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Common Challenges with LMR Backhaul

Land Mobile Radio (LMR) systems, such as Alaska Land Mobile Radio (ALMR), are critical communications networks used by public safety agencies that provide a dedicated means of connecting first responders in real-time where every second counts during emergency situations.

A reliable backhaul network is crucial for ensuring always-available communications between first responders, improving situational awareness, and ultimately saving lives. Maintaining these extensive networks for LMR communications requires proactive monitoring as well as rapid fault detection allowing for quicker resolution of issues.

LMR systems have rigorous requirements for parameters such as latency, jitter, and packet loss. These systems also have extremely fast convergence requirements, which present unique challenges for monitoring and maintenance.

In the context of network backhaul, site links refer to the connections between radio sites and a centralized radio core or master site. When a site link is degraded, it may result in reduced data rates, increased latency, and reduced voice quality.

A degraded site link can be caused by several factors, including weather conditions (such as heavy rainfall or snow), equipment malfunctions, or interference from other radio frequencies. Degraded site links can have a ripple effect on the rest of the network, causing congestion and reduced performance across the entire network.

To address this issue, Alaska Public Safety Communication Services (APSCS), implements robust network monitoring and maintenance practices to detect and remediate these degradations quickly. This requires real-time monitoring and reporting on the network's performance of both the LMR and the backhaul. They also must have backup systems in place to ensure continuity of communications in the event of link degradation.

Equipment failures are another common problem APSCS administrators face, and they can significantly impact the functionality and performance of the network. Equipment failures can be caused by a variety of factors, including power outages, component failures, and physical damage.

Power outages can occur due to weather events, grid failures, or other reasons. They can cause equipment to shut down or fail, resulting in network downtime and disruption to communications. To mitigate the impact of power outages, backup power systems, such as generators or battery backups are used, however, these systems are often costly to implement.

Component failures can occur from wear and tear (aging equipment) or manufacturing defects. Components such as power supplies, transmitters, and receivers can fail, leading to reduced performance or complete failure of the network. APSCS technicians implement regular maintenance practices, including equipment inspections, to identify and replace faulty components before they cause disruptions to the network.

Finally, physical damage to equipment can be caused by environmental factors like weather, vandalism, or accidents. Physical damage can impact the functionality of the equipment, leading to reduced performance or complete failure. Having spare equipment on hand is a must for every component in the network.

(Article prepared by Mr. Paul Fussey, ALMR Operations Manager with excerpts from the July 2023 online article, *Common Challenges with LMR Backhaul* by Dan Havens)

APCO Announces Final Approval and Publication of Minimum Training Standards

The Association of Public-Safety Communications Officials (APCO) International is proud to announce final approval of APCO ANS 3.103.3-2025 Minimum Training Standards for Public Safety Telecommunicators.

This milestone represents a major update to the standard, which APCO first published in 2010 and last revised in 2015. The new version reflects the realities of modern emergency communications, where telecommunicators must navigate advanced technologies and increasingly complex operational demands.

APCO convened 9-1-1 professionals from across the country—representing emergency communications centers (ECCs) of different sizes, regions and operational models—along with industry partners to update the standard. Their collaborative effort produced a forward-looking standard that addresses current best practices and emerging technologies reshaping emergency communications.

"Public safety telecommunicators are the critical first link in the emergency response chain, and this updated standard reflects our commitment to their professional development," said Jack Varnado, president of APCO International. "By establishing clear training benchmarks and career progression pathways, we're empowering ECCs to build stronger, more capable teams ready to meet the evolving demands of public safety communications."

The standard outlines core competencies telecommunicators need to effectively manage calls across law enforcement, fire, and EMS. Key areas include call taking procedures, dispatch protocols, communication skills, system operations and incident coordination. It also promotes ongoing professional development beyond initial training.

The revised standard tackles pressing workforce challenges head-on. By providing clear, comprehensive training guidelines, it helps agencies combat burnout and turnover while better equipping telecommunicators to handle the high-stress nature of their work. A well-structured training program can make the difference in both recruitment success and long-term retention.

(Article prepared by Mr. Paul Fussey, ALMR Operations Manager with excerpts from the November 7th, 2025 APCO international PSC news)

ALMR Tower Technicians

The Alaska Land Mobile Radio (ALMR) and the State of Alaska Telecommunications Systems (SATS) towers range in height from 20 feet up to 300 feet. The individuals who work on and maintain these towers must be ready to respond year round and in inclement weather.

The work is physically demanding and some possible hazards from this work include falls from great heights, electrical, falling objects, equipment failure, structural collapse of towers, and improper rigging and hoisting practices.

All tower technicians are required to take recurring training every two years to maintain Occupational Safety and Health Administration (OSHA) and American National Standards Institute (ANSI) certification.

ANSI/ASSP A10.48-2023 establishes minimum criteria for safe work practices and training for personnel performing work on communication structures including antenna and antenna supporting structures, broadcast, and other similar structures supporting communication related equipment. This American National Standard serves as a resource, outlining many construction and maintenance practices. It provides comprehensive specifications that encompass the entirety of the tower construction, service, and maintenance industry.

The tower technicians are also required to complete wilderness first aid training as many sites are in remote areas, to include mountain tops, tower rescue training and they are trained to work around running helicopters. They are an integral part of the system and can sometimes work long hours to keep ALMR and SATS operational for all agencies.

(Article prepared by Mr. Paul Fussey, ALMR Operations Manager)

ALMR Operating System Update.

The Alaska Land Mobile Radio (ALMR) is currently operating on the ASTRO 25 software system version 2021.1. ALMR receives frequent updates for security measures and randomly upgrades all of the dispatch consoles in conjunction with the dispatch centers across the state.

The 2021.1 version was released on January 13, 2021 and standard support ended on January 13, 2025. It has been announced that the extended support period will end on January 13, 2028, leaving ALMR with only two years to upgrade to a current system release.

ALMR is a joint DoD, State, and Municipality of Anchorage system. To maintain security and supportability, the operating software and hardware should be updated every two years. A two year update cycle optimizes cost, feature support, and cybersecurity. To ensure the system remains viable, the ALMR partners each need to obtain funding, execute a contract, and complete a complex system upgrade project to update to a current system release.

(Article prepared by Mr. Paul Fussey, ALMR Operations Manager)

APSCS Tower Types and Maintenance

There are two basic types of towers: guyed and self-supporting. A guyed tower is a slender steel structure supported by one or more levels of high-strength steel guy cables that anchor it to the ground. In contrast, a self-supporting tower can be a three- or four-sided steel-lattice pyramid, box, or tubular monopole.

A guyed tower requires much more land than a self-supporting tower because the guy cables are usually anchored to the ground at a distance from the base equal to about 80% of the tower's height. For example, a 250-foot guyed tower may require more than four acres, whereas a 250-foot self-supporting tower requires less than one acre.

Comparing the cost of towers requires an examination of an entire list of expenses, including materials, erection time, shipping and land requirements. The material expense for guyed towers typically is less than for self- supporting towers because less steel is used. Most foundations for guyed towers cost less than those for self- supporting towers because they usually are smaller, requiring less concrete. Because less steel is used, on -site construction time for guyed towers is generally less than for self-supporting towers.

Guyed towers with 20-foot- long, solid-steel, pre-welded sections can be erected even quicker than formed-plate guyed towers, further reducing erection costs, but they may be more expensive to ship because of their weight and volume. Although these comparisons may make one think that a guyed tower costs less than a self-supporting tower, that may not be the case because of land requirements.

The State Communications shop uses contractor PE licensed engineers and references the TIA Structural Standard ANSI/TIA-222-1 for guidance and installation standards.

In general, annual inspections are recommended for all types of towers. This includes checking tower and antenna bolts, safety ladders, cable bridges, pressurization equipment, weatherproofing, lighting, grounding, and foundations.

Guyed towers may require more frequent maintenance than self-supporting towers. The guy cables should be inspected for proper tension and to detect corrosion. Proper tension ensures that the tower is supported correctly and that there is minimal deflection of antennas caused by the twisting of the tower. Alaska land Mobile Radio (ALMR) and Alaska Public Safety Communications Services (APSCS) towers are located on a variety of State, Private, Native and Federal Government lands. Depending on who owns the land, APSCS is required to conduct annual site inspections, take aerial photographs and pay to lease the property.

Selecting the right tower for the job depends on various factors, including radio and microwave dish antenna size and weights, soil conditions, wind and ice loading conditions, and temperature and weather conditions based on regional data. Numerous mathematical equations and formulas are used to ensure safety is a priority. Engineer of Record (EOR), competent riggers, and qualified tower climbers work together to install and maintain a large variety of towers through the entire State. This requires extensive and recurring training while adhering to strict safety standards aligned with ANSI, ASSE, and OSHA guidelines.

Additional specifications might include Uniform Building Code (UBC), Building Officials and Code Administrators (BOCA), Southern Standard Building Code (SSBC), or specific government agency requirements in the area where the tower will be built. These specifications are in addition to the limitations stated in permits issued by the Federal Aviation Administration (FAA) or Federal Communications Commission (FCC). All codes will affect the factors used to determine loading requirements.

Tower site construction involves many steps: building an access road; bringing in electric and phone lines; erecting a fence and installing other security measures; providing and installing the equipment shelter; erecting the tower and installing transmissions lines and antennas; and testing alignment of all lines and antennas. In Alaska, there is the added cost of helicopters and pilots as many sites are on mountain tops.

Many ALMR and APSCS towers are shared with other agencies and this can be broken down even further for specific equipment. There is not a one size fits all for the tower sites and maintaining a good working relationship is imperative for site maintenance. An example of this would be the land owner of the tower site is the Forest Service, APSCS maintains, the microwave dish, utilities, and the Alaska Railroad maintains the alarm system, the multiprotocol label switching (MPLS), and the site phone.

Towers are more than just a metal fixture and they require coordination, engineering, time, money, and many hours to build and maintain.

(Article prepared by Clayton Childs, APSCS engineering supervisor, with excerpts from the Urgent Communications article *The ABCs of communication towers, February 1996,* and APSCS policies)

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Radio Frequency (RF) Evolution

Radio Frequency (RF) technology first began in 1864 with James Maxwell's theory on Electromagnetic Waves (EMW) traveling at the speed of light in free space, and that light was an electromagnetic phenomenon. Then 20 years later, Heinrich Hertz experimenting in the laboratory, proved this by generating and detecting radio waves, showing that they had wave-like properties, and to commemorate his achievement the units of frequency are called hertz (Hz).

A number of distinguished scientists assisted with the discovery of "wireless telegraphy," but work done by Guglielmo Marconi, an Italian radio-frequency engineer, inventor, and politician, known for his creation of a practical radio wave-based wireless telegraph system, which used the EMW for transmitting and receiving information is the most important. He commercialized the use of wave propagation for wireless communication. Wireless telegraph and Morse code, became a faster means of communication, and a business, which replaced pigeons and flags for maritime communications.

Different forms of communications such as, Telegraphs, broadcast, telephone, and point-to-point radios were already available before World War II (WWII), and it continued during and after WWII to facilitate longer distances, which is when relay systems were employed.

It was only in 1959, J.R. Pierce and R. Kompfner laid the groundwork for modern satellite communications, which opened another era of global communications.

(Article by Mary Burnham, ALMR Document Specialist, with edited excerpts from Wikipedia and Nanyang Technical University—https://www3.ntu.edu.sg/home/eccboon/DIP%20website/RF.html)

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2025 ALMR Statistics

ALMR had another robust year of usage statewide. There were 20,096,810 calls, a 12% increase, 31,645,127 push to talks (PTT), a 9% increase with only 7059 busies for .0223% of the total PTTs. There are over 32,000 subscriber units on the system.

The ALMR team looks forward to assisting all of our members to have another safe and successful year in 2026.