

Appendix A

Desired Features

The following WyoLink features evolved during the process of collecting information, interviews with stakeholders, and discussions with the Project Team and Steering Committee during development of the WyoLink Planning Report.

Primary areas of concern to be addressed are:

- Improved interoperability
- Replacement of aging equipment
- Adding data capability
- Adding encryption capability
- Increased reliability
- Adding channels
- Improved coverage
- Meet FCC requirements for refarming.

Potential system needs were addressed by the consensus vote of the Steering Committee members and divided by Federal Engineering into Technical, Functional, Coverage, Interoperability, and Operational areas. The Steering Committee discussion and voting process placed each system need into categories of Basic, Optional, or Expandable depending on their relative importance or urgency (second *alpha* designator in each feature) as follows:

- Basic (B) are considered essential or mandatory system requirements and designed into the initial WyoLink system.
- Optional (O) are items that may not be implemented with the initial system, but the design should accommodate an easy transition to them.
- Expandable (E) are future near-term items that may not be implemented with the initial system unless they can be added without significantly increasing system cost.

1.0 Technical

Specific technical capabilities typically related to a maturity of electronics, standards, spectrum and installation practices.

1.1 Technology

1.1.1 Narrowband Radio Equipment

Upgrade with only narrowband capable equipment (TB-2). The FCC now has mandated requirements to eliminate all wideband equipment and systems. All new purchases of public safety equipment (radios and infrastructure) will be capable of operating in narrowband modes. Parts of WyoLink system may operate initially in wideband mode to give sufficient time during transition. The state Mutual Aid channel is the primary example of wideband analog operation.

1.1.2 APCO Project 25

Adopt APCO Project 25 standards (TB-3). The WyoLink system will be designed to meet APCO Project 25 standards. All new equipment (radios and infrastructure) purchases will be P25 compliant.

1.1.2.1 P25 Phase I

Minimum Requirement.

1.1.2.2 P25 Phase II

WyoLink will periodically review enhancements to APCO P25 for inclusion in future standards.

1.1.2.3 High-Speed

Future compatibility with P25/34 (high-speed data) should be considered.

1.1.3 Analog Capability

Adopt mixed analog/digital capability, if digital is recommended (TB-1). Digital technology is recommended by virtue of adopting APCO P25 standards which are digital. Mixed analog and digital capability would allow using analog subscriber equipment (portables and mobiles) on the new system at least during the transition period from existing equipment/systems to WyoLink. Complete WyoLink system features may not be available while using analog equipment. Wideband on initial implementation; eventually narrowband capability may be needed.

1.2 Site Infrastructure

Upgrade network local sites to state standards (TB-4). Expansion of the existing infrastructure (especially for coverage) will require additional sites. These may include existing state, local or federal sites. All WyoLink sites will be upgraded to improved state standards including: backup power, shelters, HVAC, towers, and security.

1.2.1 Procedures

Cooperation will be necessary between the WyoLink system and owners of sites selected for use by WyoLink. Memorandums of Understanding (MOUs) must be issued to cover such items as: site access, site management, and site sharing agreements.

1.2.2 Power

1.2.2.1 Generators

Add generators to all network sites, where necessary (TB-6). Many of the existing public safety radio sites within the state do not have emergency backup generator power. All WyoLink sites will have generator backup power for system reliability. Also see Section 1.2.2.2 requirement (TO-4).

1.2.2.2 Fuel Capacity

Expand generator fuel capacity to 10 days (TO-4). Many of the existing public safety radio sites within the state do not have emergency backup generator power, those that do may require upgrades to fuel capacity. All WyoLink sites will have their onsite generator fuel capacity increased to approximately ten (10) days at full communication and HVAC loads. Also see Section 1.2.2.1 requirement (TB-6).

1.2.2.3 UPS

Upgrade sites with UPS capacity (TB-7). Most existing public safety radio sites within the state do not have UPS capability. All WyoLink sites will have sufficient UPS capacity added for a minimum of 15 minutes while operating all communications equipment. This serves two purposes: a) to clean commercial power and b) to have a clean transition from commercial to generator power.

1.2.3 Physical Structures

1.2.3.1 Towers

Upgrade towers, where necessary (TO-1). Existing State towers and other local/federal towers at new WyoLink sites may require upgrades due to age/condition, poor grounding, or simply to handle additional microwave/radio antennas/feedlines loading. All WyoLink sites will be examined and upgraded where necessary.

1.2.3.2 Grounding

Upgrade grounding, where necessary (TO-2). Improved reliability and reduced maintenance may require grounding improvements at WyoLink sites. All WyoLink sites will be inspected and upgraded for any and all site grounding deficiencies (*i.e.*, tower, equipment/racks, and feedlines).

1.2.3.3 Shelters

Upgrade shelters, where necessary (TO-3). Existing state sites and additional state/local/federal WyoLink sites may require additional space and/or shelter improvements. All WyoLink sites will be inspected to determine if shelter upgrades will be necessary.

1.2.4 Physical Security

1.2.4.1 Building Security

Upgrade all network sites for building alarms (TO-5). All network sites will be upgraded to include building alarms to monitor entrance, power conditions, and environmental status.

1.2.4.2 Site Security

Add/improve site security at remote sites (TE-2). While most remote sites are somewhat protected by locked gates at the entry point of the access road, there are no other devices to alert operators to site intrusion. In today's environment of homeland security, operators have looked at advanced monitoring including remote monitoring of gate entry, vehicle detectors near the shelter and/or video security.

1.2.5 Environmental

Add air conditioning, if necessary (TE-1). Most existing sites have not traditionally included air conditioning. While this has not been a significant and/or documented problem with the older technologies, it may become necessary to add air conditioning to provide a proper environment for the newer radios and control equipment. Temperature monitoring will provide maximum readings to determine which sites require upgrades.

1.3 Systemwide Reliability

1.3.1 Backbone Network Reliability

Upgrade state microwave for reliability - closed loops (TB-5). Currently the State is upgrading its microwave backbone network with higher capacity, digital microwave equipment. While traditionally, the existing microwave backbone network has shown high reliability (compared to other system components), it is recommended that the future WyoLink microwave backbone close path links to provide alternative communications to remote sites. Closed loop backbone will be evaluated by WYDOT to determine the cost versus benefits of the upgrade. The planned statewide consolidation of public safety radio systems under WyoLink may require the upgrade.

1.3.2 Network Control Reliability

Enhance network reliability - add multiple master control points (OB-4). As the future WyoLink system is intended to consolidate much of the multiple parallel systems in existence today with a single unified system, the new WyoLink must be very reliable. To that end WyoLink will incorporate multiple master control points.

2.0 Functional

This category includes the capabilities available to the users. Basically, respondents were satisfied with their voice capabilities, in that they are able to communicate.

2.1 Low-Speed Applications

Add low-speed (less than 19.2 kbps) data capability (FB-2) to accommodate statewide low-speed applications. Users that require data communications will purchase data radios and the necessary mobile data computers and application software. Also refer to Section 2.2 (FO-5). The WyoLink infrastructure should be designed for easy upgrades of data applications in support of these applications.

2.1.1 Text Messaging

Add e-mail capability (FE-2) without attachments. FE-2 could be added to any subscriber terminal equipped for mobile data communications as add-ons to their mobile data computers. The WyoLink infrastructure should be designed for easy upgrades of data applications in support of these applications. Instant messaging would be an example of low-level implementation of text messaging.

2.1.2 Voice Mail

Add voice mail capability (FE-3).

2.1.2 Database Queries

Interface to terrestrial databases and computer systems.

2.1.3 Casual Use

Allow casual use capability (FO-1). Users have reported other non-public safety wireless systems in use. The WyoLink infrastructure will allow casual use (secondary priority) during idle periods for activation and/or monitoring of other wireless applications such as: activating sirens, SCADA, and general data collection applications. Users will provide the necessary ancillary equipment using the WyoLink wireless transport.

2.1.4 Emergency Button

Require emergency button on subscriber units (OO-1). Many agencies have expressed the need for their users to have a very simple to operate emergency button. WyoLink will incorporate optional subscriber units with emergency buttons for those agencies that desire this feature.

2.1.6 Paging

Allow paging capability (FO-2). Many users have separate or commercial paging systems. The WyoLink network offers an excellent opportunity for further consolidation and statewide paging.

2.2 High-Speed Data

Add high-speed (greater than 19.2 kbps) data capability in selected areas (FO-5). Several agencies have expressed the need for higher speed data to accommodate large file applications beyond that offered by low-speed data communications. While it is understood that statewide application or high-speed data would probably not be cost effective (at this time), WyoLink will be designed to accommodate future "hot spots" of increased data rates beyond the statewide coverage of low-speed data in Section 2.1 (FB-2).

2.2.1 Mobile Video

Add mobile video capability (FE-1). Mobile video would likely require high-speed data capability made available under Section 2.2 (FO-5).

2.2.2 Intranet/Internet Access

Interface to terrestrial web-based applications.

2.3 Transmission Security

2.3.1 Encryption

Add systemwide encryption capability (FB-1). All state operated networks and most of the local/federal systems do not have the capacity to operate with encryption. The digital P25 specifications allow a relatively easy transition to include both clear and encrypted communications on each transmission as needed. The infrastructure will accommodate encryption capability on all channels allowing individual agencies that require encryption to add that capability by purchasing encryption-capable radios.

2.3.2 User Identification

Add subscriber ID capability (FO-4). Agencies have expressed interest in the ability to identify individual users by automatic identification. This will also allow remote shutdown of unauthorized use of the subscriber radio. The WyoLink system will support subscriber identification and control.

2.4 Computer Interfaces

Applications that can be added to subscriber terminals.

2.4.1 AVL

Add AVL (automatic vehicle location) capability (FO-3). Agencies have expressed the need for an AVL feature to track and locate their users especially during emergency situations. The WyoLink infrastructure will support AVL functions. Users requiring AVL will purchase subscriber equipment within built-in or added AVL modules. AVL implies some sort of position sensor interface to the computer or communication link, however the sensor information could be useful locally to the mobile user.

2.4.2 Card Inputs

Add card swipe reading capability (FE-4). This will be an end user choice. No WyoLink support is necessary.

2.4.3 Printing

Add mobile printing capabilities (FE-5). This will be an end user choice. No WyoLink support is necessary.

3.0 Coverage

This category is generally defined as the geographic area in which signals are adequate to permit users to communicate with the network.

3.1 Mobile Coverage

Upgrade statewide mobile coverage (CB-1). Wyoming does not currently enjoy statewide mobile coverage for any agency. WyoLink will be designed for a target mobile coverage of 95% of the state.

3.2 Portable Coverage

3.2.1 Limited Area Portable Coverage

Upgrade portable coverage in selected areas (CB-2). Due to significantly reduced performance of portable radios (lower power and antenna gain), statewide portable coverage would be less than mobile coverage. Agencies that rely on portable subscriber units such as cities and forestry agencies require additional signal margins to allow reliable portable operation. Statewide portable coverage may be economically unfeasible and unnecessary, therefore as a minimum the WyoLink

network will be designed for increased signal strength and margins in selected geographic areas that need portable coverage to a 90% minimum coverage level. Portable coverage will be augmented using voting receiver technology.

3.2.2 Statewide Portable Coverage

Upgrade statewide portable coverage (CO-1). Ideally agencies would prefer statewide portable coverage. WyoLink will investigate possible economical solutions that will strive to extend portable coverage over a greater percentage of Wyoming. Also refer to Section 3.2.1 (CB-2).

3.2.2 In-Building Portable Coverage

Upgrade in-building coverage for selected locations (CO-2). Agencies that have significant operations within buildings have expressed the need for in-building coverage. In-building coverage is more challenging than either mobile or portable coverage. The WyoLink design will allow possible future enhancement solutions beyond the voting receivers allocated for general portable coverage to increase signal strengths and margins allowing portable subscriber units to operate within buildings. This may include additional voting receivers and/or repeater sites or passive/active in-building enhancements as the particular problems are investigated and the best solution determined. Budgetary costs are not included at this time, as each problem and solution will be unique. Also refer to Section 3.2.1 (CB-2).

3.3 Roaming

Add statewide roaming capability (CB-3). Many agencies expressed the need to communicate while outside their normal geographic area. WyoLink will be designed to accommodate statewide roaming whereby any subscriber can communicate to their "home" area anywhere within the state.

4.0 Interoperability

The ability of different organizations to communicate with one another when necessary.

4.1 Intrastate Interoperability

Intrastate interoperability can be summarized as the ability for any WyoLink subscriber to interoperate with any other WyoLink subscriber, when appropriate following WyoLink Standard Operating Procedures (SOPs).

4.1.1 Day-to-Day Interoperability

The WyoLink network will be designed to allow any WyoLink subscriber to communicate with any other WyoLink subscriber, when necessary.

4.1.1.1 Statewide Interoperability

Improve statewide interoperability (IB-1).

4.1.1.2 Local Interoperability

Improve local interagency interoperability (IB-2).

4.1.1.3 Regional Interoperability

Improve inter-county/regional interoperability (IB-3).

4.1.1.4 State Interoperability

Improve interoperability with all state agencies - including WHP (IB-4). IB-4 requirement should also refer to Section 4.1.2 (IE-1).

4.1.1.5 Federal Interoperability

Improve interoperability with Federal agencies (IB-5).

4.1.2 Exclusivity

Incorporates the ability to disallow communications from unauthorized agencies to exclusive agencies. WHP desires to maintain circuit discipline on its primary dispatch working channel by excluding non-WHP agencies (IE-1). The WyoLink design will incorporate the ability to disallow communications within a talk-group. Also refer to Section 4.1.1.4 (IB-4).

4.2 Interstate Interoperability

4.2.1 State Networks

Add/improve neighboring state interoperability with state networks (IO-1). Many state agencies that operate on Wyoming's borders require the ability to communicate with neighboring state's public safety agencies during joint operations. While this can be a challenge due to the wide variety of neighboring state systems, WyoLink will be designed to interface with those mutually cooperating out-of-state agencies to allow interoperability between Wyoming state agencies and out-of-state agencies. Also refer to Section 4.2.2 (IO-2).

4.2.2 Local Networks

Add/improve neighboring state interoperability with local networks (IO-2). Many local agencies that operate on Wyoming's borders require the ability to

communicate with neighboring state's public safety agencies during joint operations. While this can be a challenge due to the wide variety of neighboring state systems, WyoLink will be designed to interface with those mutually cooperating out-of-state agencies to allow interoperability between Wyoming local agencies and out-of-state agencies using WyoLink's more open Mutual Aid channel. Also refer to Section 4.2.1 (IO-1).

5.0 Operational

This category defines how agencies operate and use their communications systems.

5.1 Improved Capacity

5.1.1 Additional Channels

Add channel(s) for tactical, backup, or reserve needs (OB-1). Many agencies expressed the need for additional channels for special tactical situations or as backup/reserve channels during primary channel outages. WyoLink will be designed as a more efficient trunking system with a minimum of four (4) channels statewide and an additional two channels (6 total) at 10% of the sites, typically where high usage is anticipated for urban cities.

5.1.2 Channel Efficiency

Improve/maximize channel efficiency (OB-2). The FCC encourages channel efficient designs to reduce the number of channels required. WyoLink will maximize channel efficiency and operational flexibility by incorporating a trunk design rather than a conventional design like those used by the majority of agencies today.

5.2 Upgrade Philosophy

5.2.1 System Upgrades

Replace obsolete equipment, only with system upgrades (OB-3). While many of the systems within Wyoming are using obsolete equipment that requires replacement, it has been decided to replace this equipment only during system upgrades onto WyoLink to avoid short-term expenses. Also refer to Section 5.2.2 (OE-1).

5.2.2 Short-Term

Replace obsolete equipment, short-term (OE-1). Significant quantities of obsolete equipment must be replaced as soon as possible due to difficulty of repair. While it has been agreed in general to delay replacement until systems are upgraded and moved to WyoLink, this may not always be possible. In these situations, minimal

replacements can be made with equipment that will be compatible with WyoLink specifications. Also refer to Section 5.2.1 (OB-3).