Good day! I am Lee Chambers, KI7SS. I've been a licensed amateur radio operator for about 60 years, and been in Thurston County ARES (TCARES) for over 30 years. I'm a multiple-past President of the Olympia Amateur Radio Society, and I am the ARRL State Government Liaison.

In all that ARES time I've never seen a plan speaking to a Cascadia-sized disaster. We in TCARES practice message handling, plan for, and do help with minor incidents like wind events, power outages, snow events, etc., and take ICS training courses that detail responses to chemical spills, fires, etc., but near as I can tell, nobody speaks to the big one, THE EARTHQUAKE, that Cascadia 9.9, or its slightly smaller brothers, should one--with many aftershocks--occur. It's hard to comprehend, I know, and almost too scary. But Cascadia is THE one incident where we will be needed most critically.

This paper assumes that worst disaster predicted for our region, that major earthquake along the Cascadia fault just offshore in the Pacific, with major damage sixty to a hundred miles inland, has occured.   We understand that the earthquake causes a major tsunami that inundates the already badly damaged coastal towns. Most of us live inland a bit, along the I-5 corridor in Lewis and Thurston Counties and northward, including the cities of Tacoma, Seattle, and Everett, and we will mostly survive, but a great many of our homes, businesses, roads, power lines, and water and sewer supplies wrecked. We will be cut off, alone, part of the five-to-ten million survivors in the region in need of help.   Some say such help will be woefully long in coming--maybe weeks at best.

As you must surmise, we ARES-RACES/emergency-response-oriented amateur radio operators are way too few in number to be truly effective as communicators in such a major incident, as we have our own lives, families, homes and businesses to worry about. Still, with power and ordinary communications down our amateur radios and communications prowess will become critical resources--if they can be brought to bear in the first days and weeks-- and possibly, months-- after "the big one". We hams proudly proclame that "when all else fails" we will get some of the first perceptions of the needs of entire cities, towns and villages radio'ed out to guide the incoming national emergency response efforts. Our idealized vision of our future communication success will happen IF we have the strategies and capacity to manage the information we will be asked to forward. I posit that to make that happen in a Cascadia earthquake situation we must utilize every resource, every ham operator who shows up, "Incident Command, ARES/RACES-trained," ***OR NOT SO MUCH***. We simply will NOT have the luxury of restricting our communications efforts to only ARES/RACES-trained hams. In addition, we ***will need-- we must have,*** a well-known, efficient, preplanned, effective communications process available, functioning, practiced, understood even by neophites, a technique with some power, able to handle lots of traffic, not just a few people with two meter radios.   We will need a system that can handle the great volume of message traffic that will come to flow through our radios for many, many contiguous hours and days and possibly, weeks. Such strategies and equipment will get us through the disaster, if we've thought deeply enough, planned for the unexpected, and built the systems to support our plans.

This then, is an attempt to both sort out our ARES operator staff shortcomings and to articulate a communication process that will work under great duress, one we can teach to rank emergency-preparedness beginner-hams, those that volunteer, appearing from nowhere but who are licensed hams. We will need them to carry-on when we've become exhausted.

In any major incident all available ARES-trained amateur radio operators will immediately be busy, assuming they are alive, with two tasks: taking care of themselves, their families and homes and businesses, and then using their amateur radio equipment and emergency response training skillsets to aid in relief efforts. Worst case, they will have become refugees at shelters themselves. In that circumstance they ideally will have recovered and brought along GO kits that include both health and welfare supplies, foods, clothes, medicines, etc., --and their radios, antennas, and batteries. After a bit, as organization takes hold, all ARES members will likely be sent to nearby fire stations or school gymnasiums or hospitals; that is where the need wil be and where they will be assigned by their EC/RO's. Even if their homes are standing and in good repair, somehow heated and lighted by emergency generators, few civilians will come to random residential well-appointed ham shacks for radio help, except perhaps the next door neighbors who know of that neighbor's radios. To be effective they (we) will have to be deployed to where the radio support is needed.

Minutes after an earthquake many of us will remember to check in to the just-forming emergency nets; some of us will become the first net control operators, getting those first frantic calls for help. Some of us will try to get to the EEC's to take incoming messages. (Anyone headed that way must let net control operators know they're going.) If no one's going,

someone will need to be "volunteered". How long before some one gets "volunteered?" Does your ARES group have an ECC deployment plan?

We will ALL be in shock even if not physically hurt. We will be frightened; our nightmare is now real! Hear this: having a comprehensive plan helps immensely: you and we will survive, if we follow our plans. Having a well-provisioned Go Kit is a tremendous security blanket; get it together if its not! Keep it in the back of your head that YOU may need to start the net and don't worry if you don't or can't get the wording right because you don't have the preamble at hand. It won't matter. As soon as possible (after you make sure all's well with your family), put out those first calls that bring order to the emcomm frequency, begin marshalling resources, finding out who'se available and what their issues are. Write it down, keep a log; shadow whoever is Net Control. Don't self-deploy anywhere unless you're the EC/RO or on the deployment list; just get on the air, check in and be ready for assignment.

Sounds good. But what's the big picture long-term? What's the overall plan; how will it work, in such a calamity, over the days and weeks and months? Here's where the problems for our hypothetical radio net begin: Assume that in the first hour after the earthquake 300 ham radio operators, most of whom are not ARES trained (one-fifth of Thurston County's hams, for example,) all try to "check in" on "the ARES" net, the one you just called to order--or on your simplex channel if the repeaters are down-- to report the many serious issues in their neighborhoods and homes. These non-ARES hams are mostly panic'ed, disoriented, unnprepared; many are in need of help for themselves or loved ones, and they need help right NOW! They will have time-critical, life or death traffic and little patience with other's interests and problems. How will you and your net deal with those dozens, if not hundreds of hams who will want to let people know they are alive and have that critical traffic, or are volunteering communicator services, and then, expecting a response from "the net" -- that's you Mr. Net Control, in a reasonable timeframe, i.e., minutes? If each time-critical check-in/report of a serious issue requires three or four minutes of communications time (two to receive, two to forward, assuming there's somewhere to forward to, waiting, not serving others), only fifteen to thirty check-in's and messages an hour are possible, less if there's qrm and interruptions. If you can be an authoritarian Net Control and your net operators pay attention and don't yell "BREAK BREAK" every time you release the mic button you have a chance at order and are a rare net control operator, indeed. For the most part, the understandable ineptitude of the hams calling in is a recipe for radio/repeater frequency bedlam, and then, believing the nets are all but useless, abandonment of the radio resources. What if the repeaters are down and you're on simplex and therefor, not heard by half the hams calling in (of course, we ARES members have our lists of alternative repeaters and worse case, simplex channels)? And, what if NO ONE goes to the ECC to accept your incoming traffic, or what if the ECC itself is damaged, or the EC/RO is not on the air?

Backing up a bit: In Thurston County our non-ARES customer is ostensibly and firstly the Department of Emergency Management, but there are also other hams, then maybe the Sheriff's office, local police, fire stations, hospitals, and disaster relief centers at schools or churches where we will be deployed soon, and they will become our customers too. As noted above, chaos will reign, and in its midst we must each be able to move to a new location and extablish reliable communications from wherever. Who assigns us those locations; where do we go? Our EC/RO of course, or our assistant EC/RO, or...the next in line in the chain of command. Do you know that list?

It seems logical to me that most of us will be assigned a facility nearest our homes; we spend 2/3 of our time at home, and it will be easiest to get to a nearby shelter after an earthquake.

At each shelter facility we are likely to find hundreds of displaced people looking for a way to get a message out. We may be their only hope.

Heres a partial list of who we will logically support: hospital's that will need to know of injuries coming their way; fire stations needing to know of large fires or EMT requests; police needing to know of dangerous situations; relief centers needing to know of requirements for food and water and beds, the power company will need to know of downed lines or poles, WSDOT needing to know of road or bridge issues or failures; the gas company will need to know of propane or natural gas leaks, the Red Cross, requesting food, water, beds, etc. In other incidents a process of finding people thought to be lost or at another, distant, shelter has been a big need. Thus, we will need a methodology for efficiently managing a volume of querys, for efficiently moving them from call-ins or walk-up's to responders, and back again. In this light, is the ubiquitous form 213 the best format for all these varying requests? Or is more than one type of form or communications methodolgy called for? How many such forms do you have in your ARES Operations Manual? After the quake, where will you get more?

In Olympia we have one most-used, "main" repeater system, the OARS's 147.36 / 224.46 / 441.40 Mhz system.

We have another seven or so "backup" repeaters on our list, including Capitol Peak, a repeater sure to be overloaded. We also have two truly portable two meter repeaters -- the OARS portable repeater, recently showcased by Ken K7TAG at an ARES meeting, and my own portable repeater (on 145.13, 88.5 h tone), used mostly for car rallies. Perhaps there are others I don't know of? These "backup" repeaters are unknown to most Thurston County hams, and thus, of much lesser value.

As noted before, assuming they were all operational and managed in the usual way, all repeaters would likely be overwhelmed by volunteers "checking in", and overwhelmed by message traffic. Moreover, the ECC has only a couple 2-meter radios, and if one talks it will probably jam the other--their antennas are within rock-throwing distance of one another.

We need an plan to manage all that message traffic, spreading it out, both on the intake and transfer sides. And, the ECC 2meter/220/440 frequencies will be a bottleneck.

On the message-intake side, I suggest that as these few repeaters are inadequate for the response workload we divide the county into areas, each area with an assigned <u>simplex</u> frequency, and as soon as possible put on TWO local ARES members--that's us, folks, TWO ARES members, as net controls on EACH simplex frequency.

Backtracking for a moment to our "main" repeater: Clearly we will not abandon our repeater; rather, it gets a different, critical task, with its own net control operator at the ECC. These are its two critical tasks: 1.) critical, life-threatening message handling ONLY, and 2.) communication of Instructions. Initially we will not use the other repeaters--even if the OARS repeater is down. In that case we will go simples. On our repeater, or on its simplex frequency we will broadcast from atop Tumwater hill, every fifteen minutes, a script, explaining what other frequencies are in use and who is using them, and some other instructions. Such a script will take three or four minutes to read-- but it is to be repeated as often as necessary, at least twice an hour. I propose that, between such scripts, ONLY life-threatening, critical, "Priority One" messages will be taken by the net control operators on the repeater/simplex channel itself, for the reason I mentioned earlier: In the ECC there can be <u>only one</u> two-meter radio on the air at any one time: more same-band radios interfere with each other. (There might be a fix for this, using repeater duplexer resonant cavities, creating narrow-band filters, but it would freeze our radios onto specific frequencies that might not work in our emergency. We need to study this.) Absent that technological fix I believe the ECC can only talk with only one repeater or one simplex two meter station at a time, even if there are more operational stations waiting. Longer-term It may be that several area simplex frequencies will be moved onto our "backup", available repeater frequencies, assuming those repeaters are up, but at any one location, like the ECC only one active rig per band works withoug QRMing the other station.

So, the above-referenced repeater-message-process involves a major change. It moves the vast majority of hams wishing to volunteer onto a new network of simplex (or possibly repeater) stations, once they become active and available. This doesn't really solve the problem: how to get multiple simultaneously-arriving messages to the ECC expeditiously, but it gets most of us, trained ARES operators, on the air as net control intake staff members, a critical issue, as the incoming messages can now be parsed and quantified by these ARES members, right off the bat. Again, In Thurston County after a major earthquake, approximately eight (?) simplex stations will be brought, as soon as possible, on-line, each staffed with a minimum of TWO operators to expedite the forwarding of incoming messages. These stations start out wherever the ARES members are, but become the stations at designated fire stations or shelters once deployed.

Here's the challenge: One operator will be on the radio with the "local," or "field" hams or taking locally created messages *and parsing them according to priority*, the other operator will be managing/forwarding the last, just-taken message. If there's more people they can help with locally originated messages; there will likely be a very busy radio area at a shelter, taking in traffic, posting responses received. Again, If these two operators, ideally sitting side-by-side at a shelter, both get on two meter radios at the same time, they will jam each other. That's the core issue at the ECC too. Thus, to forward incoming traffic, each shelter or team of two must have access to other bands, 220, or 440, for example.

If we had eight remote stations up, that's sixteen of our 28 ARES members. A minimum of two more are needed at the ECC. Over half our resources are deployed immediately! We can't sustain this for more than a dozen hours or so. Those eight field stations--sixteen operators-- need to begin identifying their immediate replacements, and getting them up to speed! They won't be ARES people; we need handbooks to hand them, for them to go through while we pull the first shifts and teach them the ropes. After we've been on the air for ten or fifteen hours they must be able to pick up the slack...but they've had no sleep either. How do we manage that, especially if there's aftershocks? We can't...no one will be able to sleep. Those first few days will be chaotic. We'll be working on adrenaline. If anyone can crawl into a car parked out in the open, and sleep...send them!

If those eight field stations all try to get message traffic to the ECC on 440 instead of two meters there is still the same message logjam, only now it's moved up to 440. The ECC has an almost unbreakable bottleneck, given today's "broad receiver" radios and the mechanics of the radio room at the ECC. We must find a way to allow rapid communication from and to the eight area nets, nearly simultaneously, from the ECC. This can't be done using fm voice radio systems; there's too much inbound traffic, too much chance for mispronunciations; each message takes too long; our voices will wear out. And, we'd need eight operators on eight different bands at the ECC to simultaneously take these eight incoming messages! Clearly, we need an alternative high-speed message pathway. The answer is, we go digital. We will use WinLink. Moreover, it should be UHF: 440 Mhz WinLink, so our digital signal doesn't interfere with those simplex two meter area nets.

Why UHF Winlink? Because a 440 Winlink station at a shelter can be operational while Net Controls utilizes a two meter station to talk with hams in their geographic areas without interference, taking critical messages over the repeater, announcing where local-area hams should tune.

High Frequency Winlink could be useful, but in my experience it's painfully slow, taking two minutes or more per message, and that's assuming there's no one else on the frequency, an assumption often inaccurate. Moreover as propigation changes HF propigation qualities change. On HF it's difficult to keep a really good WinLink session going over more than a few hours before skip changes the path. Meanwhile, UHF WinLink at 1200 or ideally 9600 baud takes just a dozen seconds to move a message, assuming good propigation, and several messages can be que'd and sent together. UHF WinLink, hosted locally, should be able to manage our eight shelter's transmittions.

At the ECC locally addressed, incoming WinLink messages from the eight simplex nets will of course go to the Incident Commander for management. Messages from the Incident Commander back to the eight simplex nets can be answered digitally. Messages for Camp Murray's Incident Commander will likely go via 80 or 40 meter HF or HF WinLink during the mid-day time, as direct 80 meter contact fades away, and probably two meter fm contacts via Capitol Peak's repeater will not be practical: there will be too much traffic.

We need to develop two overlaying maps: One, where we live and work, and the other, where our customers will be after an earthquake. That is, where the fire stations and relief centers are likely to be, where we will likely be posted. We need projections of the numbrs of survivors likely going to each of those shelters looing for aid. We need to anticipate how and where we will install radio systems and antennas at those shelters, and what our workoads will be. How many message forms will we need?

We need to agree on and publicize a list of frequencies and geographic   PAGE   4   locations for our simplex nets. Every ham should know of this plan. We need to develop a heirarchy for opening and operating each simplex net. I roughly propose such assignments below.

Staffing: As soon as possible after the incident volunteer hams should be brought up to speed. They should be invited in, briefed, and put on the air under the watchful eyes of ARES members. If not familiar, they need to know how to generate a WinLink message, and in general, the whole process. They should be put to work, freeing the ARES operator to rest. That operator should stay close to the operating positions, perhaps sleeping beside it, ready to answer questions and guide the volunteers. No one should work a shift longer than twelve hours.

Equipment: In my view, at a minimum each area's ARES operator(s) will need a 2 meter station, a preamble, a very large supply of form 213's, a 440 Winlink station including a printer, a battery power source, and a well provisioned personal GO kit, to keep them, and their families, from becoming victims.

ECC: I recommend we install a 440 Winlink system at the ECC. We need to have available one or several portable Winlink repeaters, perhaps powered by solar cells. A possible location for a permanent one is on Tumwater hill, at the Boy Scout headquarters. They are planning a generator back up system. Other sites might be Capitol Peak, or Crawford Mountain. Failing those, we can drive somewhere high and power a repeater from a car's battery--if we can find the people with the time. We will need to make this 440 WinLink system redundant amd reliable.

I recommend we have a complete WinLink gateway system in operation, used for emcomm activities only, and a plan for its replacement should it be damaged in the earthquake.

Here's a first draft of a VHF -fm repeater announcement to be read every 15 minutes or as often as necessary:

"QST QST QST This is _____, net control for the Amateur Radio Emergency Service. This message is to direct you to localized simplex nets that are manageing the flood of Health and Welfare messages we are seeing. Each of you are urged to tune to one of the eight simplex frequencies, all handling Health and Welfare messages. These areas and frequencies are as follows: Cooper Point and the NorthWest area: 146.40; North East area 146.42; Hawk's Prarie 145.44; Central Olympia 146.46; Tumwater, 146.48; Lacey 146.50; Yelm 146.54; Tenino 146.56. "

(There are other emergency nets planned; LDS church has its members committed to one, for example. My frequency assignment list will need to be built around these other networks.)

"Each frequency I just mentioned has two net control operators, alternating message reciept with message forwarding. Messages are being forwarded to the appropriate agency at high speed using WinLink digital technologies. If you have critical, life threatening message traffic only, we will now take it on this repeater for the next fifteen minutes, when this message will be repeated again. Does anyone need fills?   Ok. Is there critical, life or death traffic for the Police or Fire or EMTs? All other traffic should be sent in via the simplex links I just mentioned. Over."

What is the appropriate equipment for a Go Kit? In general, an inexpensive laptop with RMS Express and SoundModem on it, a Signalink (or equivalent) pc-to-radio interface, and a 440 radio and antenna with a long (100') coax, and a long (100') battery cable, and a 2-meter FM radio, antenna, long (100') coax, and another long (100') battery cable. A copy of the grey books' frequency lists, ARES operators callsigns, etc., preambles, and many, many copies of form 213 and blank paper, and pens, all in easy-to-carry cases, lockable, securable, are a minimum.   I recognize that this places a significant financial burden on our members. If we agree that every ARES member should have such a GO kit, could we get a grant for them, have them owned by DEM, and sign for them?

With respect to the 440 WinLink solution, there is another,parallel, more unique but possibly more effective option: a private WAN using Linksys routers. The ARRL book High Speed Multimedia for Amateur Radio describes everything we need to set up and use a High Speed Microwave Network. The book describes how to reprogram several brands of inexpensive routers to increase their power and cause them to create a "mesh network." Such networks have been deployed in a number of areas across the country very effectively. It's been done county-wide in Texas. Perhaps we could build a parallel mesh network, locating the routers right along with our 440 gateway stations, and gain internet speeds for our backbone communications.

One task we need to address, dramatized in the Indonesia tsunami's, that certainly will need doing is reuniting seperated families. Potentially time consuming and radio-intensive, it will be a major and needed task. Perhaps a file server fed by a WAN? Who would write the program, or does it exist? How will data be presented--pc's that can be used by the public, or paper printouts taped to the walls?

Suggested equipment: I recommend we apply for grants and acquire forty complete Go Kit radio systems that can be powered from a car's battery, including a VHF two-meter FM stations and 5/8 wave, magnetic-mount antenna, with 100-feet of quality feed line and 100 feet of battery cable, a 440 transciever and antenna and power and feedline, a Signalink USB interface, and inexpensive laptops capable of running Windows 7 or newer ($300 or so), and an appropriate carrying cases, with a locking cable. Every ham should have a personal Go Kit, ready for deployment. Meanwhile, I recommend each ARES member put together his or her own Go Kit, as grants are long-lead-time, uncertain providers.

A question we need to answer is where we get the power to run our radios for extended periods of time. Car batteries will last a few days at best. Then what? Low-power generators? Solar?

My focus has been rather parocial as Thurston County isn't a high-population-density county. If this disaster heavily damages Seattle or Tacoma or both, a version of this strategy needs to be articulated for those environments. I haven't got a good handle on the ARES relationships with those counties, or the sizes of their ARES memberships, but I can see issues with dozens of shelters trying to share the few simplex channels that exist. These frequencies, and multiple WinLink frequencies, need to be parsed for use, and advertized.

"Advertised" means that every operator should know what their emergency frequency is. In Thurston County I plan to mail every county ham a description of our plan, once the details are filled in, once frequencies and likely shelters are defined. In addition small signs, like the Kwanis use, will be affixed to roadside welcome signs at intersections: "146.42" or "147.54", for example. Every savvy ham will recognize that as a two meter frequency, a constant reminder of what frequency will be the active one in a disaster.

The above is certainly not the only way to handle the emergency. What other strategies might we enploy? What plans already exist? Doubtless there are dozens of undefined issues. What are they? Write them down! E-mail to KI7SS@arrl.net, or bring them to our next ARES meeting, please! 73

Notes: At the Comm Academy presentation several points were made:

1. CERT volunteers with FRS radios can be an extremely useful extension of the communications piplines, BUT the process of getting back to CERT volunteers with message results can be exasperating. Nonetheless, training exercises should include CERT volunteers to simulate real-world conditions.

2. The process of sending messages via WinLink over 440 MHz to the ECC has the potential to be a bottleneck inasmuch as not all WinLink 440 stations will be able to hear each other, and thus may transmit over each other and thus, jam each other's messages. A solution is to have the repeater net control station call each WinLink station in turn, giving each station a "clear channel". This idea needs development.

3. The Redmond WiFi group is way ahead of us in developing a dedicated WiFi system that will initially support their EEC and about seven fire stations. They are able to make it work at 900 MHz but going up to the desired 5Gig frequency band resulted in great difficulties in making and sustaining connections. They received two grants and were able to buy test equipment and enough operational gear to begin to understand the complexities, and admit the challenge of covering a wide area is daunting. Still, the reward, if they can make it functional, will be a lot of bandwidth for their customers. One question asked was why, if it could be done, wasn't the ECC and fire stations doing it themselves. The answers were the usual: money, and personel time. It will be instructive to learn how their efforts work out; perhaps next year they will have a model we can emulate.

Thank you for your many comments at the Comm Academy, and afterwards. It is gratifing to learn that these ideas have resonated as loudly as they have. 73.

Lee Chambers
KI7SS