

Introduction to Wyoming

Welcome to the State of Wyoming, covering some 97,200 square miles. For the geographically challenged, Wyoming is north of Colorado, south of Montana, east of Idaho and west of Nebraska and the Dakotas.

This is Cowboy Country, and the population of 500,000 has traditionally been independent and self reliant. The two largest cities of Cheyenne and Casper total about 20% of the total population. Major tourist destinations include Jackson Hole and its nearby ski facilities. Wyoming has also long been a favorite locale and setting for the motion-picture industry.

Wyoming's geography varies from the high plains in the east to the Rocky Mountains in the center and the Tetons in the west. Yellowstone National Park, the Great Divide Basin and Devil's Tower National Monument are several examples of the natural beauty of our state.

Public Safety Communications

The natural terrain presents a number of challenges to the public safety communications planner. Wyoming agencies, like many others, started out in the 50's and 60's on the VHF low band around 42 MHz. These systems were simplex for the most part, and were replaced with repeater systems when migration to the VHF high band around 155 MHz took place in the 70's. These systems retained their simplicity even to the present day, as evidenced by the Wyoming Highway Patrol system of 1 repeater pair, on 21 mountaintops, using different PL tones.

The demands of modern-day interoperability are rapidly outstripping the capabilities of these simple, reliable legacy systems. Wyoming has embarked on a path of updating and modernizing its communications systems to meet present-day and foreseeable future needs. We began by contracting with Federal Engineering to research our capabilities and shortcomings, compare our needs to available technology, and develop proposed solutions for our consideration. After much debate, it was decided that a statewide trunked radio system on VHF would best meet our present and future requirements at the most reasonable cost.

The WyoLink System

The State of Wyoming is currently in the process of procuring, constructing and implementing a State-wide VHF trunked radio system to APCO digital P25 standards. The WyoLink system will comprise some 57 high-level mountain-top sites, with an additional 23 low-level sites to be located in the County seats of the 23 Counties in Wyoming. Begun primarily to meet the needs of the State, it is expandable to be able to include all agencies within our borders that wish to join up and participate. To date, governance has been under the auspices of the Wyoming Department of Transportation, by way of a Public Safety Mobile Communications Steering Committee. Legislation has passed to establish a state Public Safety Communications Commission that will start up on July 1, 2004. In addition to continuing the work of the Steering Committee, it is expected that the new PSCC will also serve as the Region-46 800 MHz Regional Planning Com, as well as the Region-46 700 and 4.9 GHz RPCs and the SIEC.

Design

The WyoLink system will be an APCO P25 digital trunked radio system. It resembles the Alaska and South Dakota systems in that it will operate in the VHF radio spectrum. It will also be fully compatible with the Integrated Wireless Network IWN envisioned for national federal implementation. The system will use the existing statewide 6 GHz digital microwave system, already in place in south Wyoming and currently in the implementation phases in north Wyoming. The master system controller will be in Cheyenne, with a complete, parallel and redundant hot-standby controller 190 miles away in Casper. Integrated low-speed 9.6 data, AVL, encryption and other advanced features will be incorporated in the WyoLink system. The system will support MDT use, generally associated with CAD systems, for small agencies and departments that do not have a CAD system in place. Provisions have also been made for "roaming" MDT users from outside the state that wish to access MDT services while operating in Wyoming.

Funding

The initial WyoLink system build-out will include the trunking system with 57 high-level sites and 11,700 subscriber (mobile/portable) units. This initial system is budgeted at \$51 million installed. The governor has adopted the WyoLink system as a high priority for our citizens. Currently, the first segment as a demo project has been funded at \$5.1 million. Given that Wyoming was one of two states to run a budget surplus last year (\$1.4 billion) and that recent reports show that revenue collections this year are running ahead of projections, we feel confident in expecting that continuing WyoLink funding will not be a problem.

Procurement

From the outset, the WyoLink Steering Committee has been committed to an open, competitive systems procurement. The WyoLink project manager, Tom Mahon, is in the process of preparing a comprehensive Request For Proposals document for the system. The RFP has a target date to be "on the street" by June 28th. RFP replies are due to WyDot by September 20th. It is expected that Announcement of Intend to Award will be made by October 7th.

The system implementation will begin with a Pilot Demonstration phase in southeast Wyoming. This phase is expected to be operational in October of 2005. Approximately 90 radios will be distributed to user agencies in Laramie and Albany counties, including the cities of Cheyenne and Laramie. The intent is to intensively test the system from the initial 5 sites to be built, prior to rolling out the system state-wide. It is expected that the system will be built to 60% in phase 2 in 2006 and completed state-wide in phase 3 in 2007.

System RF Plan

The WyoLink system is intended to be a six (6) voice channel system. With the control channel, a total of seven (7) pairs will ultimately be needed at final build-out. 7 duplex channels in service at 57 high-level and 23 low-level sites means that the system will be using the equivalent of (80 sites * 14 frequencies) 1,120 site-frequencies. This is viewed as something of a challenge at VHF, one that would require some detailed RF systems and design engineering. The system design would also have to go through formal frequency coordination for FCC licensing as an exclusive-use FB8/MO8 basis and on a slow-growth implementation.

Several steps are necessary in order for the system to be put on the air. An RF system design is needed to determine configurations, frequency coordinations are needed to find usable channels for the configuration, and formal applications need to be prepared and submitted for FCC license authorizations to operate the system. A number of organizations are capable of the RF system design, and the license applications. The frequency coordination work, however, must be done by a FCC-recognized frequency coordinator.

In the interests of accountability, traceability, simplicity and efficiency, it would be best if the entire planning and licensing effort could be conducted by one firm. A review of the engineering problem and licensing requirements, with the KISS principle in mind, led us to look at the possibility of finding an organization that could offer one-stop shopping of the engineering and licensing services. All four of the FCC-recognized frequency coordinators APCO, AASHTO, FCCA and IMSA were contacted to ascertain their interest in the project. We asked specifically what parts of the work could be done in-house, and which parts would have to be contracted out.

All of the coordinator services and their contacts were very cordial and helpful, and their candor and frankness much appreciated. AASHTO and IMSA indicated that they would have to plan to contract out a significant part of the work, most likely to RadioSoft. FCCA likewise indicated a need to contract out much of the work, in their case with Fox Ridge. As a relatively larger organization, APCO was able to commit to doing all of the work in-house, and would contract out work only in the event of an unforeseen overload. It was decided to enter into a negotiated contract with APCO to design, coordinate and license the entire WyoLink system. This effort is currently under way, with a projected completion of December 2004.

This effort is entirely separate from the general WyoLink system procurement, for several reasons. We did not want to unduly delay the RF design and licensing, which would run the risk of losing some VHF frequencies due to licensing activities by other entities. We wanted a level playing field for the system procurement by RFP, by eliminating the channel and licensing variables from the RFP process. Also, we preferred to do it ourselves rather than have a vendor do it for us, as part of the RFP, at a marked-up additional cost.

Frequency Planning

The WyoLink system is intended to meet the needs of public safety agencies in Wyoming for the foreseeable future. The FCC will be mandating the move to narrowband technology for all VHF systems at some point, so it is only prudent to implement the new system on narrowband channels from the start. The RF plan contract with APCO therefore specifies that the system will be designed to use narrowband channels.

The VHF band is the most heavily-used radio band for public safety in the US. Several reasons account for this popularity, among them a wide range of available equipment at correspondingly reasonable prices and very favorable propagation characteristics. These factors undoubtedly contributed to the fact that a significant part of the public safety users in Wyoming are on the VHF band. These are all selection factors that led the WyoLink system to adopt the VHF band also.

The VHF low (30-50) and VHF high (150-174) bands began to see substantial land mobile and public safety usage in the post-WW II era, from the late 40's to the late 50's and early 60's. Mobile relay station, or repeater, use was beginning to become popular and desirable as a way to enhance communications. When the UHF band was made available in the early 60's, it was specifically set up to support the new repeater mode of operation. The earlier VHF bands had seen repeaters, but they had had to be implemented in a somewhat haphazard manner, due to the lack of a formal bandplan that would support repeater operations.

There is a movement underway, as evidenced by discussions within national communications groups, to look at the desirability and feasibility of re-banding the VHF high-band radio spectrum. Intended to take place in conjunction with the upcoming transition from wideband to narrowband, the re-banding is intended to realign the VHF band to better and more cleanly support the use of mobile relay stations, also known as repeaters.

Part of these discussions included a submission from Floyd Ritter in Utah, outlining a proposed VHF realignment. Floyd examined the current VHF public safety pool allocations and identified an interesting pattern. He found that there are about 30 frequencies in the 151 MHz range, about 60 frequencies in the 154/155 MHz range and about 30 frequencies in the 158/159 MHz range. Looking at the need for transmit/receive spacing requirements for repeaters, Floyd's plan proposes that the 30 frequencies at 151 and the 30 frequencies at 158/159 be used as input frequencies, and paired with the 60 frequencies at 154/155 that would be used as repeater outputs. For the discussions, he developed his plan further with some recommended frequency pairings to produce repeater pair channels.

The Ritter plan looks very workable from a spectrum management standpoint. It is a logical layout of frequencies that yields a T/R split in the vicinity of 4 MHz. It has all of the repeater outputs in the center of the band, which lends itself very well to transmitter combiner designs and implementations. It has the inputs separated into 2 separate sub-bands, which gives flexibility for frequency coordination - if one sub-band is congested, use an input from the other sub-band. For trunking systems, a dual window filter can be used ahead of a receiver multicoupler, allowing both input sub-bands to be used.

The Ritter Plan is a draft proposal and needs to be reviewed carefully. We have examined Floyd's plan and expect that some version of the Ritter plan will be implemented at some point in time. As mentioned earlier, the WyoLink system is intended to meet the needs of public safety agencies in Wyoming for the foreseeable future. Our contract with APCO therefore also specifies that the Floyd Ritter rebanding plan will be implemented to the extent possible for the WyoLink system, subject to and consistent with the requirements to meet professional frequency coordination standards.

Narrowband VHF Interoperability Channels

We have been looking at how to implement the new VHF interoperability channels into the WyoLink system. They are simplex channels sprinkled through the band as follows:

151.13750	Voice Channel V-TAC1 - Simplex	<i>Input A</i>
154.45250	Voice Channel V-TAC2 - Simplex	<i>Output B</i>
155.7525	Calling Channel V-CALL - Simplex	<i>Output A</i>
158.73750	Voice Channel V-TAC3 - Simplex	<i>Simplex</i>
159.47250	Voice Channel V-TAC4 - Simplex	<i>Input B</i>

These channels are licensed for Mobile use by rule, everyone can use them without specific authorization. The question is, how do we fit them into the WyoLink system smoothly for best interoperability? There has been some discussion that one good way would be to set them up for repeater use. Incorporating them into the Ritter Plan might be as simple as pairing VTAC1 as an input with the VCALL channel. In a similar manner, V-TAC4 would serve as an input to a repeater output on V-TAC2. V-TAC3 would be retained as a "fireground" simplex channel. We have taken no action on this proposal but we think that it would be a good idea to have local flexibility.

NPSTC Planning Efforts

We have outlined the new WyoLink system and how we see it coming together. It is envisioned that NPSTC is ideally suited to participate in several issues related to the frequency issues specific to the VHF band:

1. NPSTC should take the lead to establish a rebanding project and generate a position paper to develop and support a rebanding plan;
2. NPSTC should undertake to support the position paper before the FCC, possibly in the form of a request for a formal Notice of Inquiry or Rulemaking;
3. NPSTC should serve as the central clearinghouse for liaison with other FCC-based land mobile groups such as LMCC to enlist support for rebanding efforts;
4. NPSTC should approach and enlist federal agencies such as NTIA for their support in the VHF band enhancement efforts;
5. NPSTC should consider the application of a finalized Floyd Ritter Plan for application on a regional approach level, enlisting the support of the various states that are seriously considering enhanced new systems in the VHF spectrum;
6. NPSTC may wish to consider some level of participation with the federal Integrated Wireless Network IWN project, a coordinated national VHF P25 network for federal agencies.

