

Long Range Digital Radio Public Safety Use Cases

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Long Range Digital Radio (LRDR) represents the evolution of HF long distance communications from analog based to digital for voice, messaging and data communications. LRDR is a long distance communications medium utilizing the HF spectrum to provide a voice quality and data transmission experience similar to cellular and P25 communications, while also providing the capability for encryption, IP and Ethernet connectivity and all standard HF capabilities. Public safety agencies, have been relying on modern land mobile radio (LMR) systems operating in the VHF, UHF and 700-900 MHz bands for over 50 years. These systems have provided public safety agencies with effective communications under most “normal” situations. However, there are public safety use cases that can benefit from LRDR systems to provide essential communications between remote operations and dispatch as well as within field operations in wide-spread areas of operation.

LRDR Basics

Long Range Digital Radio (LRDR) radio networks utilize the HF radio spectrum (2-30 MHz) along with advanced features to provide reliable P25-like quality voice communications over wide areas of operation. With proper system design and appropriate antennas, LRDR systems can provide communications from 0 to 500 or more miles.

Using Automatic Link Establishment (ALE), users select the station they want to call from a contact list and then the LRDR network selects the appropriate channel and connects with the desired station. The user does not need to have any technical radio knowledge or operator license to use their LRDR network.

Utilizing digital voice features, LRDR networks provide P25-like quality voice transmission that can cut through the radio interference commonly encountered on the HF bands due to the large amount of computer and communications equipment, radars and other modern “noisy” appliances and equipment prevalent in our radio environment. This feature also allows for single channel monitoring without the hiss and crackle of analog-only radios. Only signals from other stations in the network will break the silence.

LRDR networks can also provide bi-directional interconnection with the public switched telephone network (PSTN). This allows the LRDR user to call anyone with a landline, cell phone or satellite phone as well as receiving calls from those sources.

LRDR networks also support digital data transmission that provides users with in-network email, Internet email and SMS-like text messaging between stations in the network. Electronic forms can be exchanged in the network facilitating user data entry and improving transmission time – only the information, not the form design, is transmitted, then the received data is rendered into the form design on the receiving user’s screen. For example, users can create a message using the standard ICS-213 Message Form and the receiving station will automatically render the message back into the ICS-213 for physical delivery to the intended recipient. Applications can also be included in

the user’s LRDR connected computer using the LRDR network for transmission between users and cloud servers.

LRDR networks can also leverage IP connectivity to provide “blue sky” network support, remote network operations and testing as well as remote maintenance. These features are used to ensure the immediate readiness of the network to support emergency needs. Local control of LRDR transceivers located at an incident base or ICP and be easily distributed within the base or ICP using a local area network or wireless LAN.

Wildland Fire Response

Wildland fires often occur in areas with poor or non-existent LMR coverage. Initial response, as well as reinforced response in the first few operational periods may be forced to operate with very limited radio communications until incident-specific LMR repeaters can be placed into service. Placing these repeaters on appropriate high locations to provide incident coverage can also be very challenging. Fire conditions, availability of repeater systems, and technical staff as well as road/helicopter access to suitable radio sites are all challenges in establishing incident-specific LMR networks.

If initial response overhead and later division and branch supervisors are equipped with LRDR integrated with their LMR system (typically VHF for wildland fire), those supervisors will be able to communicate with dispatch and the Incident Commander/Operations Section Chief immediately upon arrival at their assignment. This will greatly improve the safety of their personnel and allow for much better common operating picture and coordinated management of fire suppression efforts.

Using integrated LMR/LRDR equipment in these overhead vehicles will allow for access to the LRDR circuits from the user’s LMR devices, including handheld radios. This can provide service back to

the Incident Command Post (ICP), dispatch, and other overhead on the LRDR network with capability similar to incident specific repeaters placed on high ground.

Backcountry/Wide Area SAR

Much like wildland fires, many Search and Rescue (SAR) incidents are conducted in remote backcountry areas. SAR teams, and their supporting agencies, generally do not have established LMR systems that provide radio coverage in remote areas of their jurisdictions. So, SAR incident communications unit leaders have to deploy portable repeaters, manual relay stations, or fixed wing based repeater relays to provide communications to field resources. In addition, ICPs are also often located in areas without LMR and cell phone coverage making it very challenging for the Incident Management Team (IMT) to maintain contact with their support dispatchers to coordinate resource requests and other support.

Equipping SAR communications support vehicles and overhead personnel with mobile or portable as well as fixed station LRDR systems at their support facilities (such as Public Safety dispatch) will allow them to establish and maintain contact regardless of how remote the ICP location. If their LRDR network includes a telephone interconnect, the IMT will be able to make and receive telephone calls. If their LRDR system includes digital data options, email and text messaging services will also be available at remote backcountry locations.

Loss of Line of Sight (LOS)

Many modern LMR systems depend on line of sight (LOS) links to connect remote receivers and repeaters to provide continuous coverage over the supported area for the radio system. These LOS links may use microwave or UHF (400-470 MHz) equipment. Depending on the design of the LMR system, loss of an LOS link may greatly reduce or eliminate coverage in a portion of the LMR radio network's area of operation.

Depending on the location of the LOS outage, weather and road conditions etc., restoration of an impacted link could take many hours to days. In the meantime, LMR coverage would remain impacted. LRDR can be used to temporarily replace an impacted LOS link. The LRDR system can be integrated into the equipment at both ends of the LOS link and replace the LOS functionality until it can be repaired. LRDR support should be planned in advance and suitable equipment pre-positioned at remote critical links so that it is ready for immediate activation and support of the LMR system.

Wide Area Disasters

A common thread in many wide area disasters is that normal communications systems are impacted limiting the ability of first responders, EMS and critical infrastructure restoration teams to communicate with their dispatch centers, ICPs, Emergency Operations Centers (EOCs) and interoperate between agencies and jurisdictions. Restoration of damaged communications systems can take some time as well as the deployment of cellular and broadband equipment to create temporary areas of communication coverage.

Forward looking public safety agencies can pre-position LRDR equipment in supervisory and communications support vehicles. With pre-positioned LRDR equipment and the pre-planning associated with such progressive efforts, temporary replacement of disaster impacted communications systems can be activated within minutes and provide critical command and control communications for that agency. LRDR equipment can be integrated with the agency's LMR system providing even more capability down to individual personnel and apparatus.

Pre-positioned LRDR systems can also provide immediate interoperability between public safety agencies, EOCs, critical infrastructure providers, non-governmental agencies and Federal response agencies. LRDR can provide both high quality voice links as well as reliable, but small bandwidth, digital data capability.

Isolated Work Areas

In many areas of the country, public safety agencies have repeater sites located in very remote areas. One characteristic of many of these locations is that the only communications to those sites and portions of the route to them is the LMR system located at the site. Personnel dispatched to repair such a remote site that is off the air, are required to operate without any communications with their dispatchers or others. If they need emergency assistance, or just some help from others not travelling with them, they have no way to communicate out or be contacted.

If equipped with an LRDR radio that is a component of an agency system, these crews could remain in contact with their dispatch center while traveling and operating in this "dark territory". Mobile or portable LRDR equipment can be permanently or temporarily installed in service vehicles or, in the case of a portable system, quickly established at a remote site. Leveraging LRDR system capabilities, the repair personnel could have access to bi-directional telephone calling as well as integration with their LMR equipment allowing personnel to roam around a remote site and remain in control of their vehicle-based LRDR system.

State-Wide Crisis Interoperability

Wide area disasters, large scale cyber attacks or electromagnetic pulse (EMP) events or attacks can significantly impact normal communications systems and thus inhibit state-wide interoperability. Voice phone service (landline and cellular), internet and even satellite phone service can be disrupted or unavailable. This impact, in turn, will slow down and otherwise inhibit inter-county mutual aid and both state and Federal support during the initial critical hours and days of the incident. Inter-county and state communications provide a path for the exchange of situational awareness common operating picture (COP) information, requests for mutual aid and other support and responses to those requests.

Forward looking state and local emergency management agencies should implement coordinated and well-planned LRDR statewide networks to provide a resilient and survivable communications system to augment or replace normal communications systems. Implementation as a coordinated system will ensure that the LRDR crisis network will be well maintained and ready to support operations within minutes of the impacting event. Ad hoc networks with agencies bringing their own radio, although better than nothing, will fall way short of the capability and reliability of a pre-positioned single-entity managed statewide LRDR network.

SHARES

The **SH**ared **RES**ources (SHARES) High Frequency (HF) Radio program, administered by the Department of Homeland Security's (DHS) Cybersecurity and Infrastructure Security Agency (CISA), provides an additional means for users with a national security and emergency preparedness mission to communicate when landline and cellular communications are unavailable. SHARES members use existing HF radio resources to coordinate and transmit messages needed to perform critical functions, including those areas related to leadership, safety, maintenance of law and order, finance, and public health.

The SHARES Program was approved by the Executive Office of the President in 1988. The SHARES Program brings together existing HF emergency radio resources of Federal and federally affiliated organizations when normal communications are overwhelmed or destroyed. Federal, state, and industry entities that request access to the SHARES nation-



wide network identify their HF radio stations for inclusion in the SHARES station directory. These stations agree to use standard radio operating and message formatting procedures when handling SHARES message traffic, and participate as they see fit in "on-the-air activities" such as quarterly national exercises and weekly tests to maintain SHARES operational readiness.

SHARES resources can augment Federal, State and local governments, critical infrastructure / key resource providers, and non-governmental organizations (NGOs) with backup communications, interoperability, and situational awareness.

SHARES is available 24/7 to provide a radio communications link to support intra/inter-agency mission requirements with national security and emergency preparedness backup communications. SHARES can support voice and data operations including file transfers.

In Summary

By electing to acquire and deploy an LRDR system using modern HF radios with their advanced features, you will have a highly user friendly, resilient and dependable radio system that can support day-to-day operations as well as meet contingency communications requirements. Work with your value-added system integrator to leverage these capabilities and build a system that will exceed your needs.

About NVIS Communications, LLC

NVIS Communications is a systems integrator and the exclusive partner/distributor for CODAN HF equipment in the US, Mexico and the Caribbean. NVIS works with critical infrastructure, i.e. electricity, gas, oil, water, telecommunications and cable TV broadcasting, as well as public safety at the federal, state, and local levels to help them design and implement resilient communications systems built on an HF-ALE core. NVIS also works closely with the Department of Homeland Security's SHARES program to further critical infrastructure entity participation in SHARES.

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