Section 3

Future Requirements

3.1 Executive Summary

3.1.1 Introduction

Section 1 presented the Public Safety Mobile Communications (PSMC) infrastructure as it exists today in Wyoming. Section 2 discussed today's baseline needs as envisioned by the project participants. In this section we peer into the future identifying additional and emerging requirements over a ten year planning period.   Some of the requirements are new, and others expand on the baseline requirements established in Section 2. As is typical in other states, most Wyoming participants found it difficult to provide input beyond five years recognizing that the outer years become much more changeable due to the advances in technologies and the inability to forecast new initiatives such as the emphasis on Homeland Security. *FE*'s ability to forecast beyond five years is similarly limited, but long range forecasts have been provided where possible.

Inputs to this analysis include data obtained via the *FEClientNet* survey, interviews with participants in Wyoming, *FE'*s work with other state public safety mobile communications systems, and general industry experiences. This section continues the use of the framework established in Sections 1 and 2 regarding Technical, Functional, Coverage, Interoperability, and Operational considerations.

3.1.2 Summary of Future Requirements

Future requirements covered in this section build upon needs that exist today as addressed in Section 2. In general, we see a steady evolutionary trend for more channels and expanded feature sets rather than a revolutionary need for radically changed capabilities. With an environment such as exists in Wyoming today, with so many unfulfilled needs and an aging infrastructure, the tendency on the part of the respondents was to identify most of the needs - baseline or future - in the baseline questions. Agencies need better interoperability now - if they get it as a baseline need, they are less likely to identify it as a future need. Many of the areas that were heavily emphasized in Section 2 were identified in this "future requirements" section but in many cases with less popularity. This does not imply that the requirements are less important for the future. Rather, it is a factor of the respondents feeling that they have been met as part of the baseline requirements.

It is a fundamental principle of the public safety mobile communications project that planning will explicitly address technology innovations and how they may be adopted. Implementation will require best systems engineering disciplines for efficient and cost-effective updating of the system over a long lifespan.

Of particular note was that the ever-looming FCC requirement for narrowband equipment and systems which was not mentioned by any respondents. This may be the result of a

lack of regulatory sensitivity on the part of smaller public safety mobile communications organizations. If the final outcome of this study is the "business as usual" approach, significant attention will be needed to deal with these FCC issues by all of the agencies. The following is a summary list of significant future needs:

3.1.2.1 Technical Requirements - the specific technical capabilities typically relating to maturity of electronics, standards, spectrum and installation practices
- Flexible design to accommodate additions, changes, and new technologies and standards as they emerge.

3.1.2.2 Functional Requirements - the capabilities available to the users
- Growth in the use of mobile data, as baseline systems will need to be augmented to support additional traffic from MDTs.
- New capabilities, especially AVL (automatic vehicle location) and user identification.
- Applications are on the horizon that will require high speed data communications.
- Additional encryption requirements.

3.1.2.3 Coverage Requirements - the geographic area in which signals are adequate to permit users to communicate with the network
- Improved coverage, especially for portable users.

3.1.2.4 Interoperability Requirements - the ability of different organizations to communicate with one another when necessary
- Better interoperability between all agencies, anywhere in the state.

3.1.2.5 Operational Requirements - how agencies operate and use their communications systems
- Additional capacity - traffic growth is expected to exceed baseline network capacity; the existing number of channels cannot support either existing or future demands.
- Growth in subscriber equipment, with at least 27% more equipment expected to be acquired for replacement and/or expansion over a five-year time frame.
- Continued replacement of old, obsolete equipment not accomplished with the baseline changes. The FCC refarming initiative will accelerate the need for replacement of much of this equipment.

It should be noted that an assessment of dispatch centers is beyond the scope of this project. The need for additional dispatch centers, upgrades/changes to existing dispatch facilities, and improvements to consoles (including software and support systems such as CAD) are ancillary to an improved statewide public safety mobile communications network.

However, the interface to existing dispatch centers and the microwave/fiber interconnects to the network are within the scope of this project and have been addressed.

3.2 Technical Requirements Detail

One of the major problems within the existing Wyoming public safety communications environment has been the lack of technical innovations over the past ten or more years. This is not necessarily the fault of agencies but rather a consequence of inadequate funding. Industry has enjoyed a major evolution in technology from the analog, wideband, conventional equipment currently in use in Wyoming to narrowband, digital, trunked radios. Once Wyoming adopts these new technologies, it opens the doors for future industry innovations at relatively lower incremental costs. Emerging technologies deserve scrutiny:

3.2.1 Project 25 Compliance

Respondents were unanimously in favor of maintaining alignment with evolving future standards, especially related to APCO Project 25.

3.2.2 IP (Internet Protocol) Based Radios

These emerging technology radios will facilitate low cost interconnection to remote repeaters and dispatch centers. More importantly, IP radios will allow for full interoperability regardless of the frequency band or channel assignments of the communicating devices.

3.2.3 Software Defined Radios

Emerging software defined radios can rapidly adapt to the local network environment promoting interoperability across a diversity of infrastructures, much like today's multimode cellular radios. This innovation promises to allow a visiting public safety responder to communicate with local dispatchers regardless of the frequency band or type of radio.

3.2.4 Flexibility

Although these innovations may be years away, any new Wyoming system should be sufficiently flexible to adopt these and other new technologies as they emerge. *FE* recommends that emerging technologies should be addressed in the RFI to be released early in Phase 2. Vendor feedback will determine if these particular technologies should

be considered for the initial system or delayed for future enhancements.

3.3 Functional Requirements Detail

The future functional requirements were primarily grouped into two areas - data communications and security. These are consistent with the findings for the baseline requirements, but add future capabilities that were not identified for the short term.

3.3.1 Low-Speed Data

The *FEClientNet* survey inquired as to the need to communicate using data with other agencies that cannot be accomplished today. Eleven agencies (15% of respondents) answered affirmatively. *FE* believes that this is somewhat additive to the baseline estimates in Section 2 for 16% of the mobile radios (670 of 4,190) that would need data capabilities. The following summarizes data interconnect needs of the respondents:

- Interagency.
- Cities to county.
- Federal agencies.
- Highway Patrol.
- Neighboring states (including border cities).
- Neighboring towns.
- Warrant checks.
- NCIC.

Respondents that currently do not rely upon data communications were asked to rate its importance:

- 77% indicated it was an optional requirement,
- 20% said it was needed for routine operations, and
- 3% indicated it was mission critical.

We believe that the high percentage of "optional requirement" responses is primarily due to the fact that many agencies have not, as yet, implemented distributed information systems. Once these capabilities become available, their use will grow rapidly. History has shown that mobile information resources provide a considerable increase in accuracy, result in more efficient use of available bandwidth, and relieve dispatchers from being information intermediaries. In addition, packet data communications can, using error

management protocols, result in increased coverage and effectively function at the fringes of coverage areas.

3.3.2 High-Speed Data

Specific questions were not asked in the survey concerning the need for high speed data. High speed data is a longer term concern on the part of many in public safety nationwide. As applications move away from a text-based user interface, and rely more upon GUIs (graphical user interfaces), the communications bandwidth needs go up exponentially. Add to this GIS (geographic information systems) and other popular emerging government applications, and the need for high speed data in the long term becomes apparent. However, there are no short term wide area solutions available; equipment suppliers have yet to rise to this challenge.

DCI and other agencies did express concerns that today's low-speed public safety mobile data technology would not handle anticipated future traffic. Needs were identified for data transmission rates up to 10 Mbps (essentially a wireless LAN). Application types and their typical data volumes were provided in some cases, but it is too early for agencies to quantify their high speed data transmission needs. At this point in the planning process, it is not necessary to determine detailed system throughput requirements. Many States and local governments are considering "hot zones", which are generally relatively small strategically located areas within which high-speed data communications capabilities are provided. As the high-speed data communications needs are better identified, and as technology and wireless data security capabilities evolve, this approach should be evaluated by the State.

3.3.3 Encryption

The *FEClientNet* survey inquired as to the need for encrypted (secure) voice and data communications and found that seventeen agencies (24% of respondents) answered affirmatively. Respondents that currently do not rely upon secure communications were asked to rate its importance:
- 57% indicated it was an optional requirement,
- 23% said it was needed for routine operations, and
- 20% indicated it was mission critical.

FE believes that the high percentage of respondents indicating "optional" is primarily due to the fact that these agencies currently have no choices and are using poor alternatives, such as cellular telephones. An infrastructure with associated subscriber radios that supports secure communications at affordable prices will allow users the flexibility to mix clear and encrypted communications on a channel-by-channel basis.

3.3.4 Enhanced Security Features

Clearly, security has become a priority in the post-September 11 environment. Twenty-two agencies responded through the *FEClientNet* survey describing features and capabilities needed for enhanced security, including:

- NSA approved Type I encryption.
- EMP (electromagnetic pulse) protection.
- Preassigned simplex frequencies for major incidents or tactical use.
- Tactical talk groups for all users, to all dispatch points.
- Data capabilities.
- All public safety interoperability.
- Better interoperability; current mutual aid frequencies and cross-channel interconnects are not effective.
- Secure communications ranging from basic encryption to total encryption of all channels.
- Additional dispatchers.
- Additional dispatch locations
- Better realtime dissemination of information and alerts.
- Stored portable radios for out-of-area responders.
- Additional repeaters for improved coverage.
- Satellite phones for backup at command centers.
- Satellite phones for improved coverage.
- Improved communications for regional response teams.
- AVL (automatic vehicle location) capability.

3.3.5 Future Enhanced Features

Survey respondents were asked to rate specific enhanced features that are not currently available. Survey respondents were given the choice of high, medium, or low importance. The following chart, Exhibit 3.1 summarizes the results, listed highest to lowest.

Exhibit 3.1 - Ranking of Enhanced Features

Feature	High (3)	Medium (2)	Low (1)	Overall Rating
Paging	23	17	13	2.189
Mobile Data Access	15	16	24	1.836
Automatic Vehicle Location	9	24	24	1.737
Mobile Identification	9	15	29	1.623
Mobile Video	8	15	31	1.574
Mobile E-mail	7	12	35	1.481
Mobile Card Swipe	5	10	36	1.392
Mobile Voicemail	3	15	36	1.389
Mobile Printing	5	10	38	1.377

While these features were not rated by all of the respondents, *FE* believes that they represent a good snapshot of the emerging requirements that a robust public safety mobile communications system might need to accommodate during the planning horizon.

3.4 Coverage Requirements Detail

Coverage has been extensively dealt with in the baseline requirements, so it was not surprising to find only a few indications of it for a future requirement. Of the 56 agencies that identified statewide roaming coverage as a requirement, 31 (55%) rated it as a medium or high priority. It was ranked second of ten areas, with only Paging ranking higher (see Exhibit 3.1 above for the remainder of the survey categories).

3.5 Interoperability Requirements Detail

The interoperability requirements that were identified were primarily from those organizations that felt that additional requirements to the baseline approach would be necessary. While it could be stated that the baseline approach should ideally provide for "100% interoperability," in reality this is not likely in the short term. Therefore, the views of some agencies that responded to this question are worth considering to reinforce that interoperability is a valid long-term goal of the public safety mobile communications plan.

3.5.1 Additional Interoperability Requirements

The *FEClientNet* survey asked agencies if they require voice communications with other agencies that cannot be accomplished today. Nineteen agencies (26% of respondents) answered affirmatively. This is supplemental to the 70% of the respondents that identified interoperability as a critical need for the existing/baseline requirements. The following is a summary of the future interoperability needs reported:

- Just about anyone - at times.
- Neighboring towns.
- Highway Patrol.
- Cities to County and neighboring counties.
- Federal agencies.
- Neighboring states (including border cities).
- Interagency within a town.
- Federal agencies to all state/local public safety organizations.

Other interoperability issues reported in the survey and interviews were:

- The need to share services (dispatch centers and tower sites).
- Lack of ability to communicate whenever frequency bands and/or technologies are not compatible.
- State Mutual Aid is not repeated.
- Mutual Aid is muted at WHP dispatch.
- Inability to relay messages through dispatch.

Respondents that currently do not enjoy voice interoperability were asked to rate its importance. Approximately 60% indicated that it was either mission critical or needed for routine operations while 40% indicated it was an optional requirement. We believe the "optional requirements" reflected the agencies' future visions and that it would be highly useful, if available. This once again demonstrates the increased need for improved interoperability within the Wyoming public safety community.

3.6 Operational Requirements Detail

Future operational requirements were identified in several areas, particularly related to the replacement and growth of subscriber devices.

3.6.1 Currently Funded Improvements/Growth

Project related information submitted by Wyoming participants confirms the stated growth assumptions. Current commitments for funding additions, replacements, and expansion of agencies' public safety mobile communications networks prove that this growth trend is immediate and that current facilities do not meet existing needs.

Respondents to the *FE*ClientNet survey indicated the following public safety radio improvements are currently funded as of October 2002:

Equipment Type	# of Agencies	# of Units	Average Budget per Unit	Total Budget
Base Stations	7	11	$45,200	$497,200
Repeaters	7	13	$10,750	$139,750
Mobiles	13	104	$4,390	$456,560
Portables	12	243	$500	$121,500
Control Stations	3	9	$25,714	$231,426
Dispatch Consoles	4	7	$48,800	$341,600
Dispatch Locations	2	2	amount unknown	n/a
Mobile Data Terminals	2	16	$14,000	$224,000
Radio Channels	4	15	$1,800	$27,000
Total public safety radio improvements funded				$2,039,036

This represents more than $2M in funded public safety mobile communications projects. *FE* believes it would be a tragic mistake to implement these enhancements without coordinating on a statewide basis to ensure direct interoperability with an improved statewide public safety mobile communications system.

Several agencies also mentioned other funded projects without giving specific dollar amounts, including:

- FEMA grants.
- New pagers.
- Updating all mobile radio systems.
- Consolidation of communications from multiple departments.

- Remote control of base/repeater stations.

Additional information regarding specific agencies and funding details can be found in Appendix E.

3.6.2 Additional Growth

The following table summarizes public safety radio growth over the next five years as determined via the *FEClientNet* survey. This growth is above and beyond those projects already funded as called out in the Section 3.6.1, *Projects Funded by October 2002*.

Equipment Type	# of Agencies	# of Units
Base Stations	20	44
Mobiles	32	482
Portables	32	638
Control Stations	6	35
Dispatch Consoles	8	17
Mobile Data Computers	9	234
Radio Channels	12	29

Combing the data called out in the above two tables, growth rates over the next five years can be summed up as follows:

Equipment Type	Funded Oct. 2002	Next 5 Years	Total Additional Units	Existing	Percent Growth
Mobile	104	482	586	4,190	14%
Portable	243	638	881	3,277	27%
Control	9	35	44	193	23%

This represents a substantial growth/replacement rate, demonstrating the urgent need for agencies to replace their systems.

Several agencies mentioned other growth components without providing details including:

- Implementation of a VHF digital trunked system.
- More cellular radios.
- Update obsolete equipment.
- Consolidated communications with related non-PS departments.
- A mobile command center.
- Replacement of aging pagers.
- New pager capability.
- Channel expansion.
- Additional repeaters.
- Wireless siren warning.

Neither existing traffic levels nor traffic growth were specifically provided. However, the expressed requirement of additional channels, the need for tactical channels, and channel overloading during joint emergencies or special events indicated traffic has grown over the years to the point that the existing infrastructure can no longer support user demands.

In additional several agencies indicated that their expansion plans are currently on hold due to the uncertainty of the statewide plan and associated funding.

FE's experience indicates that these growth rates are reasonable and perhaps slightly on the conservative side. The emphasis on security is expected to continue, generating potentially even more demand for public safety mobile communications. Additional systems and applications will most likely emerge that will further expand the need for wireless access. Thus, there should sufficient expansion headroom to provide additional communications capacity as these and other initiatives develop.

Specific agency details regarding participant's growth can be found in Appendix E.

3.6.3 Maintenance

As described in Section 2.2.5.6, system maintainability continues to be of concern to many agencies. As their systems age and become more difficult to repair, frustration levels are increasing. Repair parts are becoming more difficult to obtain further exacerbating the situation. Agencies in this situation have expressed concern over expensive repairs and/or long repair times. Potential users are expecting significant improvements in this area by an enhanced public safety mobile communications system.

Many participants view communications as a tool enabling them to perform their jobs. In *FE'*s opinion agencies, especially smaller ones, would rather not shoulder the burden of responsibility for the day-to-day operation of the communications system. A reliable

statewide system would be viewed positively by these participants.

3.6.4 Network Control and Operation

As was described in Section 2, existing individual public safety mobile communications systems enjoy considerable autonomy. Individual groups determine their own system designs, methods of control, implementation priorities, and operational procedures. A consolidated statewide system is often viewed as a loss of this autonomy; a compromise; possibly the yielding of priority to other organizations. Many fear consolidation will result in a loss of certain critical functions. Although many of these concerns are unfounded, they are nonetheless negative perceptions on the part of some users.

A true all-agency statewide public safety mobile communications system requires central management and system operation. To promote a central authority, build stakeholder support, and minimize the perception of lost control, several communications and team-building initiatives should be considered:

- Establish a User Group, composed of a wide cross section of agencies similar to the current Steering Committee, that meets on a regular basis around the State. This group will be empowered to institute policies, establish operational procedures, set user fees, and provide other management guidance. The group will also serve as an advocacy group representing the needs of the individual participating organizations. Meetings should be open to all with a rotating core of individuals elected by the group.

- Establish a newsletter to be distributed to all public safety agencies (whether or not they are using the network) covering: brief minutes from previous meetings, new industry technical innovations, FCC news, procedure changes, systems enhancements, and other pertinent news.

- Conduct annual needs assessments to ensure that current requirements are being met, future requirements are being planned for, systems performance is acceptable, and equipment vendors are meeting expected system goals.

3.6.5 Consolidation

In designing for future systems, past *FE* experience has shown that consolidation of infrastructures, especially transmitter sites, is the key to reducing costs, creating greater reliability, increasing systemwide coverage, and improving interoperability. Having a large number of duplicated sites offer no advantages to a public safety mobile communications system, and should be addressed in the planning process.

Partnership agreements must be established between State, county, local, and Federal agencies to improve statewide coverage through the use of shared sites by the State network. Once it is determined where these new State network sites should be ideally situated, the site owner should be contacted to establish an agreement to facilitate usage of the site by the State network. It should be made known that State, county, local, and Federal agencies will enjoy improved coverage and interoperability through the consolidation of sites.

3.6.6 Transition and Implementation Schedule

In looking at future requirements and the ability of the users to participate in such a system once/as it is built (particularly the county and local groups), some are concerned that their agency may not be able to participate fully in an advanced public safety mobile communications system, primarily due to cost and funding issues for new equipment. This concern exists even though it is understood by most that the improved public safety mobile communications network is a significant project that will be implemented over a period of time. Planning for and providing a transition period using current equipment will, therefore, be important. In order to accomplish this, existing systems must be maintained in operational condition while interconnected to the new infrastructure for as long as required to fully transition all interested agencies.

A "reasonable" implementation schedule should be established based primarily upon funding availability and secondarily upon infrastructure upgrades to support a new public safety mobile communications system. The fielding of a smaller pilot or core subsystem may be appropriate to fully understand and define the system design before proceeding with statewide implementation.

3.7 Validation and Prioritization Process

The survey asked for general input and comments regarding features, benefits, and design considerations for a future public safety mobile communications system. Comments included:

- Modular and expandable.
- Commercial off-the-shelf technologies and equipment.
- Software upgradeable.
- User friendly.
- Same radio capabilities at the county, local, State, and Federal levels.
- Compatibility with neighboring states.
- Improved interoperability, especially to WHP (Mutual Aid is inadequate for this purpose).

- More repeaters; improved coverage.
- More personnel during peak periods.
- State funding to assist low income communities; many cannot afford to upgrade their public safety mobile communications systems or equipment.
- Congested channels.
- Public safety mobile communications is critical to the operation of public safety agencies.

These comments reinforced previously annunciated needs and provided the Project Team and Steering Committee with further insights as to thoughts and needs of the participating organizations.

Many needs, changes, and enhancements have been identified by engaging the various communities of interest. The Project Team and Steering Committee were engaged to assess these requirements and establish priorities.

The Steering Committee members, who represent State, county, local, and Federal interests, are K. Hamilton, R. Wyatt, F. Cadez, J. Evans, J. Heller, T. Hibbard, B. Janes, M. Joiner, D. Kinghorn, M. Luna, J. Narva, D. Perko, and S. Reeves. The Project Team consists of K. Hamilton, K. Drummond, R. Wilson, and M. Joiner.

3.7.1 Validation and Prioritization Methodology

FE developed a methodology that first validated the needs expressed by agencies and then prioritized the features/upgrades to be implemented in the improved public safety mobile communications system. This was communicated in an early draft of the first sections of this report. Careful consideration of all needs was made by the Steering Committee and Project Team with each voting member adhering to the following steps:

- Conduct a thorough review of all *FE* reports, specifically for needs. In performing a preliminary review, *FE* and the project team established a starting point for this analysis by the Steering Committee. This list is shown in Exhibit 3.2.
- Using the list shown in Exhibit 3.2, select those technical features/upgrades that they believe are in the best interest of an improved statewide public safety mobile communications system.
- Distribute 500 points across the requirements categories as they see fit with a maximum of 50 points per item and enter the points that they assign for each item on a worksheet. (The actual form used in the validation and prioritization process is contained in Appendix K - Prioritizing Needs Form).

Exhibit 3.2 - Features and Upgrades

Feature/Upgrade	Description
Improve statewide mobile coverage	Improve mobile coverage in all areas to a common level statewide
Upgrade statewide portable coverage	Extend mobile coverage to a similar coverage for portable radios (vendor will suggest methods)
Upgrade portable coverage in selected areas	Extend mobile coverage for portables in selected areas (*i.e.*, cities, forests, etc.)
Upgrade in-building coverage for selected locations	Ask vendors for their recommended method to accomplish in-building coverage in RFI
Upgrade sites with UPS capacity	Add UPS units to supply site radio load for 15 minutes
Upgrade network local sites to state standards	Non-state sites that will become statewide network sites should be upgraded to state standards
Upgrade state microwave for reliability (closed loops)	Convert state's digital microwave into closed rings, to eliminate single points of failure on the backbone network
Add channel(s) for tactical, backup, or reserve needs	Review channel needs of sites and add channel(s) to reduce congestion for tactical, backup or reserve capacity during channel overloading
Improve/maximize channel efficiency	Increase channel loading on underutilized channels (per FCC requirements)
Adopt mixed analog/digital capability, if digital is recommended	If a digital system is recommended, should the network support analog channels/radios
Replace obsolete equipment, short-term	Should obsolete radios be replaced ASAP with similar technology radios (*i.e.*, conventional, analog, wideband equipment)
Replace obsolete equipment, only with system upgrades	Should obsolete radios only replaced during system upgrades with whatever the selected technology is
Add systemwide encryption capability	If encryption capability is needed, determine how many simultaneous channels will be expected at each site (*i.e.*, two channels per site)
Upgrade towers, where necessary	Upgrade network towers as needed after inspection for age and antenna wind loading to ANSI/TIA/EIA-222-F-96 standard
Upgrade shelters, where necessary	Upgrade network shelters in poor condition or of insufficient size
Upgrade grounding, where necessary	Upgrade network site grounding to meet Motorola R56 standard
Add air conditioning, if necessary	Review A/C requirements at network sites with successful radio vendors, add where necessary
Add generators to all network sites, where necessary	All network sites should have generator capability (to state standard), add to sites without
Expand generator fuel capacity to 10 days	All network sites should have state standard 10 day fuel capacity
Add/improve site security at remote sites	Except of collocated sites (within secure buildings), upgrade network site security for Homeland Security - sites have minimal, if any, security at this point

Feature/Upgrade	Description
Upgrade all network sites for building alarms	All network sites should have a full suite of building alarms to monitor door access, power temperatures, etc.
Allow casual use capability (*i.e.*, activating sirens)	Users requested use of PSMC system for casual/low traffic uses
Improve local interagency interoperability	Technical support of local (municipal and county) agency interoperability within the jurisdiction among all PS agencies
Improve inter-county/regional interoperability	Technical support of agency interoperability within a region (multi-county) among all PS agencies
Improve statewide interoperability	Technical support for interoperability between any PS agency, anywhere within the State
Improve interoperability with all state agencies (including WHP)	Technical support for interoperability between any non-State agency and State agencies including WHP
Improve interoperability with all state agencies (excluding WHP)	Technical support for interoperability between any non-State agency and State agencies excluding WHP (maintain current exclusive WHP channel)
Add/improve neighboring state interoperability w/state networks	Technical support for interoperability with neighboring state networks (Note: These may not include local users)
Add/improve neighboring state interoperability w/local networks	Technical support for interoperability with neighboring state's local user networks (that are not part of neighboring state's networks)
Improve interoperability with Federal agencies	Technical support for interoperability with all Federal networks (Note: Score lower if only selected Federal networks)
Upgrade with only narrowband capable equipment	Any and all network/subscriber upgrades will be required to have narrowband capability
Adopt APCO Project 25 standards	Require network design and equipment to have P25 compatibility
Add statewide roaming capability	System should have capability for any user to operate anywhere in the State on their talk channel
Enhance network reliability - add multiple master control points	Should network have multiple (at least two) master control points for reliability/backup for natural or terrorist attack
Allow paging capability	Should network support paging functions
Add AVL (automatic vehicle location) capability	Should infrastructure support AVL capabilities if subscriber radios are so equipped
Add subscriber ID capability	Should infrastructure support user ID capabilities if subscriber radios are so equipped
Add low-speed (less than 19.2 kbps) data capability	Should network support low-speed data communications, number of channels will be determined later
Add hi-speed (greater than 19.2 kbps) data capability	Should network support systemwide hi-speed data communications beyond the capability of voice channels – this would require special equipment (i.e., 700 MHz, WiFi, 4.9 GHz) and may not be feasible
Add mobile video capability	Network support for video to/from mobile platforms (see hi-speed data)
Add mobile e-mail capability	Application support would require low-speed data capability and MDTs
Add mobile voice mail capability	Network support for voice mail storage when user radio is off, out-of-range, etc.
Add mobile card swipe capability	Accessory for MDTs would require low-speed data capability

Feature/Upgrade	Description
Add mobile printing capability	Accessory for MDTs would require low-speed data capability
Require panic/emergency button on subscriber units	Generally a subscriber unit option/requirement, network support required

Initial point assignments for each requirement were sent to Federal Engineering by fax or email. **FE** acknowledged each submission to the Project Team.

FE entered each evaluator's points into a master spreadsheet. The spreadsheet summarized all scores showing: items, reviewer points and high, average, and low ratings in relative order. The spreadsheet was emailed back to each reviewer in preparation for the April 23rd Steering Committee Meeting, structured in order of most to least important items. During the Steering Committee Meeting, features, upgrades, and enhancements were openly discussed between Committee and Project members with the goal of reaching a common consensus as to the specific requirements. It was not expected that there would be, or need to be, total agreement on all items. At this juncture, the process of prioritizing was limited to technical features and upgrades. It did not include cost, funding, transition, or operational components.

There were no changes made to individual scores during the steering committee meeting. **FE** updated the spreadsheet based upon several score sheets that had not been received, and following the meeting provided a final, updated sheet reflecting all known inputs. **FE** provided the Steering Committee with several analyses of the scores, with categorization of the individual items into the five categories of Technical, Functional, Coverage, Interoperability, and Operational. A priority grouping of High, Medium, and Low was also established by **FE**, using the relative scores within a category and based on our knowledge of the public safety mobile communications environment. There was no forced distribution of the items into any of the classifications. The High/Medium/Low schema used to reflect the relative time horizon and urgency of the requirements was modified by the Steering Committee and redefined as *Basic, Optional, and Expandable*.

The results of the analysis, classification, and prioritization of these future requirements is shown in Exhibit 3.3.

Exhibit 3.3 - Summary of Requirements

	Basic	**Optional**	**Expandable**
Technical	Adopt mixed analog/digital capability, if digital is recommended Upgrade with only narrowband capable equipment Adopt APCO Project 25 standards Upgrade network local sites to state standards Upgrade state microwave for reliability (closed loops) Add generators to all network sites, where necessary Upgrade sites with UPS capacity	Upgrade towers, where necessary Upgrade grounding, where necessary Upgrade shelters, where necessary Expand generator fuel capacity to 10 days Upgrade all network sites for building alarms	Add air conditioning, if necessary Add/improve site security at remote sites
Functional	Add systemwide encryption capability Add low-speed (less than 19.2 kbps) data capability	Allow casual use capability (*i.e.*, activating sirens) Allow paging capability Add AVL (automatic vehicle location) capability Add subscriber ID capability Add hi-speed (greater than 19.2 kbps) data capability in selected areas	Add mobile video capability Add mobile e-mail capability Add mobile voice mail capability Add mobile card swipe capability Add mobile printing capability
Coverage	Upgrade Statewide mobile coverage Upgrade portable coverage in selected areas Add statewide roaming capability	Upgrade statewide portable coverage Upgrade in-building coverage for selected locations	
Interoperability	Improve statewide interoperability Improve local interagency interoperability Improve inter-county/regional interoperability Improve interoperability with all state agencies (including WHP) Improve interoperability with Federal agencies	Add/improve neighboring state interoperability w/state networks Add/improve neighboring state interoperability w/local networks	Improve interoperability with all state agencies (excluding WHP)
Operational	Add channel(s) for tactical, backup, or reserve needs Improve/maximize channel efficiency Replace obsolete equipment, only with system upgrades Enhance network reliability - add multiple master control points	Require panic/emergency button on subscriber units	Replace obsolete equipment, short-term

This list forms a primary input for the upcoming RFI (Request For Information).

3.8 Future Network Requirements

Wyoming's public safety user agencies rely upon vital communications to perform their difficult assignments. Future improvements to the public safety mobile communications network will facilitate seamless expansion and enhancements overcoming the limitations inherent in today's environment. Tomorrow's networks should include:

3.8.1 High Availability
- Ability to communicate when and where users need.
- System must be highly reliable with little to no down time.
- Additional channels for backup during failures.
- Sufficient excess capacity for periods of high traffic.

3.8.2 Feature Rich Environment
- Public safety grade subscriber equipment.
- System must provide most of the features required.
- Both voice and low speed data through a common radio.
- Accommodate emerging applications such as AVL and user ID.

3.8.3 Survivability
- Public safety mobile communications system must be capable of continuous operation surviving single mode failures during natural disasters or terrorist attacks.
- Graceful degradation via overlapping coverage and other means.
- Backup operation should a network control failure occur.

3.8.4 Expandability
- Network should be capable of straightforward growth while maintaining architectural integrity.
- Additional channels can be added to existing sites with minimal effort.
- Additional sites can be added to improve coverage.
- New user groups and their dispatch centers can be incorporated into the network.

3.8.5 Infrastructure
- Adequate network support including planning, operations, and maintenance.
- A robust/reliable microwave interconnect network.
- Shelters, towers, power, and HVAC to meet the needs of the upgraded systems.

3.8.6 Interoperability
- Flexible and wide-ranging communications that can adapt to dynamically changing user needs.
- Routine groupings to support local, State, and Federal users.
- Support for emergency, special events, and tactical groupings.
- Interfaces to existing systems and networks.
- Interconnections to neighboring states.

As directed and approved by the Steering Committee, user needs and system improvements will be addressed in the upcoming RFI. This RFI will be issued at the beginning of Phase II to interested system and equipment vendors to solicit industry feedback on how best to meet these requirements and the associated system cost estimates.

3.9 Comparison with Prior Studies

As most of the prior studies did not differentiate between current/baseline and future requirements, this section will provide a summary of the combined requirements as outlined in those studies, and compare to what has been developed by *FE* in this section.

3.9.1 Quantum Analysis of Statewide Telecommunications Study (May, 1999)

The Quantum study also strongly endorsed the use of the RFI process to determine the architecture and design alternatives that vendors would recommend for meeting the current and future needs of the State. The Quantum study compiled results of the survey which had been previously gathered by the User Group. Future needs were identified as follows:

3.9.1.1 Technical Findings
- The State must act quickly in order to take advantage of the frequencies that may be available.
- The State should move to digital technologies.

3.9.1.2 Functional Findings
- Encryption - 32%.
- Mobile data terminals - 24%.
- Paging - 48%.
- Telephone interconnect - 38%.
- AVL - 23%.

3.9.1.3 Coverage Findings
- Better unit-to-unit coverage - 52%.
- Localized coverage - 76%.
- Wide area coverage - 55%.

3.9.1.4 Interoperability Findings
- Interoperability - 52%.
- Mutual aid - 55%.

3.9.1.5 Operational Findings
- More channels - 47%.

3.9.2 RSM McGladrey (August, 2000)

The RSM McGladrey study was quite general in terms of their findings overall, and rather than identifying needs, it proposed a system design that the State should consider. Since the *FE* public safety mobile communications plan does not recommend a design it is not possible to directly compare the results of the McGladrey study. However, *FE* agrees that most of the design characteristics are valid and will probably be similar to what is obtained through the RFI process. The major exception is that *FE* feels that the 800 MHz frequency recommendation is premature and needs to be developed in conjunction with the overall design and costs of the proposed system.

3.9.2.1 Technical Findings
- Standardization of equipment, technologies, and frequency range.
- Digital microwave for the wide-area backbone.
- Digital, trunked radio systems.
- Most likely 800 MHz.
- Project 25 compliant.

3.9.2.2 Functional Findings
- None identified.

3.9.2.3 Coverage Findings
- None identified.

3.9.2.4 Interoperability Findings
- Call patching on the Emergency Communications Channel.

3.9.2.5 Operational Findings
- Consolidation of sites.

3.9.3 Motorola Study (September, 2000)

The Motorola study provided a roadmap for developing a system design, rather than specifying a set of baseline or future requirements. It outlined three conceptual alternatives, including a "do nothing" approach, a state-owned approach, and a public/private alliance to build, own, and operate the new network. It identified services that would be provided as part of the system but did not identify the requirements that were driving the creation of those services. For example, it outlined Network Management, Dispatch Service, and Technical Support as potential services but did not specify the requirements or service levels that would be associated with those services. The following key points are in general alignment with the findings that *FE* presented in the previous sections:

3.9.3.1 Technical Findings
- Use of pre-determined technology sets based on Motorola's design.

3.9.3.2 Functional Findings
- None identified.

3.9.3.3 Coverage Findings
- Full capability for all users to roam and have service across the state.

3.9.3.4 Interoperability Findings
- None identified.

3.9.3.5 Operational Findings
- Uses 100 sites - 50 existing WYDOT sites and 50 more "conceptual" sites.

3.9.4 PSWN Wireless Business Case Strategy (June 2002)

This PSWN study was primarily an approach to developing a business case for the creation of a statewide public safety mobile communications plan. The study makes a very strong case for the use of the business case approach, which is essentially what Wyoming is following in this plan. It is much more of a process recommendation than a study of service gaps or requirements. It identifies several areas in which today's systems do not meet the user requirements, but doesn't specify any detail about what those requirements should be. It assumes that the definition of the requirements will be done prior to developing the detailed system architecture. From both a philosophical as well as a process standpoint, *FE* strongly agrees with this approach. The areas that the study identified in need of improvement are:

3.9.4.1 Technical Findings
- Disparate systems using varying operational frequencies and proprietary technologies obstruct interoperability.

3.9.4.2 Functional Findings
- The current environment does not support encrypted voice communications.

3.9.4.3 Coverage Findings
- There is insufficient coverage in may regions of the state, particularly in the mountainous terrain.
- The use of mutual aid frequencies and dispatcher relays is often the only way to provide coverage.

3.9.4.4 Interoperability Findings
- There is insufficient interoperable communications capacity among local, state, and federal public safety agencies.
- Interoperability is handled by providing spare radios from other jurisdictions/agencies to responders who need to interoperate.

3.9.4.5 Operational Findings
- There is insufficient channel capacity resulting in frequent congestion and inability to communicate.

3.9.5 Conclusions

Although these studies were less quantitative, and more subjective, they painted a consistent picture. None of these reports contradicted the findings of Federal Engineering and in fact, supported *FE'*s findings.