

The Beginning of the Mid-Island AREDN Network

Ron Rowe, VE7RQX

In the very early days of the pandemic, a very small group of Amateurs from the communities of Qualicum Beach, Parkville and Nanaimo in British Columbia gathered on Zoom to talk about an interesting technology they'd come across called Digital Mobile Radio (DMR). Now, most Amateurs will probably roll their eyes to think that DMR is something "new", but for those on Vancouver Island – where the most common phrase is "that's not how we do it here" – DMR was a hard sell in a region of C4FM and System Fusion repeaters. Of course, AREDN – the Amateur Radio Emergency Data Network – was something unheard of.

I had been trying to bring up interest in AREDN and also HamWan – "a modern, multi-megabit, IP-based, digital network" at <http://hamwan.org/> – for six months prior to the meeting, but without success. Aside from a very small group of Oceanside Amateurs, the wider community was simply not interested in trying new technologies. The Mid Island DMR group is, by its very nature, a group of Amateurs interested in network technologies and trying new things so I felt safe enough to bring up the topic of moving away from Packet Radio to higher bandwidth technologies using the Microwave Bands allocated to Amateur Radio. Namely, AREDN and HamWAN.

As luck would have it, Amateurs in Nanaimo already had some Microwave equipment in storage from when they had provided communications support for the "Great International World Championship Bathtub Race and Nanaimo Marine Festival" (<https://www.bathtubbing.com/>). Although they were not familiar with AREDN, they were very curious about it as were the other Amateurs who attended the meeting.

Within a couple of weeks, several Nanaimo Amateur Radio Association members had pulled out their old Ubiquity gear, Internet phones (IP) and purchased some MikroTik hAPs and dishes. Soon Amateurs on the Mainland also took up the challenge as did those in Parkville/Qualicum Beach when a group order was placed with the Solimedia technology e-store in Vancouver.

Nanaimo has continued to act as the lead in the project and they made the decision to adapt AREDN instead of HamWAN because AREDN was easier to set up and operate. The end result of that initial DMR meeting is a regional AREDN network with one Emergency Communications save under its belt and big plans for the future.

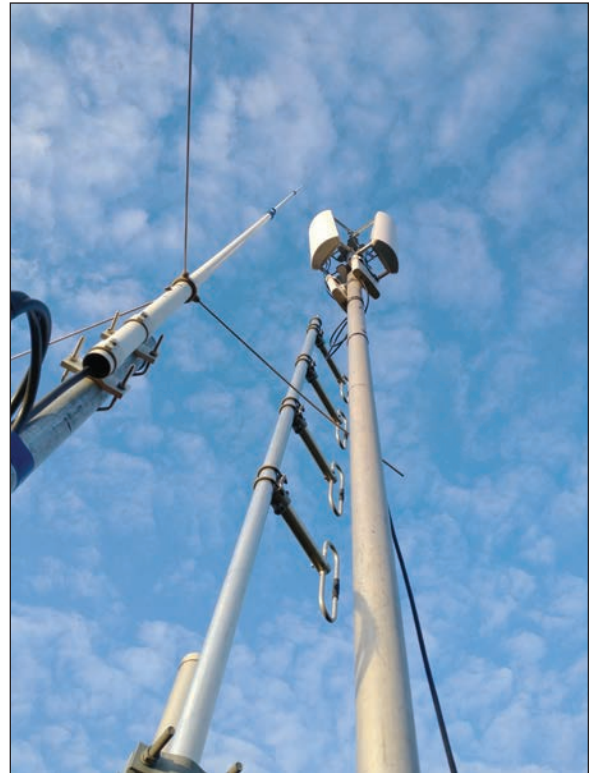
Ladysmith Amateur Radio Emergency Data Network (AREDN)

Devan Banman, VE7LSE

The first RF installation in our network was at Ladysmith, which is a town located on the 49th parallel north on the east coast of Vancouver Island.

I decided to just go ahead and purchase the necessary equipment to see how it all worked. I have a repeater tower here on the property and thought this would be a good location to try it out.

I installed 2 MikroTik 19 dBi sector antennas and ran the outdoor rated Cat 5 cable into the repeater shack and hooked it up to the Power over Ethernet (PoE) injector.



The data side of the PoE injector was then jumpered from each port to connect the two sector nodes together. Voltage from the 12-volt battery bank goes through a 12V to 24V converter and up to the sectors. A few days later Chris Anton, VE7TOP, and I went to Ladysmith just across the bay to see if we could make a connection. Lo and behold we had no difficulty making a connection. We thought, "this was pretty cool! Let's try another location a little further away." We then went south about seven kilometres and tried again and were still able to make a good connection. As a result, we happily announced that we had now had AREDN coverage in the Ladysmith area. More tests were conducted by Mike Lamont, VA7MLZ, and we also tried some Voice over Internet Phone (VoIP) connections with some success.

It was now time to get some users on the network. I installed a MikroTik dish at my house and pointed it up the hill to make a connection. It worked and got a great signal. My station in the shack consists of a MikroTik HAP, Cisco SPA 525 IP phone, a Raspberry Pi running FreePBX for a SIP (Session Initiation Protocol) phone server and the dish connected to my sector antennas. A short time later we got our Mount Benson high altitude site – 9 kilometres west of Nanaimo – installed with two 19 dBi sector antennas. Tests were done around the Nanaimo area and on Gabriola Island at first. Chris, VE7TOP, also did tests in the Parkville area with success.

In the summer of 2022, Andrew McPhee VA7ASI, and I worked on linking my sector nodes to his off-grid nodes on Salt Spring Island (see page 54). We initially pointed a dish from those nodes to Mount Benson's nodes. The distance between them was on the fringe of good signal strength and quality so we decided to try and link to my nodes instead. After pointing my dish at his we got great results with over 30dB signal-to-noise ratio (SNR). We were very happy. I'm now in the process of linking to the Mount Benson nodes in Nanaimo to complete the link from Salt Spring Island to the rest of the network over RF.

We have a few services running on the network now. Our main PBX phone server is hosted by Kyle McLaughlin, VE7ODG, in Nanaimo and it has been working great! I also host a backup one on a Raspberry Pi 3B. The two are trunked together so that they can both be used and you can call extension numbers from one to the other. We also have a link to the Alberta PBX phone system as well.

Some users have set up external phone numbers as landlines. Several of the Amateurs on the network are hosting MeshChat services for text messaging between users. We do have live flight tracking over the network and that is hosted on a FlightAware Flight Feeder Raspberry Pi setup you can get from FlightAware. It's pretty cool seeing the beacons from the nearby aircraft! As a group, we hope to start implementing IP cameras at some of the sites.

AREDN has been a fun and interesting learning experience and we hope you check it out!

Nanaimo AREDN – Chris Anton, VE7TOP

Jumping into something totally different in Amateur Radio like AREDN is always a lot easier if there is some existing equipment available to play with. We were fortunate that the Nanaimo Amateur Radio Association had a variety of Ubiquiti Rocket M5 transceivers, 5.8 GHz dishes and sector antennas tucked away in a cupboard. This gear had been purchased to set up video links to cover a local bathtub race. Think of a small planing hull married to a fibreglass bathtub and powered by a 10 HP outboard motor racing on a 25-kilometre course on largely open ocean. The project worked well and then the gear was stored away at our clubhouse.

After a lot of reading and research on the AREDN site it looked like we could try this “firmware flashing” challenge. First to flash was a MikroTik hAP and, after a number of valiant attempts, the Ubiquiti Rocket M5 transceivers were flashed and running AREDN. Tunneling across the internet between hAP units showed us how the AREDN software looked and how we could configure the nodes. Now the question was, could we talk to anyone using RF.



Chris, VE7TOP, doing the first RF tests from Nanaimo to Ladysmith (VA7DXX's QTH).



Kevin, VE7KGV, Devan, VE7LSE and Gord, VE7UY, completing the Mount Benson sector install.

One of our members David Evans, VA7DXX, has a QTH location on a high ridge south of Nanaimo. Using the Ubiquiti Airlink tool it looked like there was a 23-kilometre line of sight from there to a high elevation subdivision in Nanaimo. With a sector antenna at one end and a small and a medium dish at the other, we discovered how easy and well an AREDN connection could be made. The Airlink tool makes it easy. Drawing the line on the satellite view from one site to the other is simple. Zoom in on one site and then know you don't have to be able to see the other site, you only have to point to the street lamp a block away which lies directly under the Airlink plot. Amazingly with a little adjustment we had a good +20 dB connection and by driving to another high elevation site we had a 28-kilometre link.

Nanaimo sits on the east side of Vancouver Island and directly behind the city is Mount Benson with an elevation of about 1,100 metres. This site hosts a variety of VHF and UHF repeaters courtesy of Cercomm Electronics Ltd who have a commercial telecom site at the summit. If we wanted an AREDN site with great coverage this was the natural location. Sulo Poystila, VE7SUL, at Cercomm has always been a great supporter for the Amateur Radio community so he and his staff were happy to support our plan for the site. This is a great site with only one significant challenge. One third of the year the site is inaccessible due to snow and winter storms. Whatever equipment we mounted up there would need to be able to survive the winter and be stable enough to keep working without any maintenance.

The design was for two Ubiquiti 120-degree sector antennas mounted together, one pointed southeast and one pointed northwest to provide coverage all across Nanaimo and covering 80 kilometres along the east coast of Vancouver Island. Putting this all together though would require funds and the local Amateur community came together with donations to buy the antennas, the cable, mounting hardware, batteries and a power supply. All this was connected together and tested down below in a garage courtesy of Jack Olsen, VE7GDE.

Even in the summer access to the site is a challenge for any vehicle. Courtesy of Cercomm we were able to hitch a ride up to the site where they helped us get the antennas installed.

Fortunately there was an existing 4-inch mast located in the middle of the communication building which was perfect for this installation. Unfortunately, we had only brought 2", 2.5" and 3" clamps. The good news was that a length of 2.5" pipe was found underneath the building along with the necessary Sinclair pipe to pipe connectors so we were in business. The pipe was only long enough for one antenna but that was now operational. A huge thanks to Drew from Cercomm for doing the installation up on the edge of the roof with a huge drop down below.

Many weeks later a second trip up the mountain with a longer pipe was made. Gord Patalla, VE7UY and Devan Banman, VE7LSE, pulled everything apart and reassembled with both antennas in place. It was now September so we were running out of time. Tests had shown that the antennas were angled too far down. It was also pointed out by Dave from Cercomm that the entire installation was too high and might be subject to excess movement in the winter 160 km/h winds.

A third trip was made to raise the antenna angle, lower everything closer to the roof line and get ready for winter. Kevin Gerlach, VE7KGV, joined Devan and Gord for this trip. Amazingly it all worked with great coverage provided to small, medium and large dishes aimed from down below the mountain. We had one station connecting from 96 kilometres with a larger dish. Very small 6" square MikroTik SXT antennas worked from 10 kilometres while 18" and 24" dishes provide excellent connections out to 35 kilometres.

This installation has now been operational for 18 months without any interruptions in service. Our current network consists of Amateurs who are now connected over RF and tunnels (over internet) connections from Comox to the Vancouver area. In addition, we are connected to the AREDN network in Alberta which provides the network with MeshPhone and other neat services.

We have recently installed a sector antenna and link dish pointing to Mount Benson to bring AREDN to our main Nanaimo repeater site at Lost Lake. The sector antenna will be used to cover parts of the Sunshine Coast as there are a few AREDN active Amateurs over there. Currently connected to the system is Patrick Truchon, VA7FI, who is linked by RF to the Mount Benson site. He also graciously hosts the West Coast AREDN (www.wcaredn.ca) website for us!

Salt Spring Island AREDN – Andrew McPhee, VA7ASI

Amateur Radio Emergency Data Network (AREDN) is a game changer when it comes to throughput speeds. We have all sent Winlink messages over VHF, paused and waited for the connection, then the little green progress bar to migrate across the screen all while trying to minimize the size of our message. With AREDN that is not the case. Instantaneous send, Wi-Fi style data transfer speeds, VoIP Phone, live video feeds, chat features and more make up a very cool mode of communication to experiment with. Furthermore, in an emergency, having internet speed throughput is a game changer for communication!

Getting involved with AREDN can happen in a variety of ways. An initial approach is to check the AREDN map to see if there are any nodes that you might have line of sight with. You can find the map at: <https://www.arednmesh.org/content/aredn-map>

If there are nodes available then I encourage getting an antenna and a router. If there aren't any nodes, then you can still get started by getting an AREDN compatible router (<https://www.arednmesh.org/content/supported-platform-matrix>) and using your own internet to tunnel into the network and see what is there. With AREDN, you are using commercially available hardware and then flashing Amateur Radio firmware onto it for Amateur capabilities. Thus, making sure you have compatible hardware is key! There is lots of information on the AREDN website about this.



Gord, VE7UY, testing the VoIP phone connection after installing the Mount Benson sector antennas!



Devan, VE7LSE, performs the first test from Salt Spring Island to Mount Benson nodes.

The MikroTik hAP, which sells for about \$60, is the router that most people in the area use. This is what is needed if you want to connect a phone, computer, antenna etc. The bare minimum for connecting to AREDN is one of these and tunneling in. Solimedia is located over in Vancouver but is often sold out. I have also seen products available on eBay for similar price points but you have to look around.

For antennas, I am a big fan of the MikroTik LHG XL HP5 Which sells for roughly \$115. Again, these are often sold out so you may have to poke around for availability. Depending on proximity and visibility of the node you are trying to hit there are a variety of antenna options out there.

We were fortunate on Salt Spring Island to get a grant from Amateur Radio Digital Communications (ARDC) which gave us funding to establish a backbone link to the Vancouver Island Mesh Network and build it out to Fernwood School.

To achieve this we installed a remote node on Mount Belcher. For antennas, it consists of a 30 dBi dish on Ch 135 with a 5 MHz bandwidth pointed towards Mount Benson, which actually has a fantastic connection to a Woodley Range dish as well giving us two points of connectivity. There is a 16 dBi 120-degree sector antenna on Ch 133 with 5 MHz Bandwidth pointed at the north end of the island and a 27 dBi dish on Ch 140, 5 MHz pointed at Fernwood School.

We have 200 watts of solar power going through a Renogy MPPT Charge controller to replenish a 100 Ah LiFePO4 battery with self-heating technology for the cold days. In addition, we are using a Victron SmartShunt connected to a Raspberry Pi running Venus OS to give us remote battery monitoring capabilities on the network. In the box, we have a 12V to 24V up converter feeding a Power over Ethernet (PoE) injector to power the antennas. We are also using a 12V unmanaged network switch to allow all the antennas, Raspberry Pi and additional add-ons to talk to each other. Down the road we are hoping to add a pan/tilt/zoom (PTZ) IP camera to the site to help with wildfire detection and monitoring on the north end of the island.

At the time of writing this article, VA7ASI on the north end of the island and Fernwood School are both connected to the Vancouver Island mesh network through RF which is pretty exciting. Through conversations with other Amateurs on Salt Spring Island and nearby Thetis Island, there is a great deal of interest in using the infrastructure that has been created to join into the network which only helps increase the stability and viability of the network. I look forward to seeing the network continue to grow in coverage and include more hams in the surrounding area. A huge thank you goes to the Amateur Radio Digital Communications organization for providing the initial funding to get this project going on Salt Spring Island.

More info:
<https://wcaredn.ca/>
<http://www.ve7na.ca/aredn/>

Gabriola Island AREDN – Paul Giffin, VA7MPG

Starting in 2021 the Coast Emergency Communications Association (CECA) has been working in collaboration with the Nanaimo Amateur Radio Association (NARA) regarding the establishment of an AREDN network.

In a proof-of-concept program the Coast Emergency Communications Association worked with the Gabriola Fire Rescue to establish a link between the #1 Fire Hall and the AREDN site on Mount Benson. Due to the topography on both Gabriola Island as well Vancouver Island multiple challenges were encountered. While members of both organizations were able to install AREDN in their homes, the bulk of the connections was via the tunnel network. Radio links provided additional challenges.

Coast Emergency Communications Association maintains a radio room in the #1 Hall of the Gabriola Fire Rescue. This radio room not only serves Gabriola Island, but is part of the Nanaimo Regional District and the City of Nanaimo communications network. It also serves as a station in the Provincial Emergency Radio Communications System. The room has VHF, UHF and HF capability on both voice and digital modes. In addition a packet VHF/UHF node is operational 24/7.

The AREDN dish was installed on a 50-foot tower located at the old #1 Fire Hall. This tower provides the radio link to Mount Benson as well as a radio link to the new fire hall. As part of the AREDN network a phone was installed in the radio room. This phone was also associated with two different PBX locations on Vancouver Island. A phone number and a link to the Telus network was also installed.

In late November 2022, a storm hit the Georgia Strait Basin bringing very strong winds and a lot of rain. During this storm the aerial cable between Gabriola and Vancouver Island containing phone and fibre optic cables severed. It is my understanding that when the cable severed the ends of the cable came in contact with the high voltage lines that bring power to Gabriola island. When this occurred all communication as well as power was lost on the island. The population of 4,000 plus people lost their 911 and lifeline connections. In addition the bank and nearly all computers, cash



Gabriola AREDN Node temporary first set up on the roof with 40 watt solar panel and 90 Ah 12volts.

registers, ATMs and other equipment went out of service. In essence there were no communications.

Coast Emergency Communication members attended #1 Fire Hall and began their work. One of the first things that occurred was the local Fire Chief was able to speak directly to the Emergency Program Coordinator at the Regional District of Nanaimo via AREDN. This allowed the response to begin immediately even as the Emergency Operations Centre (EOC) was being activated.

It was subsequently learned that when the cable came in contact with the high-tension power lines there was damage to the power lines. While BC Hydro did their best they could not provide full power to the island for several days. It also took several days to repair the fibre optic and phone cables.

While there was never any doubt AREDN would work, the question was could we make it work given our topographical conditions, not to mention all the trees and water in our coverage area. What was set up as a proof of concept worked out very well in a real emergency. We are now working with the local medical clinic to see if they can be included in the network.

Bottom line is AREDN was there and worked well when it was needed. An excellent example of Amateurs working together to provide service to their communities.

<https://groups.io/g/Mid-Island-AREDN-Mesh-Network>
<https://www.arednmesh.org/>