18,339

Of the 18,000 Amateurs, about 600 are involved in public service in Oregon ARES programs around the state. *Far too few to respond to expectations for more than a few days.* Probably one-third or more are relatively inactive and not involved in training. There are about 20 counties in the ARES program today although many in Eastern Oregon are very small. In addition there are many NGO groups that use amateur radio for emergency response communications as listed below.

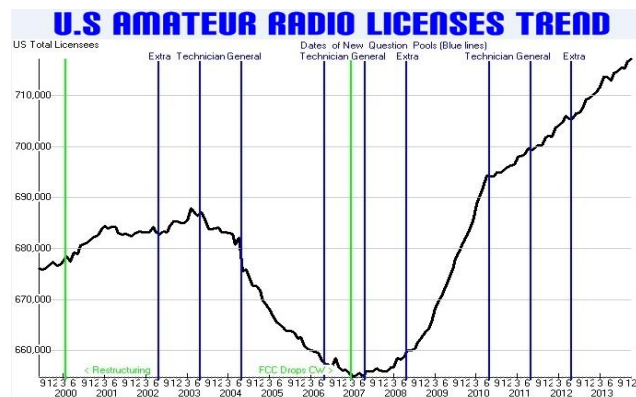
As of April, 2017, ARES County ECs report a total of 641 volunteers that donated nearly 2,300 hours of service to Oregon Emergency Managers. About 1/3rd are in the Portland Metro area.

It is important to understand a few things about Amateur Radio volunteers that serve in ARES:

- Most are retired people that want to serve the community but on their own term. They are involved in their families, travels and other interests. Many are reluctant to get involved in training but have important technical skills that are of great value (retired engineers, IT managers and communications specialists). They enjoy the social aspects of being part of a group with common interests. Some are in declining health and have limited physical mobility. Most of all, Public Service volunteers want to have fun and be of service on their own terms.
- There is always a need to balance the tendency to ask too much from a volunteer and the desire to have well trained, professional, dependable and dedicated communications volunteers. Lessons learned from training on how to work with volunteers may be helpful in recruiting more people into Public Service. Overall, ARES membership has grown substantially over the years because it is an active program that attracts beginning Amateur Radio licensees into a fun, educational Public Service activity.

Amateur Radio Trends in Oregon

Below is the Amateur Radio license trend for the entire US. The trend in Oregon is similar, with large increases in Technician Class licenses. At over 18,000 Amateurs licensed in Oregon, there is a deep pool of potential Public Service volunteers.



State Coordination

As noted, there are many groups that use amateur radio for disaster communication. Those groups have participated in Oregon ARES – sponsored Simulated Emergency Tests (SETs) are listed below:

County and City EOCs, Statewide	Portland General Electric
Hospitals and Medical Clinics, Portland, Salem, Bend/Redmond, Albany and Silverton	Bonneville Power Administration
American Red Cross, Portland	Oregon Dept. of Transportation
Oregon Food Bank, Portland	CERT & NET Teams – Salem, Tigard, Beaverton, Portland
Tualatin Valley and Redmond Fire & Rescue	Willamette, Lewis Clark, Linn-Benton Colleges
LDS Church, Salem	Marion County Sheriff's Jeep Patrol

At present, there is no single organization that covers all of the many entities that use Amateur Radio. Oregon ARES, because of its size, technical capacity and training programs, is the go-to point of contact for many. While ARES is willing to help, it is overwhelmed with requests. Everyone needs training and technical support, drill opportunities, program information and most of all a common understanding of how amateur radio emergency communications works in Oregon. At present, it is all ad hoc.

Identification of Priority Issues: Governance

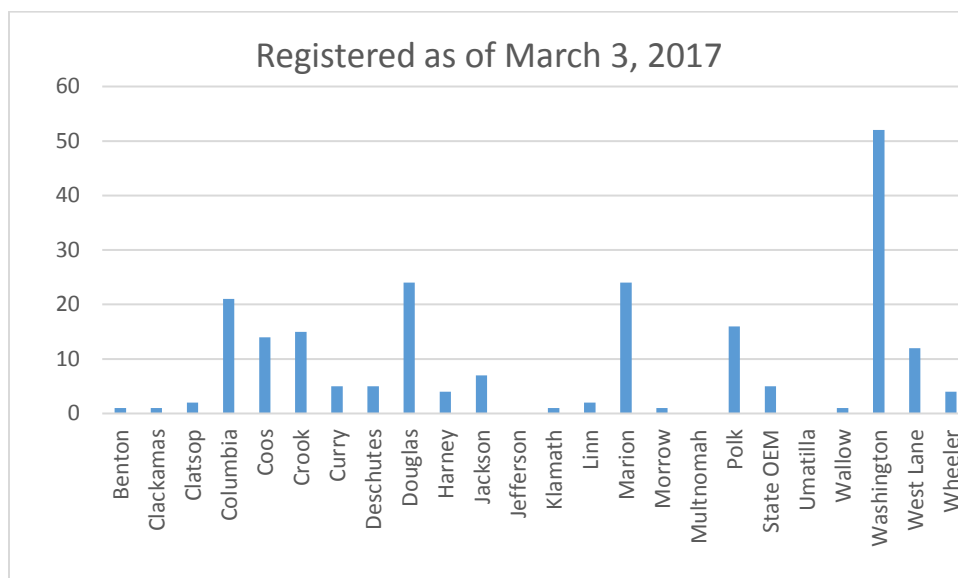
This discussion includes Amateur Radio Volunteers, State Coordination and Training required to build a resilient Amateur Radio auxiliary communications program in Oregon.

1. There are far too few active, trained and skilled Amateur Radio operators involved in Public Service. In the event of a major disaster, many may find it very difficult to travel to their designated EOC after they secure their families. A new program to recruit Amateurs into service is needed. Oregon ARES has neither the funding nor ability to host a long term effort to recruit but can assist. Further, ARES does not cover all of the Counties, agencies and RACES/AUXCOMM groups in Oregon. The design and execution of this program must be done professionally.
2. Once recruited, volunteers need to be trained, drilled and engaged in their assigned post. Training programs for everyone involved need to be designed, promoted and administered for the entire volunteer force which is again far beyond the capacity of ARES to deliver. Simulated Emergency Tests have proved highly successful in the past but have not covered the wide scope of an all-agency, large-scale program.
3. A forum is needed to bring everyone together to continue discussions beyond the House Committee Amateur Radio Workgroup. Current governance does not provide such a structure.

Training

In August, 2016 a new ARES state training program was announced for Oregon ARES units. This is a three-part program:

Members register on-line to participate. As of early March, 2017, 235 members are participating in the program. Registrations by County are shown below.



Note that those Counties that are not ARES-affiliated are responsible for training their volunteers. ARES is helping with this by making available our new ARO On-Line training course. This training is intended for new volunteers and is designed to prepare them to operate radio systems in County and City EOCs. It is not intended to provide advanced skills that may be required for Federal Agencies ICS COML (Communication Leader) certification. Volunteers are encouraged to take the FEMA AUXCOMM and other ICS courses, however. Unit Emergency Managers may require additional training specific to their needs.

1. Amateur Radio Operator (ARO) On-line training is a 7 – *module knowledge based, self- paced course with three exams covering ARES, Emergency Management in Oregon, Operating during a disaster, Radio systems, antennas, The Winlink System and other topics.* Anyone can take this training as it is freely available on the internet whether ARES-affiliated or not. This typically takes new students 20 hours to complete. A link is provided below:

<https://sway.com/nDOPx7hyf3Ru50EI>

2. A proctored, internet based course in the use of Oregon ARES Digital Network (OADN) forms is conducted twice yearly. Students learns how to send ICS forms, Declaration of Emergency, Situation Reports and others using the Winlink System for digital radio. This is a 6-week class. About 200 volunteers have completed this course to date. The class now is session has 71 students.

3. Completion of a Task List administered by the County ECs to train hands-on radio use in County EOCs. This task list include demonstration of competency using EOC radios and personal emergency preparedness.

Completion of all three of these elements is required to receive an ARO Certificate from Oregon ARES. Counties and other groups not affiliated with ARES may have other requirements, if any.

Identification of Priority Issues: Training

1. Groups other than ARES need to support and conduct training for auxiliary communications volunteers. There is a large and on-going need. Volunteers come and go; new hospital/EOC/ODOT staff/others want and need training and technical support. Designing, delivering and administering such a large program is beyond the capacity of Oregon ARES.
2. Many valuable ham radio operators can contribute their skills during a disaster but are not interested in formal training program. There is a need to accommodate them. “The abilities of volunteer operators must be recognized and accounted for by the emergency managers they serve. Enhancement of those abilities must be guided and funded to provide for the needs of the emergency manager’s mission”.³
3. Training at present is unfunded and done on an ad hoc basis. If a serious training program is desired, resources and people will need to be organized to reach goals yet to be set.

³ Nathan Hersey, Multnomah County Emergency Coordinator April 6, 2017.

Radio Systems

Oregon ARES volunteers use their personal fixed-station and mobile radios for Public Service as well as County/City and State –owned equipment installed in EOCs, trailers and portable stations called “Go-Kits”. The hospitals, ODOT, Federal Agencies and Tribal Nations all own their own equipment. These radios provide VHF/UHF/HF voice and data messaging both locally and to other stations located outside of the state. Most local traffic (tactical messages) are done through VHF/UHF FM repeaters located throughout the state, all volunteer owned and maintained. The bulk of the EOC-OEM traffic is through HF Winlink digital radio email that provides critical out-of-region communications.

We have found that Eastern Oregon counties (especially) occasionally need technical support with their radio systems. The volunteers with the expertise to provide support are often several hours of drive-time away and not able to fund travel expenses out of their own pocket. As a result, some Eastern Oregon Counties (Sherman as an example), has been off the air for the past 2 years. Malheur County has similar issues. There is a need to resolve this on-going problem, maintain these radio system on a regular basis and keep the county EOCs on the air.

Winlink Radio Email

The Winlink Radio System Email (www.winlink.org) hardware (radios, computers, modems, antennas, power supplies, etc.) was purchased through a Governor’s grant of \$250,000 in 2008 following a damaging windstorm that knocked out communications to most of the Northern Oregon Coast. These fund revolutionized Amateur Radio communications in Oregon. The Winlink System (referred to as the Oregon ARES Digital Network or OADN) is now nine years and three generations of radio technology old. Much faster and more capable equipment in the form of technology is now (or soon will be) available. All of our computers run outdated operating systems. There is no plan in place to update the OADN system or expand it’s capabilities.

High Speed Mesh Networks

Advances in wireless network technology (referred to as MESH Networks) may be capable of providing high speed data connectivity between Portland Metro EOCs on Amateur Radio bands if there is an internet failure. Such a network would not likely be operational following a major earthquake, however. Should this capability be of interest within the Portland Metro – Salem region, a funded effort would be needed to design and coordinate the program. This would likely involve ODOT as they own/manage many of the communications towers that may be needed. The equipment used in these networks are low cost and have been successfully used elsewhere. Appendix 1 provides additional information.

SHARES

Other advances that would move Winlink radio from the Amateur frequency bands to the DHS SHARES (Shared RESources High Frequency Radio System) channels (thereby avoiding normal Amateur radio interference) are also possible. Funding would be needed to modify the Amateur HF radio and build new HF SHARES Radio Message Gateways. This is made possible by very recent changes to the SHARES program which would also permit all-hazard voice/data HF contingency communications systems for *most levels* of civil authorities and their critical infrastructure partners using employees of State, County and other entities to operate radios under their own SHARES License (no Amateur license required). This reduces dependence on volunteer Amateur operators and places responsibilities for the agency radio operators to the agency itself. Amateur operators would volunteer to work directly for the SHARES

licensed agency. DHS NCC Program Manager Ross Merlin is principal point of contact at ross.merlin@hq.dhs.gov.

Portable Stations (“Go Kits”)

These are complete Amateur Radio Stations built into a portable case. The stations are designed to be operated on battery, generator or commercial power and can be easily moved. Many (ODOT Strategic Technology Reserve kit, pictured) include VHF/UHF as well as HF radios and digital radio PACTOR modems for Winlink use. All Portland Fire Bureau stations have VHF/UHF radio kits. Other than the few ODOT STR kits, there is no larger cache of radio kits that can easily be deployed when and where needed in the event of a major disaster. All of these kits require a laptop PC, software that must be updated as well as batteries and antenna systems that require continuing maintenance by skilled Amateur Radio operators. They must be used in drills and maintenance records kept. Oregon ARES has long had an interest in developing a Mutual Assistance Team capability but that would use these “Go Kits” has not previously had the resources to equip such teams.



Emergency Power

In a Cascadia Subduction Zone event, available fuel for power generators at EOCs, hospitals and many other disaster responders will likely not last very long but a small 2 Kw highly portable generator commonly used by Amateurs can provide 8 hours of power on one gallon of gasoline to run a radio, computer and lighting. One 70 amp-hour gel-cell deep cycle RV battery will also run a 100 watt Amateur Radio station about 1 day or longer before it needs recharging (depends on transmit time and power levels used). There are solar panel recharging options that, combined with large capacity batteries, can be used if these power systems are maintained in an accessible cache or deployable reserve. Car batteries are not ideal for Amateur Radio use, but can work if there are no other alternatives. Propane powered or dual fuel gasoline/propane generators are another option as it may be possible to obtain propane barbeque tanks. Accessible power sources are a critical need.

Identification of Priority Issues: Radio Systems

1. A plan and funding to update the County EOCs and OADN system are both needed. This should include radio modifications to permit the use of SHARES frequencies and expansion of the current Remote Mail Gateways to include these new SHARES frequencies. Upgrades to the digital radio modems to the new technology, county EOC antenna system improvements, computer updates, and new HF radios. Equipment being replaced can be used in “Go-Kits”.
2. Investments in a “proof of concept” high speed MESH network within the Portland Metro area that is completely independent of the worldwide internet system may be worthwhile.
3. Expand the number and availability of portable station “Go Kits” and station emergency power capabilities to allow rapid deployment to critical areas of the state. These kits need routine maintenance. Volunteers need ready access to them.

Appendix 1: High-Speed Data via Amateur Radio

The Amateur Radio Emergency Data Network (AREDN) is mesh networking software that is designed to be installed on commercial wireless equipment in order to allow amateur radio operators to utilize licensed frequencies and higher power levels, allowing for increased range.

In the United States, licensed amateurs are allowed to utilize frequencies around the common consumer and commercial wireless bands of 900 MHz, 2.4 GHz, 3 GHz, and 5 GHz. AREDN allows amateurs to create a high speed, self discovering, self configuring, fault tolerant, wireless mesh computer network with low cost equipment.

AREDN picks up where the internet fails. Each site becomes its own “node”, allowing the same data services that can go over the internet, to go over an amateur radio network, including high speed data (150+ Mbps) for file transfers, email, websites, streaming video, and even telephone voice over IP systems.

Each site “node” should have a line-of-sight view to other “nodes” they wish to “mesh” with. In order to connect to nodes on the other side of hills, a “mesh” cell is installed on a pole or tower. Below is a picture of one in Eschweiler, Germany, annotated with the various distances to the nodes they are connecting to.



Node costs can vary based on size of antenna needed, frequency used, and mounting and cabling needs. Below are some example hardware costs. Technical AREDN video presentation: <https://www.youtube.com/watch?v=fkl5Nbnz24Y> The estimated cost for a “proof of concept” ARDN network for the Portland Metro area is about \$10,000.



Ubiquiti NanoStation Loco M2:
\$50 each



Ubiquiti Bullet M2: \$80 each
Plus 2.4 GHz Antenna: \$100 each



Ubiquiti Rocket M2: \$90 each
Plus 2.4 GHz high-gain dish antenna: \$230 ea.