Lehigh County Emergency Communications Network Strategic Development

Needs Assessment Survey

~ January 2022 ~

ESSENTIAL
MANAGEMENT SOLUTIONS, LLC

Table of Contents

1.0 Executive Summary

The Lehigh County public-safety community and various County representatives have discussed problems, concerns and the future of communications in Lehigh County for a number of years. In early 2021, the County provided direction to begin a comprehensive strategic planning effort, and an initial structure for this initiative was outlined in the *Lehigh County Emergency Communications Network Strategic Development Project Plan* completed in May.

A key aspect of this plan was to conduct a "needs assessment survey" within the stakeholder community in an effort to determine the need for a project and its prospective direction and goal. This survey was conducted from September through November 2021, and 214 responses were collected. These included 74 representatives of the law enforcement community, 68 fire/rescue stakeholders, 35 from emergency medical services, 22 communications representatives and another 15 from various other disciplines.

The first part of the survey focused on the current public-safety radio system. Fifteen characteristics were included in the survey, and the leading concerns centered on existing coverage deficits (including portable radio coverage) along with channel crowding and interoperability. It was interesting to note, though, the survey yielded no "critical" concerns impacting the system today.

The next section focused on 27 desirable attributes for any successor network that may be developed. While improved coverage ranked very high, the stakeholder community placed a premium on issues relating to network reliability, survivability and ongoing maintainability.

Survey participants were also invited to provide any additional open-ended comments related to the present or future radio systems, and nearly a quarter did so. Many of those comments showed an excellent understanding of communications technologies and user needs, and provided a vital insight into stakeholder thinking and participation in solutions development.

All survey responses were scored and ranked on a comprehensive basis, and this reflects the primary focus of this report. Appendices have also been provided to show comparisons between stakeholder communities and among the various roles within those communities; these will be useful in the future if and when a project begins to take shape.

The needs assessment results demonstrate that a "business case" has been developed for Lehigh County to establish a project intended to determine the next generation of mission-critical communications for both short- and long-term futures. This can be anticipated to be a complex, time-consuming undertaking that will require close management and direction. The communications network that will eventually evolve, however, will represent a direct investment in both first-responders and the community that will benefit Lehigh County for the next generation.

2.0 Survey Overview / Methodology

Discussions on the future of public-safety communications in Lehigh County have been held for a number of years, but comprehensive strategic planning began early in 2021. An initial structure for this initiative was outlined in the *Lehigh County Emergency Communications Network Strategic Development Project Plan* (the *Project Plan*) which was completed in May 2021. Section 3 of that plan, *Communications System Strategic Planning*, discussed the initial recommended steps:

> "...it will be necessary to assess the existing radio network, identify immediate, short-term and long-term concerns with its operation and determine its ability to continue supporting emergency communications until such time that a new or upgraded network can be deployed."[1]

> "A parallel information-gathering requirement will be to identify current and future needs envisioned for the communications network."[2]
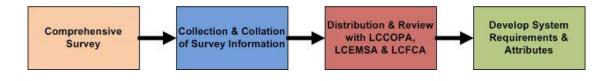
While the *Project Plan* noted the most effective manner to achieve these objectives would be through a series of personal interviews with all system stakeholders, it was also obvious such a process would be both time- and labor-intensive. However, the development of an open stakeholder survey was identified as an efficacious alternative.

A comprehensive instrument was developed and tested consisting of four (4) parts:

- Demographic identification of the survey participant's primary service affiliation;
- The participant's role within that service;
- Perceptions on 15 distinct traits of the existing communications network; and,
- The importance of 27 common attributes of modern public-safety communications systems.

Survey participants were also provided with an opportunity to provide any additional comments they considered germane to the subject.

The *Project Plan* envisioned this process to follow a flow depicted by the following illustration:

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[1] *Lehigh County Emergency Communications Network Strategic Development Project Plan* (hereinafter referenced as *Project Plan*), May 2021; Page 7
[2] *ibid.*

This report represents the "bridge" between the second and third stages of the needs assessment effort identified in the *Project Plan*.

The survey was conducted using an on-line tool, and a link to that tool was distributed by the County among the stakeholder community. The survey was opened on September 8th and closed on October 31st; it was briefly re-opened from November 1st through November 13th to capture input from an overlooked emergency services discipline. In all, 214 surveys were sufficiently completed to be included in this analysis.[3] The distribution of participants is illustrated in the following table:

Agency Type	#	Pct.
Law Enforcement	74	34.6%
Fire/Rescue	68	31.8%
EMS	35	16.4%
Communications	22	10.3%
Other	15	7.0%
Total	**214**	

Analysis of participant responses related to "Current System Observations" and "Future System Requirements & Goals" are discussed in the next two sections of this report. Appendix A is a comparative analysis of the comprehensive survey results with the individual service affiliations; while illustrating some parallels between services, this analysis also reveals some differences in perspectives.

Additional analysis of individual primary service affiliation responses can be found in Appendices B-F. These illustrate the different roles within service disciplines and opinions that both converge and diverge; these will be particularly useful if an when a project moves forward into a detailed design phase.

While it is unfortunate that some Lehigh County stakeholders opted to limit their participation in this effort or, in some instances, not participate at all, the distribution of responses from within the public-safety community provides a sufficiently clear picture of existing radio communications concerns and the perceived needs for the future.

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[3] Several surveys were started and included only demographic information. It appears many were subsequently re-started and completed later the same day or within the next 1-2 days. These "false starts" were excluded from consideration.

3.0 Current System Observations

The initial focus of the survey was to gain an understanding of stakeholder perceptions of the current public-safety communications system. This provides a benchmark from which the desired attributes of a *new* system can be identified and placed in perspective (i.e.: an attribute that is "nice to have" v. one that is already causing a concern in daily operations).

Survey participants were asked their impressions of 15 different system characteristics, and to evaluate each on a six-point scale:

0=	No problem identified
1=	Identified problem; currently not of concern
2=	Occasionally a problem; affects some operations, but is generally worked around
3=	Regularly a problem; operations routine affected
4=	Frequently a problem; affects operations and compromises radio user mission
5=	Critical concern; usually affects operations, and is a potential life-safety issue

The following table reflects the responses received for each score, the total number of responses[4] to each statement and the calculated average response. The table has been ordered from the highest-ranked concern to the lowest.

Question / Statement	0	1	2	3	4	5	Total	Average
1. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.	29	9	64	37	34	40	213	2.74
2. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.	17	13	108	37	18	19	212	2.39
3. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.	39	19	71	33	24	27	213	2.31
4. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.	35	16	94	35	26	7	213	2.10
5. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.	47	23	69	34	24	15	212	2.05
6. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.	69	17	61	14	25	27	213	1.95

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[4] It will be noticed the total number of responses for each question will vary slightly. It is apparent that some survey participants opted to not provide an opinion on every statement.

Question / Statement	0	1	2	3	4	5	Total	Average
7. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.	64	9	80	31	17	13	214	1.85
8. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.	69	11	66	33	23	11	213	1.83
9. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.	64	21	67	30	18	13	213	1.79
10. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.	80	29	37	23	22	22	213	1.74
11. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear someone calling them.	76	23	65	27	14	8	213	1.55
12. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).	104	21	64	10	6	8	213	1.14
13. Cumbersome Operation- the user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.	121	23	48	3	10	6	211	0.94
14. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.	130	26	30	15	4	6	211	0.84
15. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.	139	34	31	3	5	1	213	0.61

The most obvious takeaway from these results is no consensus with respect to any *critical* shortcomings with the current communications system. The most salient concern is the system not being portable-based which is viewed as a regular problem often affecting operations. Most of the following system attributes suggest only occasional problems that can be mitigated in some manner, and the four lowest-ranked traits do not appear to present much of a concern for stakeholders. Rankings *do* show some differences between primary service affiliations and stakeholder roles within those groups; these are reviewed in more detail in the appendices.

4.0 Future System Requirements & Goals

The next focus of the survey was to gain an understanding of stakeholder perceptions of what a future communications network should include. Such attributes may be able to be provided by the existing system with an investment in upgrades and modifications, or they could be unique to more modern IP-based networks (generally simulcast trunked systems). Identification of desirable attributes is a necessary first step in the design of any communications network.

Survey participants were asked their views on 27 common system characteristics and their importance to their duties. As before, they were asked to rate each attribute using a six-point scale:

0= Attribute is NOT IMPORTANT to the user
1= Attribute is MINIMALLY IMPORTANT to the user
2= Attribute is NICE TO HAVE; could enhance operations
3= Attribute is USEFUL; will promote more efficient day-to-day operations
4= Attribute is QUITE IMPORTANT; necessary to mission support and life-safety
5= Attribute is CRITICAL; its absence will compromise the user's mission and life-safety

The following table reflects the responses received for each score, the total number of responses[5] to each statement and the calculated average response. The table has been ordered from the attribute with the highest-ranked interest to the lowest.

Question / Statement	0	1	2	3	4	5	Total	Average
1. Survivability- The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.	1	0	3	16	42	134	196	4.55
2. Coverage- The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."	0	1	10	23	43	119	196	4.37
3. Power Backup- All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.	3	0	10	22	35	125	195	4.36

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[5] It will be noticed the total number of responses for each question will vary slightly. It is apparent that some survey participants opted to not provide an opinion on every statement. Also, fewer participants chose to respond to this part of the survey.

Question / Statement	0	1	2	3	4	5	Total	Average
4. Reliability- The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.	1	1	6	24	60	104	196	4.31
5. Maintainability- The system shall be designed for a mean-time-to-repair of not more than two (2) hours.	2	2	10	35	78	69	196	4.00
6. Emergency Access- The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.	1	3	13	42	62	75	196	3.97
7. Intercommunications- The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.	1	2	14	39	74	66	196	3.94
8. Capacity- the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.	2	3	17	35	77	63	197	3.88
9. Training- The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.	1	1	17	59	60	58	196	3.79
10. Immunity from Interference- The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."	1	3	19	43	79	51	196	3.78
11. Support New Technologies- The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.	2	3	16	47	83	45	196	3.74
12. No Internal Congestion- The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.	3	3	16	55	67	52	196	3.71
13. Interoperability- The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.	2	4	18	57	60	55	196	3.70

Question / Statement	0	1	2	3	4	5	Total	Average
14. Future Expansion- The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.	2	3	17	55	71	48	196	3.70
15. Monitoring- Supervisors shall have the ability to monitor communications on all talk paths.	7	7	20	52	53	57	196	3.57
16. System Operational Transparency- The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).	4	4	24	65	55	42	194	3.49
17. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.	2	1	28	71	61	33	196	3.46
18. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.	3	5	31	60	57	40	196	3.44
19. Operational Boundary Flexibility- Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.	5	6	19	72	62	32	196	3.41
20. Console Features- Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.	15	2	28	51	53	47	196	3.36
21. Dispatch Operational Concept- The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.	9	3	35	58	52	39	196	3.32

Question / Statement	0	1	2	3	4	5	Total	Average
22. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.	16	18	21	35	50	55	195	3.28
23. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.	16	11	41	45	39	44	196	3.08
24. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.	22	16	27	57	41	33	196	2.91
25. Commonality of Equipment- A single vendor shall supply and install all radio system infrastructure equipment.	25	16	34	49	40	32	196	2.81
26. Long-Term Cost- The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.	30	26	17	39	50	34	196	2.79
27. Initial Cost- The initial cost of the system to Lehigh County and its affiliated users is a prime concern.	37	27	17	32	46	37	196	2.68

There are a number of interesting takeaways from this aspect of the survey with respect to the future needs assessment for a new communications network. They include:

- Four of the first five highest-ranked attributes concern overall system reliability and survivability. While this is a fairly obvious desire with any radio system, it is somewhat surprising that first-responders expressed a greater interest in this than in some of the functions that more directly support their daily operations.

- The second-highest ranked attribute, coverage, ties in closely with the biggest concerns expressed about the current system.

- Ten attributes trended toward being "quite important" and necessary to provide mission support and ensure life-safety. Eight more trended toward the "useful" rating.

- *None* of the attributes ranked with the three lowest scores: "nice to have," "minimally important" or "not important," and the four attributes that averaged below 3.0 all concerned procurement and cost matters.

Again, the rankings show some differences between primary service affiliations and stakeholder roles within those groups that are discussed in more detail in the appendices.

5.0 Survey Conclusions & Next Steps

From a project management perspective, a "business case" must be developed to support the need for undertaking any kind of project. That is, there must be a sound basis for justifying an investment in the intended outcomes. The *Project Plan* notes:

> "The current Lehigh County public-safety radio system can be generically described as a 'legacy' network that is a patchwork of different frequencies that no longer adequately support the needs of the stakeholder community. Older technology can be easily compromised, operational security is non-existent and opportunities to expand system capacity or resources on a countywide basis is impractical or, in some cases, virtually impossible. Additionally, the City of Allentown operates a modern radio platform that is incompatible with the remainder of the County, and interoperability between local first responders is difficult. At the regional, state or federal levels, these communications difficulties can lead to potentially tragic consequences."[6]

While this statement is undeniably true, the needs assessment provides empirical evidence provided by system stakeholders to support it and justify formal implementation of a "radio improvement project." A specific or recommended direction, though, was elusive.

However, the *Plan* also states:

> "In an effort to upgrade, modernize and enhance its communications capabilities, Lehigh County proposes to implement a P25 digital radio network that includes both simulcast and trunked operations. This system will support 4,500 first responders who are dependent upon radio communications to perform their mission critical duties. The proposed network will improve coverage throughout the County, eliminate disparate communications platforms now in use, and permit interoperability at the local, regional, state and federal levels that have already adopted technologically-advanced radio capabilities. Additionally, the proposed system will include enhanced network and user security capabilities necessary in the 21st century world. It is also intended that the new network will be easily upgradable and maintainable for the foreseeable future without a need for expensive modification or replacement."[7]

The *Project Plan* envisioned this proposed direction as it is in concert with common public-safety communications system development in the United State today. While the needs assessment has not discouraged pursuing this course of action, it does *not* completely justify or support such a solution. More work needs to be done.

Four general avenues for consideration of a radio improvement initiative were identified in the *Project Plan*. These included retaining and updating the existing network, developing a solution using "commercial" resources (e.g.: cellular), implementing a "shared" network by expanding upon one already in place (e.g.: Allentown, Northampton County, Schuylkill

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[6] *Project Plan*; Page 1
[7] *ibid.*

County, etc.) or acquiring an entirely new, proprietary system dedicated solely to Lehigh County.[8]

As previously noted, the most significant existing concerns focus on radio network coverage, including adequate portable capabilities, along with channel crowding and a lack of interoperability. In addition to improving coverage, issues relating to network reliability topped the "wish list" of stakeholders responding to the needs assessment. Focusing on these issues rather than a particular make or style of a radio system is where planning should begin.

Next steps for consideration should include:

➤ Wide, unrestricted distribution of the results of the needs assessment within the stakeholder community (website availability should be a consideration). More than 200 participated in the survey process and many more are likely interested in the results. Nothing in this report should be considered proprietary, nor does it contain any information or references which might compromise future conversations with vendors.

➤ Appendix A should be reviewed closely as it shows both similarities and disparities within the stakeholder communities that will influence this project. Risks can be identified where competing interests may exist that will need to be managed as any project develops.

➤ Appendices B, C, D and E will be of interest primarily to individual public-safety disciplines. These represent points of discussion within those disciplines that will need to be resolved in an effort to determine a cohesive viewpoint. (Appendix F has no "community," *per se*, but there are some points of interest raised by those who need to use radio communications on a less frequent basis and which should not be overlooked.)

➤ The individual comments included in Appendix G are unfiltered, and they provide a window into the thought processes of nearly a quarter of those who responded to the survey. The vast majority of these present views and ideas that should be carefully considered as a project begins to move forward (and those related to the current system should be taken into consideration regardless of the genesis of a future effort).

The needs assessment has clearly established that a "business case" exists to undertake an investment in a project that will meet the needs of the public-safety community for both the short- and long-term futures. This will be a complex, time-consuming undertaking that will need to be closely managed; however, the communications network that can evolve from such a project will represent a direct investment in, and benefit to, both first-responders and the Lehigh County community for the next generation.

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[8] *ibid.*, Pages 7-8

6.0 Appendices

APPENDIX A - COMPARATIVE ANALYSES

The needs assessment survey anticipated there would be differences between stakeholder groups both with respect to their experiences with the current radio system and their desires for a replacement network. The following tables provide a side-by-side analysis of responses to both parts of the survey; these tables have been ordered by their comprehensive rankings from most- to least-important.

CURRENT SYSTEM OBSERVATIONS

0= No problem identified
1= Identified problem; currently not of concern
2= Occasionally a problem; affects some operations, but is generally worked around
3= Regularly a problem; operations routine affected
4= Frequently a problem; affects operations and compromises radio user mission
5= Critical concern; usually affects operations, and is a potential life-safety issue

1. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.74	1	2.55	1	2.60	1	3.40	1	3.45	1	1.64	8

2. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.39	2	2.32	2	2.21	6	2.71	2	3.00	5	1.93	4

3. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.31	3	2.14	3	2.35	4	2.14	5	3.18	3	2.00	2

4. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.10	4	1.64	5	2.50	2	2.43	4	2.36	8	1.43	10

5. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.05	5	1.30	8	2.36	3	2.57	3	3.23	2	1.36	12

6. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.95	6	1.71	4	2.10	7	1.54	10	2.82	6	2.13	1

7. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.85	7	1.42	7	2.01	8	2.06	6	2.55	7	1.67	7

8. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.83	8	1.64	6	1.93	10	2.00	7	1.73	13	2.00	3

9. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.79	9	1.15	10	2.26	5	1.94	8	2.23	9	1.80	6

10. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.74	10	1.25	9	1.94	9	1.43	11	3.14	4	1.87	5

11. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear when someone is calling them.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.55	11	1.04	11	1.81	11	1.86	9	2.05	10	1.43	11

12. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
1.14	12	0.96	12	1.06	12	1.00	13	2.00	11	1.47	9

13. Cumbersome Operation- The user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
0.94	13	0.46	15	1.03	13	1.29	12	1.68	14	0.93	14

14. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
0.84	14	0.64	13	0.72	14	0.86	14	1.95	12	0.93	13

15. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
0.61	15	0.49	14	0.68	15	0.71	15	0.86	15	0.29	15

FUTURE SYSTEM REQUIREMENTS & GOALS

0=   Attribute is NOT IMPORTANT to the user
1=   Attribute is MINIMALLY IMPORTANT to the user
2=   Attribute is NICE TO HAVE; could enhance operations
3=   Attribute is USEFUL; will promote more efficient day-to-day operations
4=   Attribute is QUITE IMPORTANT; necessary to mission support and life-safety
5=   Attribute is CRITICAL; its absence will compromise the user's mission and life-safety

1. Survivability- The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
4.55	1	4.51	1	4.59	1	4.58	1	4.74	2	4.23	5

2. Coverage- The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
4.37	2	4.26	3	4.40	3	4.21	3	4.79	1	4.62	1

3. Power Backup- All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
4.36	3	4.31	2	4.51	2	4.15	4	4.47	4	4.33	3

4. Reliability- The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
4.31	4	4.04	4	4.40	4	4.55	2	4.53	3	4.38	2

5. Maintainability- The system shall be designed for a mean-time-to-repair of not more than two (2) hours.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
4.00	5	3.84	6	4.24	5	3.97	6	4.11	13	3.62	15

6. Emergency Access- The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.97	6	3.76	8	4.11	6	4.09	5	4.00	15	4.00	7

7. Intercommunications- The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.94	7	3.87	5	3.98	7	3.67	11	4.32	7	4.31	4

8. Capacity- the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.88	8	3.83	7	3.89	10	3.73	10	4.32	6	3.92	8

9. Training- The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.79	9	3.51	13	3.94	9	3.67	12	4.26	9	4.08	6

10. Immunity from Interference- The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.78	10	3.59	11	3.84	13	3.94	7	4.16	10	3.54	16

11. Support New Technologies- The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.74	11	3.57	12	3.76	15	3.88	9	3.95	18	3.85	11

12..No Internal Congestion- The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.71	12	3.68	9	3.75	16	3.55	14	4.05	14	3.69	12

13. Interoperability- The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.70	13	3.49	15	3.84	12	3.61	13	4.11	12	3.85	9

14. Future Expansion- The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.70	14	3.51	14	3.89	11	3.55	15	3.95	17	3.85	10

15. Monitoring- Supervisors shall have the ability to monitor communications on all talk paths.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.57	15	3.28	19	3.78	14	3.42	16	4.16	11	3.62	14

16. System Operational Transparency- The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.49	16	3.30	18	3.65	17	3.33	21	3.95	19	3.38	20

17. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.46	17	3.34	16	3.63	18	3.39	17	3.47	23	3.46	17

18. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.44	18	3.19	21	3.62	19	3.33	19	3.79	20	3.69	13

19. Operational Boundary Flexibility- Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.41	19	3.25	20	3.51	21	3.36	18	3.74	22	3.38	21

20. Console Features- Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.36	20	3.01	22	3.43	23	3.33	20	4.32	8	3.46	18

21. Dispatch Operational Concept- The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.32	21	3.32	17	3.35	24	2.97	22	4.00	16	3.00	26

22. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.28	22	2.06	26	3.95	8	3.91	8	4.37	5	3.15	24

23. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
3.08	23	3.66	10	2.48	27	2.91	23	3.79	21	2.38	27

24. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.91	24	2.62	24	3.35	25	2.52	24	3.00	25	3.15	25

25. Commonality of Equipment- A single vendor shall supply and install all radio system infrastructure equipment.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.81	25	2.88	23	2.76	26	2.30	27	3.32	24	3.23	23

26. Long-Term Cost- The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.79	26	2.10	25	3.58	20	2.48	25	2.63	26	3.46	19

27. Initial Cost- The initial cost of the system to Lehigh County and its affiliated users is a prime concern

Comprehensive		Law Enforcement		Fire/Rescue		EMS		Communications		Other	
Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank	Average	Rank
2.68	27	2.03	27	3.51	22	2.39	26	2.32	27	3.38	22

APPENDIX B - LAW ENFORCEMENT ANALYSIS

Law enforcement representatives from 18 Lehigh County agencies contributed 74 survey responses (34.6% of the total participation). As noted on the following table, there was a reasonable distribution of responses from the stakeholder roles provided on the survey:

Role	#	Pct.
Chief/Agency Head	17	23.0%
Supervisor	24	32.4%
Investigator	7	9.5%
Patrol Officer	26	35.1%
Total	**74**	

Agency participation was distributed among the following entities:

Agency	#`	Agency	#
Alburtis Boro	1	LCTI Schools	0
Allentown	1	LVIA	2
Catasauqua Boro	0	Macungie Boro	0
CLIU Schools	1	North Catasauqua Boro	1
Cooperburg Boro	7	Northern Lehigh Schools	0
Coplay Boro	2	Northwestern Lehigh Schools	0
DeSales University	0	PSU- Lehigh Valley	0
Emmaus Boro	8	Salisbury Twp.	1
Fountain Hill Boro	0	Slatington Boro	1
Lehigh APO	1	South Whitehall Twp.	8
Lehigh C&Y	0	Upper Macungie Twp.	13
Lehigh Constables	0	Upper Saucon Twp.	1
Lehigh Coroner	0	Walnutport Boro	1
Lehigh Corrections	0	Whitehall Twp.	23
Lehigh JPO	1	Other	1
Lehigh Sheriff	0		
		Total:	**74**

The following tables outline the survey responses between the various functions within the law enforcement environment, and also compares them with their comprehensive response ranking. Both the "Current System Observations" and "Future System Requirements & Goals" have been ordered in their importance only to the law enforcement community; refer to Appendix A for a comparison with the comprehensive ranking and other stakeholder groups.

Current System Observations

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
1. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.	Comprehensive	10	4	26	16	5	13	74	2.55
	Chief	4	0	6	2	0	5	17	2.53
	Supervisors	3	0	6	6	4	5	24	2.96
	Investigators	0	1	2	3	0	1	7	2.71
	Patrol Officers	3	3	12	5	1	2	26	2.15

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
2. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.	Comprehensive	4	5	43	11	5	5	73	2.32
	Chief	3	0	10	0	3	1	17	2.18
	Supervisors	0	1	11	8	0	3	23	2.70
	Investigators	0	1	5	1	0	0	7	2.00
	Patrol Officers	1	3	17	2	2	1	26	2.15

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
3. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.	Comprehensive	15	10	21	13	5	9	73	2.14
	Chief	3	1	7	1	0	5	17	2.53
	Supervisors	6	2	6	6	4	0	24	2.00
	Investigators	1	1	1	1	1	1	6	2.50
	Patrol Officers	5	6	7	5	0	3	26	1.92

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
4. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.	Comprehensive	27	6	22	5	5	8	73	1.71
	Chief	6	0	6	1	2	2	17	1.94
	Supervisors	8	2	6	4	3	1	24	1.79
	Investigators	2	1	1	0	0	2	6	2.17
	Patrol Officers	11	3	9	0	0	3	26	1.38

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
5. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.	Comprehensive	14	12	39	5	4	0	74	1.64
	Chief	5	3	7	2	0	0	17	1.35
	Supervisors	4	5	14	1	0	0	24	1.50
	Investigators	0	1	5	0	1	0	7	2.14
	Patrol Officers	5	3	13	2	3	0	26	1.81

		0	1	2	3	4	5	Total	Average
6. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.	Comprehensive	29	3	23	5	9	4	73	1.64
	Chief	8	0	5	0	4	0	17	1.53
	Supervisors	9	0	6	4	3	1	23	1.78
	Investigators	1	1	3	0	0	2	7	2.43
	Patrol Officers	11	2	9	1	2	1	26	1.38

		0	1	2	3	4	5	Total	Average
7. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.	Comprehensive	30	5	26	8	1	4	74	1.42
	Chief	7	1	4	3	1	1	17	1.59
	Supervisors	9	1	12	0	0	2	24	1.46
	Investigators	3	0	2	2	0	0	7	1.43
	Patrol Officers	11	3	8	3	0	1	26	1.27

		0	1	2	3	4	5	Total	Average
8. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.	Comprehensive	26	14	27	2	3	2	74	1.30
	Chief	8	0	7	1	1	0	17	1.24
	Supervisors	7	6	10	0	0	1	24	1.29
	Investigators	5	0	2	0	0	0	7	0.57
	Patrol Officers	6	8	8	1	2	1	26	1.54

		0	1	2	3	4	5	Total	Average
9. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.	Comprehensive	39	9	12	3	1	9	73	1.25
	Chief	8	3	0	1	1	4	17	1.76
	Supervisors	13	3	5	0	0	3	24	1.17
	Investigators	2	1	2	0	0	1	6	1.67
	Patrol Officers	16	2	5	2	0	1	26	0.88

		0	1	2	3	4	5	Total	Average
10. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.	Comprehensive	33	11	19	7	1	2	73	1.15
	Chief	7	3	5	2	0	0	17	1.12
	Supervisors	10	3	8	2	0	1	24	1.25
	Investigators	4	1	0	1	0	0	6	0.67
	Patrol Officers	12	4	6	2	1	1	26	1.19

11. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear when someone is calling them.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	34	12	23	2	2	1	74	1.04
	Chief	10	1	4	2	0	0	17	0.88
	Supervisors	12	4	7	0	0	1	24	0.96
	Investigators	2	2	3	0	0	0	7	1.14
	Patrol Officers	10	5	9	0	2	0	26	1.19

12. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	42	6	20	0	1	4	73	0.96
	Chief	10	1	4	0	0	2	17	1.12
	Supervisors	11	1	11	0	0	1	24	1.17
	Investigators	5	0	1	0	0	0	6	0.33
	Patrol Officers	16	4	4	0	1	1	26	0.81

13. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	48	9	11	2	1	1	72	0.64
	Chief	11	2	2	1	0	0	16	0.56
	Supervisors	14	3	6	0	1	0	24	0.79
	Investigators	4	1	0	1	0	0	6	0.67
	Patrol Officers	19	3	3	0	0	1	26	0.54

14. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	51	12	10	0	1	0	74	0.49
	Chief	11	4	1	0	1	0	17	0.59
	Supervisors	17	3	4	0	0	0	24	0.46
	Investigators	3	2	2	0	0	0	7	0.86
	Patrol Officers	20	3	3	0	0	0	26	0.35

15. Cumbersome Operation- the user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	54	7	9	0	2	0	72	0.46
	Chief	11	1	4	0	0	0	16	0.56
	Supervisors	19	1	3	0	1	0	24	0.46
	Investigators	5	0	1	0	0	0	6	0.33
	Patrol Officers	19	5	1	0	1	0	26	0.42

Future System Requirements & Goals

1. **Survivability-** The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	2	8	11	47	68	4.51
	Chiefs	0	0	0	1	3	13	17	4.71
	Supervisors	0	0	0	4	2	15	21	4.52
	Investigators	0	0	0	0	0	6	6	5.00
	Patrol Officers	0	0	2	3	6	13	24	4.25

2. **Power Backup-** All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	4	12	11	41	68	4.31
	Chiefs	0	0	1	2	3	11	17	4.41
	Supervisors	0	0	0	4	2	15	21	4.52
	Investigators	0	0	0	1	2	3	6	4.33
	Patrol Officers	0	0	3	5	4	12	24	4.04

3. **Coverage-** The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	6	8	17	38	69	4.26
	Chiefs	0	0	1	3	3	10	17	4.29
	Supervisors	0	0	1	1	6	13	21	4.48
	Investigators	0	0	1	0	3	3	7	4.14
	Patrol Officers	0	0	3	4	5	12	24	4.08

4. **Reliability-** The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	1	5	10	21	30	68	4.04
	Chiefs	0	0	0	3	5	9	17	4.35
	Supervisors	0	0	1	3	8	9	21	4.19
	Investigators	1	0	0	0	2	3	6	3.83
	Patrol Officers	0	1	4	4	6	9	24	3.75

5. **Intercommunications-** The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	0	6	15	24	22	68	3.87
	Chiefs	0	0	0	3	6	8	17	4.29
	Supervisors	0	0	2	5	7	7	21	3.90
	Investigators	1	0	0	1	4	0	6	3.17
	Patrol Officers	0	0	4	6	7	7	24	3.71

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
6. Maintainability- The system shall be designed for a mean-time-to-repair of not more than two (2) hours.	Comprehensive	0	1	8	15	21	23	68	3.84
	Chiefs	0	0	1	5	3	8	17	4.06
	Supervisors	0	0	2	5	6	8	21	3.95
	Investigators	0	0	1	0	4	1	6	3.83
	Patrol Officers	0	1	4	5	8	6	24	3.58

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
7. Capacity- the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.	Comprehensive	1	1	6	14	26	21	69	3.83
	Chiefs	0	0	0	5	7	5	17	4.00
	Supervisors	0	0	2	4	6	9	21	4.05
	Investigators	1	0	1	0	5	0	7	3.14
	Patrol Officers	0	1	3	5	8	7	24	3.71

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
8. Emergency Access- The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.	Comprehensive	1	3	6	15	19	24	68	3.76
	Chiefs	0	0	0	2	7	8	17	4.35
	Supervisors	0	1	2	4	7	7	21	3.81
	Investigators	1	0	0	1	2	2	6	3.50
	Patrol Officers	0	2	4	8	3	7	24	3.38

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
9. No Internal Congestion- The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.	Comprehensive	1	1	5	21	24	16	68	3.68
	Chiefs	0	0	0	4	8	5	17	4.06
	Supervisors	0	0	2	9	6	4	21	3.57
	Investigators	1	0	0	2	3	0	6	3.00
	Patrol Officers	0	1	3	6	7	7	24	3.67

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
10. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.	Comprehensive	1	1	11	16	17	22	68	3.66
	Chiefs	0	0	2	3	6	6	17	3.94
	Supervisors	1	0	5	6	4	5	21	3.29
	Investigators	0	0	1	1	1	3	6	4.00
	Patrol Officers	0	1	3	6	6	8	24	3.71

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
11. Immunity from Interference- The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."	Comprehensive	1	0	14	11	27	15	68	3.59
	Chiefs	0	0	1	2	12	2	17	3.88
	Supervisors	1	0	4	4	6	6	21	3.52
	Investigators	0	0	1	1	3	1	6	3.67
	Patrol Officers	0	0	8	4	6	6	24	3.42

		0	1	2	3	4	5	Total	Average
12. Support New Technologies- The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.	Comprehensive	2	2	6	19	23	16	68	3.57
	Chiefs	0	1	0	4	8	4	17	3.82
	Supervisors	2	0	2	6	7	4	21	3.33
	Investigators	0	0	0	3	2	1	6	3.67
	Patrol Officers	0	1	4	6	6	7	24	3.58

		0	1	2	3	4	5	Total	Average
13. Training- The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.	Comprehensive	0	1	12	23	15	17	68	3.51
	Chiefs	0	0	2	2	8	5	17	3.94
	Supervisors	0	0	5	7	3	6	21	3.48
	Investigators	0	0	1	3	1	1	6	3.33
	Patrol Officers	0	1	4	11	3	5	24	3.29

		0	1	2	3	4	5	Total	Average
14. Future Expansion- The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.	Comprehensive	1	1	8	25	18	15	68	3.51
	Chiefs	0	1	0	6	6	4	17	3.71
	Supervisors	1	0	2	7	5	6	21	3.57
	Investigators	0	0	1	1	4	0	6	3.50
	Patrol Officers	0	0	5	11	3	5	24	3.33

		0	1	2	3	4	5	Total	Average
15. Interoperability- The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.	Comprehensive	0	1	10	24	21	12	68	3.49
	Chiefs	0	0	1	6	7	3	17	3.71
	Supervisors	0	0	5	6	9	1	21	3.29
	Investigators	0	0	1	3	2	0	6	3.17
	Patrol Officers	0	1	3	9	3	8	24	3.58

		0	1	2	3	4	5	Total	Average
16. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.	Comprehensive	2	1	10	22	25	8	68	3.34
	Chiefs	0	0	1	5	9	2	17	3.71
	Supervisors	2	0	2	9	4	4	21	3.19
	Investigators	0	0	2	1	3	0	6	3.17
	Patrol Officers	0	1	5	7	9	2	24	3.25

17. Dispatch Operational Concept- The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	4	0	10	24	16	14	68	3.32
Chiefs	1	0	2	4	4	6	17	3.65
Supervisors	2	0	2	8	6	3	21	3.19
Investigators	0	0	1	2	3	0	6	3.33
Patrol Officers	1	0	5	10	3	5	24	3.21

18. System Operational Transparency- The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	0	12	28	15	10	66	3.30
Chiefs	0	0	1	7	3	5	16	3.75
Supervisors	0	0	4	9	4	3	20	3.30
Investigators	0	0	1	1	4	0	6	3.50
Patrol Officers	1	0	6	11	4	2	24	2.96

19. Monitoring- Supervisors shall have the ability to monitor communications on all talk paths.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	3	3	10	22	16	14	68	3.28
Chiefs	0	1	3	5	4	4	17	3.41
Supervisors	0	0	3	8	5	5	21	3.57
Investigators	1	1	1	0	2	1	6	2.67
Patrol Officers	2	1	3	9	5	4	24	3.08

20. Operational Boundary Flexibility- Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	2	11	28	17	9	68	3.25
Chiefs	0	0	3	7	4	3	17	3.41
Supervisors	0	2	3	6	7	3	21	3.29
Investigators	0	0	2	1	3	0	6	3.17
Patrol Officers	1	0	3	14	3	3	24	3.13

21. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	4	14	21	18	10	68	3.19
Chiefs	0	1	5	1	7	3	17	3.35
Supervisors	0	1	4	6	7	3	21	3.33
Investigators	1	0	0	3	2	0	6	2.83
Patrol Officers	0	2	5	11	2	4	24	3.04

22. Console Features- Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.

	0	1	2	3	4	5	Total	Average
Comprehensive	7	0	15	18	19	9	68	3.01
Chiefs	2	0	2	4	5	4	17	3.29
Supervisors	2	0	5	6	6	2	21	2.95
Investigators	1	0	1	2	2	0	6	2.67
Patrol Officers	2	0	7	6	6	3	24	2.96

23. Commonality of Equipment- A single vendor shall supply and install all radio system infrastructure equipment.

	0	1	2	3	4	5	Total	Average
Comprehensive	7	5	9	26	10	11	68	2.88
Chiefs	0	2	0	8	3	4	17	3.41
Supervisors	3	1	4	5	4	4	21	2.86
Investigators	1	0	1	2	2	0	6	2.67
Patrol Officers	3	2	4	11	1	3	24	2.58

24. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.

	0	1	2	3	4	5	Total	Average
Comprehensive	9	7	12	19	15	6	68	2.62
Chiefs	1	1	3	6	3	3	17	3.06
Supervisors	6	2	3	3	5	2	21	2.24
Investigators	0	1	2	1	2	0	6	2.67
Patrol Officers	2	3	4	9	5	1	24	2.63

25. Long-Term Cost- The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.

	0	1	2	3	4	5	Total	Average
Comprehensive	18	13	7	11	9	9	67	2.10
Chiefs	1	3	0	4	4	4	16	3.19
Supervisors	6	2	1	4	3	5	21	2.52
Investigators	2	2	2	0	0	0	6	1.00
Patrol Officers	9	6	4	3	2	0	24	1.29

26. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.

	0	1	2	3	4	5	Total	Average
Comprehensive	14	16	7	18	6	6	67	2.06
Chiefs	2	3	1	8	1	2	17	2.53
Supervisors	4	6	2	6	1	2	21	2.00
Investigators	4	1	0	0	0	1	6	1.00
Patrol Officers	4	6	4	4	4	1	23	2.04

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
27. Initial Cost- The initial cost of the system to Lehigh County and its affiliated users is a prime concern.	Comprehensive	18	15	7	10	11	7	68	2.03
	Chiefs	1	3	2	2	5	4	17	3.12
	Supervisors	6	2	2	3	5	3	21	2.38
	Investigators	2	2	2	0	0	0	6	1.00
	Patrol Officers	9	8	1	5	1	0	24	1.21

APPENDIX C - FIRE SERVICES ANALYSIS

Fire/Rescue representatives from 34 Lehigh County agencies contributed 68 survey responses (31.8% of the total participation). As noted on the following table, the vast majority of responses came from chief officers; there was very limited survey participation among rank-and-file personnel:

Role	#	Pct.
Chief Officer	47	69.1%
Line Officer	11	16.2%
Firefighter	8	11.8%
Other	2	2.9%
Total	**68**	

Agency participation was distributed among the following entities:

Agency	#`		Agency	#
Allentown	1		Neffs	3
Catasauqua	1		New Tripoli	1
Cetronia	2		North Catasauqua	0
Coopersburg	1		Old Zionsville	3
Coplay	1		Salisbury Twp.	0
Eastern Salisbury	1		Schnecksville	2
Emerald	3		Slatedale	1
Emmaus	2		Slatington	1
Fogelsville	2		South Whitehall Twp.	1
Fountain Hill	1		Trexlertown	1
Friedens	0		Tri-Clover	2
Germansville	1		Upper Macungie	1
Greenawalds	8		Upper Saucon	1
Han-Le-Co	0		Vera Cruz	1
Laury's Station	5		Walnutport	2
LVIA	0		Weisenberg Twp.	5
Lower Macungie	3		Western Salisbury	0
Lower Milford	1		Whitehall	3
Lynnport	1		Woodlawn	2
Macungie	3		Other	1
			Total:	**68**

The following tables outline the survey responses between the various functions within the fire/rescue environment, and also compares them with their comprehensive response ranking. Both the "Current System Observations" and "Future System Requirements & Goals" have been ordered in their importance only to the fire/rescue community; refer to Appendix A for a comparison with the comprehensive ranking and other stakeholder groups.

Current System Observations

<table>
<tr><td></td><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td><td>Average</td></tr>
<tr><td rowspan="5">1. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.</td><td>Comprehensive</td><td>9</td><td>2</td><td>24</td><td>14</td><td>10</td><td>9</td><td>68</td><td>2.60</td></tr>
<tr><td>Chief</td><td>6</td><td>1</td><td>18</td><td>9</td><td>7</td><td>6</td><td>47</td><td>2.60</td></tr>
<tr><td>Line Officer</td><td>2</td><td>1</td><td>5</td><td>1</td><td>2</td><td>0</td><td>11</td><td>2.00</td></tr>
<tr><td>Firefighter</td><td>1</td><td>0</td><td>1</td><td>3</td><td>1</td><td>2</td><td>8</td><td>3.13</td></tr>
<tr><td>Other</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>2</td><td>4.00</td></tr>
</table>

<table>
<tr><td></td><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td><td>Average</td></tr>
<tr><td rowspan="5">2. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.</td><td>Comprehensive</td><td>7</td><td>2</td><td>28</td><td>16</td><td>11</td><td>4</td><td>68</td><td>2.50</td></tr>
<tr><td>Chief</td><td>3</td><td>2</td><td>18</td><td>13</td><td>9</td><td>2</td><td>47</td><td>2.62</td></tr>
<tr><td>Line Officer</td><td>1</td><td>0</td><td>9</td><td>1</td><td>0</td><td>0</td><td>11</td><td>1.91</td></tr>
<tr><td>Firefighter</td><td>2</td><td>0</td><td>1</td><td>1</td><td>2</td><td>2</td><td>8</td><td>2.88</td></tr>
<tr><td>Other</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>2</td><td>1.50</td></tr>
</table>

<table>
<tr><td></td><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td><td>Average</td></tr>
<tr><td rowspan="5">3. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.</td><td>Comprehensive</td><td>10</td><td>2</td><td>25</td><td>19</td><td>6</td><td>5</td><td>67</td><td>2.36</td></tr>
<tr><td>Chief</td><td>7</td><td>1</td><td>19</td><td>12</td><td>4</td><td>3</td><td>46</td><td>2.30</td></tr>
<tr><td>Line Officer</td><td>2</td><td>1</td><td>4</td><td>4</td><td>0</td><td>0</td><td>11</td><td>1.91</td></tr>
<tr><td>Firefighter</td><td>1</td><td>0</td><td>1</td><td>2</td><td>2</td><td>2</td><td>8</td><td>3.25</td></tr>
<tr><td>Other</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>2</td><td>2.50</td></tr>
</table>

<table>
<tr><td></td><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td><td>Average</td></tr>
<tr><td rowspan="5">4. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.</td><td>Comprehensive</td><td>10</td><td>5</td><td>29</td><td>8</td><td>7</td><td>9</td><td>68</td><td>2.35</td></tr>
<tr><td>Chief</td><td>7</td><td>3</td><td>22</td><td>4</td><td>6</td><td>5</td><td>47</td><td>2.30</td></tr>
<tr><td>Line Officer</td><td>2</td><td>1</td><td>5</td><td>3</td><td>0</td><td>0</td><td>11</td><td>1.82</td></tr>
<tr><td>Firefighter</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>3</td><td>8</td><td>3.13</td></tr>
<tr><td>Other</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>2</td><td>3.50</td></tr>
</table>

5. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.

	0	1	2	3	4	5	Total	Average
Comprehensive	11	7	25	11	6	8	68	2.26
Chief	6	6	18	6	5	6	47	2.34
Line Officer	2	1	5	3	0	0	11	1.82
Firefighter	3	0	1	1	1	2	8	2.38
Other	0	0	1	1	0	0	2	2.50

6. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.

	0	1	2	3	4	5	Total	Average
Comprehensive	6	4	40	8	5	4	67	2.21
Chief	4	3	31	2	4	3	47	2.17
Line Officer	2	0	6	3	0	0	11	1.91
Firefighter	0	1	2	3	0	1	7	2.71
Other	0	0	1	0	1	0	2	3.00

7. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.

	0	1	2	3	4	5	Total	Average
Comprehensive	18	4	26	2	9	9	68	2.10
Chief	12	3	19	1	8	4	47	2.04
Line Officer	4	1	5	1	0	0	11	1.27
Firefighter	1	0	2	0	1	4	8	3.50
Other	1	0	0	0	0	1	2	2.50

8. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.

	0	1	2	3	4	5	Total	Average
Comprehensive	15	2	29	13	7	2	68	2.01
Chief	8	2	19	12	5	1	47	2.15
Line Officer	5	0	6	0	0	0	11	1.09
Firefighter	2	0	2	1	2	1	8	2.50
Other	0	0	2	0	0	0	2	2.00

9. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.

	0	1	2	3	4	5	Total	Average
Comprehensive	17	11	16	10	11	3	68	1.94
Chief	11	9	11	7	7	2	47	1.91
Line Officer	4	1	3	2	1	0	11	1.55
Firefighter	2	1	1	0	3	1	8	2.50
Other	0	0	1	1	0	0	2	2.50

		0	1	2	3	4	5	Total	Average
10. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.	Comprehensive	16	6	26	10	7	3	68	1.93
	Chief	12	4	19	7	4	1	47	1.79
	Line Officer	3	1	5	2	0	0	11	1.55
	Firefighter	0	1	1	1	3	2	8	3.50
	Other	1	0	1	0	0	0	2	1.00

		0	1	2	3	4	5	Total	Average
11. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear when someone is calling them.	Comprehensive	18	5	28	10	3	4	68	1.81
	Chief	12	4	20	6	3	2	47	1.79
	Line Officer	4	1	5	1	0	0	11	1.27
	Firefighter	2	0	2	2	0	2	8	2.50
	Other	0	0	1	1	0	0	2	2.50

		0	1	2	3	4	5	Total	Average
12. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).	Comprehensive	31	9	24	2	1	1	68	1.06
	Chief	21	7	18	1	0	0	47	0.98
	Line Officer	6	1	4	0	0	0	11	0.82
	Firefighter	3	1	1	1	1	1	8	1.88
	Other	1	0	1	0	0	0	2	1.00

		0	1	2	3	4	5	Total	Average
13. Cumbersome Operation- the user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.	Comprehensive	34	10	19	0	3	2	68	1.03
	Chief	22	8	15	0	0	2	47	1.02
	Line Officer	8	1	2	0	0	0	11	0.45
	Firefighter	3	1	1	0	3	0	8	1.88
	Other	1	0	1	0	0	0	2	1.00

		0	1	2	3	4	5	Total	Average
14. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.	Comprehensive	41	10	13	3	1	0	68	0.72
	Chief	28	9	8	2	0	0	47	0.66
	Line Officer	8	2	1	0	0	0	11	0.36
	Firefighter	4	2	0	1	1	0	8	1.13
	Other	1	0	1	0	0	0	2	1.00

		0	1	2	3	4	5	Total	Average
15. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.	Comprehensive	42	11	12	1	2	0	68	0.68
	Chief	28	9	8	1	1	0	47	0.68
	Line Officer	10	0	1	0	0	0	11	0.18
	Firefighter	4	1	2	0	1	0	8	1.13
	Other	0	1	1	0	0	0	2	1.50

Future System Requirements & Goals

1. **Survivability-** The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	4	18	41	63	4.59
	Chiefs	0	0	0	4	13	28	45	4.53
	Line Officers	0	0	0	0	2	6	8	4.75
	Firefighters	0	0	0	0	3	5	8	4.63
	Other	0	0	0	0	0	2	2	5.00

2. **Power Backup-** All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	2	5	15	41	63	4.51
	Chiefs	0	0	1	4	12	28	45	4.49
	Line Officers	0	0	0	0	2	6	8	4.75
	Firefighters	0	0	1	1	1	5	8	4.25
	Other	0	0	0	0	0	2	2	5.00

3. **Coverage-** The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	3	7	14	38	62	4.40
	Chiefs	0	0	2	6	9	28	45	4.40
	Line Officers	0	0	1	0	2	5	8	4.38
	Firefighters	0	0	0	1	3	3	7	4.29
	Other	0	0	0	0	0	2	2	5.00

4. **Reliability-** The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	9	20	34	63	4.40
	Chiefs	0	0	0	8	14	23	45	4.33
	Line Officers	0	0	0	1	2	5	8	4.50
	Firefighters	0	0	0	0	4	4	8	4.50
	Other	0	0	0	0	0	2	2	5.00

5. **Maintainability-** The system shall be designed for a mean-time-to-repair of not more than two (2) hours.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	10	28	25	63	4.24
	Chiefs	0	0	0	7	20	18	45	4.24
	Line Officers	0	0	0	1	5	2	8	4.13
	Firefighters	0	0	0	2	3	3	8	4.13
	Other	0	0	0	0	0	2	2	5.00

6. Emergency Access- The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	4	10	24	25	63	4.11
Chiefs	0	0	3	10	14	18	45	4.04
Line Officers	0	0	1	0	4	3	8	4.13
Firefighters	0	0	0	0	5	3	8	4.38
Other	0	0	0	0	1	1	2	4.50

7. Intercommunications- The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	1	3	10	31	18	63	3.98
Chiefs	0	1	3	9	21	11	45	3.84
Line Officers	0	0	0	1	4	3	8	4.25
Firefighters	0	0	0	0	4	4	8	4.50
Other	0	0	0	0	2	0	2	4.00

8. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	1	4	11	23	23	63	3.95
Chiefs	1	1	3	9	14	17	45	3.89
Line Officers	0	0	1	1	3	3	8	4.00
Firefighters	0	0	0	1	5	2	8	4.13
Other	0	0	0	0	1	1	2	4.50

9. Training- The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	3	17	24	19	63	3.94
Chiefs	0	0	1	13	15	16	45	4.02
Line Officers	0	0	1	2	3	2	8	3.75
Firefighters	0	0	1	1	5	1	8	3.75
Other	0	0	0	1	1	0	2	3.50

10. Capacity- the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	0	5	12	26	19	63	3.89
Chiefs	0	0	3	10	18	14	45	3.96
Line Officers	1	0	1	2	3	1	8	3.13
Firefighters	0	0	1	0	4	3	8	4.13
Other	0	0	0	0	1	1	2	4.50

11. Future Expansion- The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	5	13	29	16	63	3.89
Chiefs	0	0	3	8	22	12	45	3.96
Line Officers	0	0	2	2	3	1	8	3.38
Firefighters	0	0	0	3	2	3	8	4.00
Other	0	0	0	0	2	0	2	4.00

12. **Interoperability-** The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	2	2	1	14	24	20	63	3.84
	Chiefs	1	2	1	10	15	16	45	3.87
	Line Officers	1	0	0	2	4	1	8	3.38
	Firefighters	0	0	0	1	4	3	8	4.25
	Other	0	0	0	1	1	0	2	3.50

13. **Immunity from Interference-** The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	1	3	16	28	15	63	3.84
	Chiefs	0	0	3	12	18	12	45	3.87
	Line Officers	0	1	0	2	4	1	8	3.50
	Firefighters	0	0	0	2	4	2	8	4.00
	Other	0	0	0	0	2	0	2	4.00

14. **Monitoring-** Supervisors shall have the ability to monitor communications on all talk paths.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	3	5	11	23	20	63	3.78
	Chiefs	0	1	3	9	17	15	45	3.93
	Line Officers	0	0	1	2	3	2	8	3.75
	Firefighters	1	2	1	0	2	2	8	2.75
	Other	0	0	0	0	1	1	2	4.50

15. **Support New Technologies-** The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	8	10	34	11	63	3.76
	Chiefs	0	0	3	8	27	7	45	3.84
	Line Officers	0	0	3	1	3	1	8	3.25
	Firefighters	0	0	2	1	2	3	8	3.75
	Other	0	0	0	0	2	0	2	4.00

16. **No Internal Congestion-** The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	2	1	3	16	24	17	63	3.75
	Chiefs	1	1	2	11	17	13	45	3.80
	Line Officers	1	0	1	3	1	2	8	3.13
	Firefighters	0	0	0	2	5	1	8	3.88
	Other	0	0	0	0	1	1	2	4.50

17. **System Operational Transparency-** The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	2	5	19	24	13	63	3.65
	Chiefs	0	2	3	10	18	12	45	3.78
	Line Officers	0	0	2	4	1	1	8	3.13
	Firefighters	0	0	0	4	4	0	8	3.50
	Other	0	0	0	1	1	0	2	3.50

18. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	5	24	23	11	63	3.63
Chiefs	0	0	4	14	19	8	45	3.69
Line Officers	0	0	1	5	1	1	8	3.25
Firefighters	0	0	0	4	2	2	8	3.75
Other	0	0	0	1	1	0	2	3.50

19. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	1	5	19	25	12	63	3.62
Chiefs	1	1	4	14	17	8	45	3.53
Line Officers	0	0	1	4	0	3	8	3.63
Firefighters	0	0	0	1	6	1	8	4.00
Other	0	0	0	0	2	0	2	4.00

20. Long-Term Cost- The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	2	7	17	23	14	64	3.58
Chiefs	1	0	4	14	15	12	46	3.70
Line Officers	0	1	2	2	2	1	8	3.00
Firefighters	0	1	1	1	4	1	8	3.38
Other	0	0	0	0	2	0	2	4.00

21. Operational Boundary Flexibility- Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	3	4	23	24	9	63	3.51
Chiefs	0	2	3	15	18	7	45	3.56
Line Officers	0	1	1	3	2	1	8	3.13
Firefighters	0	0	0	5	2	1	8	3.50
Other	0	0	0	0	2	0	2	4.00

22. Initial Cost- The initial cost of the system to Lehigh County and its affiliated users is a prime concern.

	0	1	2	3	4	5	Total	Average
Comprehensive	3	5	3	15	20	17	63	3.51
Chiefs	2	1	2	10	16	14	45	3.76
Line Officers	1	2	1	2	1	1	8	2.38
Firefighters	0	2	0	2	2	2	8	3.25
Other	0	0	0	1	1	0	2	3.50

23. Console Features- Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.

	0	1	2	3	4	5	Total	Average
Comprehensive	4	1	6	20	17	15	63	3.43
Chiefs	2	0	3	16	12	12	45	3.60
Line Officers	1	1	2	1	2	1	8	2.63
Firefighters	1	0	1	3	2	1	8	3.00
Other	0	0	0	0	1	1	2	4.50

24. Dispatch Operational Concept- The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.

	0	1	2	3	4	5	Total	Average
Comprehensive	2	2	10	18	20	11	63	3.35
Chiefs	0	0	6	14	16	9	45	3.62
Line Officers	1	1	4	1	0	1	8	2.13
Firefighters	1	1	0	2	3	1	8	3.00
Other	0	0	0	1	1	0	2	3.50

25. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.

	0	1	2	3	4	5	Total	Average
Comprehensive	3	3	5	23	16	13	63	3.35
Chiefs	1	2	3	19	12	8	45	3.40
Line Officers	1	1	1	1	2	2	8	3.00
Firefighters	1	0	1	2	2	2	8	3.25
Other	0	0	0	1	0	1	2	4.00

26. Commonality of Equipment- A single vendor shall supply and install all radio system infrastructure equipment.

	0	1	2	3	4	5	Total	Average
Comprehensive	7	7	14	12	12	11	63	2.76
Chiefs	5	6	8	9	10	7	45	2.76
Line Officers	2	0	3	1	0	2	8	2.38
Firefighters	0	0	2	2	2	2	8	3.50
Other	0	1	1	0	0	0	2	1.50

27. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.

	0	1	2	3	4	5	Total	Average
Comprehensive	10	4	17	15	12	5	63	2.48
Chiefs	6	4	12	11	8	4	45	2.51
Line Officers	1	0	5	1	1	0	8	2.13
Firefighters	3	0	0	1	3	1	8	2.50
Other	0	0	0	2	0	0	2	3.00

APPENDIX D - EMERGENCY MEDICAL SERVICES ANALYSIS

Emergency Medical Services representatives from eight (8) Lehigh County agencies contributed 35 survey responses (16.4% of the total participation). As noted on the following table, there was a reasonable distribution between EMS managers and service providers:

Role	#	Pct.
Agency OIC	10	28.6%
Supervisor	4	11.4%
Paramedic/EMT	21	60.0%
Other		
Total	**35**	

Agency participation was distributed among the following entities:

Agency	#`	Agency	#
Allentown	2	Northampton Regional	5
Cetronia	2	Northern Valley	6
Dorney Park	0	St. Luke's Hospital	2
Emmaus	1	Upper Saucon	1
Lehigh Valley Hospital	1	Other	0
Macungie	15		
		Total:	**35**

The following tables outline the survey responses between the various functions within the EMS environment, and also compares them with their comprehensive response ranking. Both the "Current System Observations" and "Future System Requirements & Goals" have been ordered in their importance only to the EMS community; refer to Appendix A for a comparison with the comprehensive ranking and other stakeholder groups.

Current System Observations

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
1. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.	Comprehensive	4	0	6	5	8	12	35	3.40
	OIC	3	0	1	1	0	5	10	3.00
	Supervisor	0	0	1	1	0	2	4	3.75
	Paramedic/EMT	1	0	4	3	8	5	21	3.52

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
2. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.	Comprehensive	3	2	13	8	2	7	35	2.71
	OIC	2	0	3	2	1	2	10	2.60
	Supervisor	0	0	2	1	0	1	4	3.00
	Paramedic/EMT	1	2	8	5	1	4	21	2.71

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
3. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.	Comprehensive	4	6	8	6	5	6	35	2.57
	OIC	2	1	3	1	2	1	10	2.30
	Supervisor	1	2	1	0	0	0	4	1.00
	Paramedic/EMT	1	3	4	5	3	5	21	3.00

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
4. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.	Comprehensive	5	0	14	8	7	1	35	2.43
	OIC	4	0	3	1	2	0	10	1.70
	Supervisor	1	0	3	0	0	0	4	1.50
	Paramedic/EMT	0	0	8	7	5	1	21	2.95

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
5. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.	Comprehensive	6	3	17	2	3	4	35	2.14
	OIC	0	1	7	0	1	1	10	2.40
	Supervisor	1	0	3	0	0	0	4	1.50
	Paramedic/EMT	5	2	7	2	2	3	21	2.14

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
6. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.	Comprehensive	9	1	12	7	4	2	35	2.06
	OIC	4	0	3	2	1	0	10	1.60
	Supervisor	0	1	3	0	0	0	4	1.75
	Paramedic/EMT	5	0	6	5	3	2	21	2.33

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
7. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.	Comprehensive	11	0	11	7	3	3	35	2.00
	OIC	4	0	3	1	2	0	10	1.70
	Supervisor	3	0	1	0	0	0	4	0.50
	Paramedic/EMT	4	0	7	6	1	3	21	2.43

8. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	10	1	12	6	5	1	35	1.94
OIC	3	1	4	1	1	0	10	1.60
Supervisor	2	0	1	1	0	0	4	1.25
Paramedic/EMT	5	0	7	4	4	1	21	2.24

9. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear when someone is calling them.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	12	2	7	8	5	1	35	1.86
OIC	5	1	2	1	1	0	10	1.20
Supervisor	3	0	1	0	0	0	4	0.50
Paramedic/EMT	4	1	4	7	4	1	21	2.43

10. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	16	5	6	0	3	5	35	1.54
OIC	4	2	1	0	2	1	10	1.70
Supervisor	4	0	0	0	0	0	4	0.00
Paramedic/EMT	8	3	5	0	1	4	21	1.76

11. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	16	5	4	5	3	2	35	1.43
OIC	6	0	1	1	2	0	10	1.30
Supervisor	3	1	0	0	0	0	4	0.25
Paramedic/EMT	7	4	3	4	1	2	21	1.71

12. Cumbersome Operation- the user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	15	4	11	2	2	1	35	1.29
OIC	5	0	5	0	0	0	10	1.00
Supervisor	1	1	2	0	0	0	4	1.25
Paramedic/EMT	9	3	4	2	2	1	21	1.43

13. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	20	4	6	2	2	1	35	1.00
OIC	8	0	1	0	1	0	10	0.60
Supervisor	3	0	1	0	0	0	4	0.50
Paramedic/EMT	9	4	4	2	1	1	21	1.29

14. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	24	1	3	6	0	1	35	0.86
	OIC	7	0	1	2	0	0	10	0.80
	Supervisor	3	0	1	0	0	0	4	0.50
	Paramedic/EMT	14	1	1	4	0	1	21	0.95

15. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	20	8	5	1	1	0	35	0.71
	OIC	7	1	1	0	1	0	10	0.70
	Supervisor	4	0	0	0	0	0	4	0.00
	Paramedic/EMT	9	7	4	1	0	0	21	0.86

Future System Requirements & Goals

1. Survivability- The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	3	8	22	33	4.58
	OIC	0	0	0	0	3	7	10	4.70
	Supervisor	0	0	0	1	1	2	4	4.25
	Paramedic/EMT	0	0	0	2	4	13	19	4.58

2. Reliability- The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	2	11	20	33	4.55
	OIC	0	0	0	1	1	8	10	4.70
	Supervisor	0	0	0	0	2	2	4	4.50
	Paramedic/EMT	0	0	0	1	8	10	19	4.47

3. Coverage- The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	1	1	5	9	17	33	4.21
	OIC	0	0	0	1	4	5	10	4.40
	Supervisor	0	0	1	1	0	2	4	3.75
	Paramedic/EMT	0	1	0	3	5	10	19	4.21

4. Power Backup- All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	2	0	3	3	3	22	33	4.15
	OIC	1	0	1	0	0	8	10	4.20
	Supervisor	0	0	1	1	0	2	4	3.75
	Paramedic/EMT	1	0	1	2	3	12	19	4.21

5. Emergency Access- The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	0	2	7	10	14	33	4.09
OIC	0	0	0	3	5	2	10	3.90
Supervisor	0	0	1	0	1	2	4	4.00
Paramedic/EMT	0	0	1	4	4	10	19	4.21

6. Maintainability- The system shall be designed for a mean-time-to-repair of not more than two (2) hours.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	0	1	4	18	9	33	3.97
OIC	1	0	0	1	5	3	10	3.80
Supervisor	0	0	0	1	2	1	4	4.00
Paramedic/EMT	0	0	1	2	11	5	19	4.05

7. Immunity from Interference- The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	1	1	7	14	10	33	3.94
OIC	0	0	0	3	6	1	10	3.80
Supervisor	0	1	0	2	1	0	4	2.75
Paramedic/EMT	0	0	1	2	7	9	19	4.26

8. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	0	5	3	10	14	33	3.91
OIC	1	0	2	1	3	3	10	3.40
Supervisor	0	0	1	1	0	2	4	3.75
Paramedic/EMT	0	0	2	1	7	9	19	4.21

9. Support New Technologies- The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	1	0	9	15	8	33	3.88
OIC	0	0	0	2	7	1	10	3.90
Supervisor	0	0	0	1	2	1	4	4.00
Paramedic/EMT	0	1	0	6	6	6	19	3.84

10. Capacity- the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	1	5	5	13	9	33	3.73
OIC	0	0	1	2	5	2	10	3.80
Supervisor	0	0	3	0	0	1	4	2.75
Paramedic/EMT	0	1	1	3	8	6	19	3.89

11. Intercommunications- The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	1	4	9	10	9	33	3.67
OIC	0	0	0	2	4	4	10	4.20
Supervisor	0	0	2	1	1	0	4	2.75
Paramedic/EMT	0	1	2	6	5	5	19	3.58

12. Training- The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	0	1	13	10	8	33	3.67
OIC	1	0	0	5	1	3	10	3.40
Supervisor	0	0	0	0	3	1	4	4.25
Paramedic/EMT	0	0	1	8	6	4	19	3.68

13. Interoperability- The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	1	3	13	7	9	33	3.61
OIC	0	0	0	5	2	3	10	3.80
Supervisor	0	0	2	1	1	0	4	2.75
Paramedic/EMT	0	1	1	7	4	6	19	3.68

14. No Internal Congestion- The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	1	5	11	7	9	33	3.55
OIC	0	0	1	5	2	2	10	3.50
Supervisor	0	0	3	0	1	0	4	2.50
Paramedic/EMT	0	1	1	6	4	7	19	3.79

15. Future Expansion- The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	1	3	8	14	6	33	3.55
OIC	0	0	0	2	7	1	10	3.90
Supervisor	0	0	0	2	1	1	4	3.75
Paramedic/EMT	1	1	3	4	6	4	19	3.32

16. Monitoring- Supervisors shall have the ability to monitor communications on all talk paths.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	1	1	4	11	9	7	33	3.42
OIC	0	0	0	3	6	1	10	3.80
Supervisor	0	0	1	1	1	1	4	3.50
Paramedic/EMT	1	1	3	7	2	5	19	3.21

17. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
Comprehensive	0	0	8	10	9	6	33	3.39
OIC	0	0	1	4	4	1	10	3.50
Supervisor	0	0	1	2	1	0	4	3.00
Paramedic/EMT	0	0	6	4	4	5	19	3.42

18. Operational Boundary Flexibility- Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	2	0	2	14	10	5	33	3.36
	OIC	1	0	0	5	2	2	10	3.30
	Supervisor	0	0	1	1	2	0	4	3.25
	Paramedic/EMT	1	0	1	8	6	3	19	3.42

19. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	0	6	13	6	7	33	3.33
	OIC	0	0	0	4	4	2	10	3.80
	Supervisor	0	0	2	1	0	1	4	3.00
	Paramedic/EMT	1	0	4	8	2	4	19	3.16

20. Console Features- Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	4	0	4	5	13	7	33	3.33
	OIC	2	0	0	2	5	1	10	3.10
	Supervisor	0	0	2	0	1	1	4	3.25
	Paramedic/EMT	2	0	2	3	7	5	19	3.47

21. System Operational Transparency- The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	2	4	10	10	6	33	3.33
	OIC	1	1	0	3	2	3	10	3.30
	Supervisor	0	0	1	1	2	0	4	3.25
	Paramedic/EMT	0	1	3	6	6	3	19	3.37

22. Dispatch Operational Concept- The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	3	0	9	9	7	5	33	2.97
	OIC	0	0	3	3	2	2	10	3.30
	Supervisor	0	0	2	1	1	0	4	2.75
	Paramedic/EMT	3	0	4	5	4	3	19	2.84

23. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	3	4	5	8	7	6	33	2.91
	OIC	1	1	2	3	2	1	10	2.70
	Supervisor	0	1	0	1	1	1	4	3.25
	Paramedic/EMT	2	2	3	4	4	4	19	2.95

24. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.

	0	1	2	3	4	5	Total	Average
Comprehensive	7	1	7	9	4	5	33	2.52
OIC	3	1	0	4	1	1	10	2.20
Supervisor	1	0	2	0	1	0	4	2.00
Paramedic/EMT	3	0	5	5	2	4	19	2.79

25. Long-Term Cost- The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.

	0	1	2	3	4	5	Total	Average
Comprehensive	6	8	0	7	7	5	33	2.48
OIC	0	2	0	3	3	2	10	3.30
Supervisor	1	2	0	0	0	1	4	1.75
Paramedic/EMT	5	4	0	4	4	2	19	2.21

26. Initial Cost- The initial cost of the system to Lehigh County and its affiliated users is a prime concern.

	0	1	2	3	4	5	Total	Average
Comprehensive	8	6	3	4	5	7	33	2.39
OIC	1	2	1	1	1	4	10	3.10
Supervisor	1	2	0	0	0	1	4	1.75
Paramedic/EMT	6	2	2	3	4	2	19	2.16

27. Commonality of Equipment- A single vendor shall supply and install all radio system infrastructure equipment.

	0	1	2	3	4	5	Total	Average
Comprehensive	9	3	4	6	8	3	33	2.30
OIC	5	1	1	0	2	1	10	1.60
Supervisor	1	1	0	2	0	0	4	1.75
Paramedic/EMT	3	1	3	4	6	2	19	2.79

APPENDIX E - COMMUNICATIONS PROVIDER ANALYSIS

Emergency communications center (ECC) representatives from two (2) Lehigh County agencies contributed 22 survey responses (10.3% of the total participation). All but one of these response came from the Lehigh County Communications Center (the other was received from the LVIA operations center), and there was good distribution between administrators and dispatch personnel as noted on the following table:

Role	#	Pct.
Administrator	4	18.2%
Supervisor	5	22.7%
Telecommunicator	12	54.5%
Technician	1	4.5%
Total	**22**	

The following tables outline the survey responses between the various functions within the ECC environment, and also compares them with their comprehensive response ranking. Both the "Current System Observations" and "Future System Requirements & Goals" have been ordered in their importance only to the ECC community; refer to Appendix A for a comparison with the comprehensive ranking and other stakeholder groups.

Current System Observations

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
1. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.	Comprehensive	1	2	3	1	10	5	22	3.45
	Administration	0	0	0	0	4	0	4	4.00
	Supervisors	1	0	2	1	1	0	5	2.20
	Telecommunicators	0	1	1	0	5	5	12	4.00
	Technicians	0	1	0	0	0	0	1	1.00

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
2. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.	Comprehensive	1	0	5	5	9	2	22	3.23
	Administration	0	0	3	0	1	0	4	2.50
	Supervisors	1	0	1	2	1	0	5	2.40
	Telecommunicators	0	0	0	3	7	2	12	3.92
	Technicians	0	0	1	0	0	0	1	2.00

3. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.		0	1	2	3	4	5	Total	Average
	Comprehensive	3	1	2	4	7	5	22	3.18
	Administration	0	1	0	2	1	0	4	2.75
	Supervisors	0	0	1	2	1	1	5	3.40
	Telecommunicators	3	0	1	0	5	3	12	3.08
	Technicians	0	0	0	0	0	1	1	5.00

4. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.		0	1	2	3	4	5	Total	Average
	Comprehensive	3	2	2	3	6	6	22	3.14
	Administration	0	0	0	0	3	1	4	4.25
	Supervisors	1	1	0	2	0	1	5	2.40
	Telecommunicators	2	0	2	1	3	4	12	3.25
	Technicians	0	1	0	0	0	0	1	1.00

5. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.		0	1	2	3	4	5	Total	Average
	Comprehensive	1	0	8	5	5	3	22	3.00
	Administration	0	0	0	3	1	0	4	3.25
	Supervisors	1	0	4	0	0	0	5	1.60
	Telecommunicators	0	0	3	2	4	3	12	3.58
	Technicians	0	0	1	0	0	0	1	2.00

6. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.		0	1	2	3	4	5	Total	Average
	Comprehensive	3	2	4	3	7	3	22	2.82
	Administration	1	1	0	1	1	0	4	2.00
	Supervisors	1	0	1	1	2	0	5	2.60
	Telecommunicators	1	1	3	1	3	3	12	3.08
	Technicians	0	0	0	0	1	0	1	4.00

7. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.		0	1	2	3	4	5	Total	Average
	Comprehensive	4	1	8	1	4	4	22	2.55
	Administration	1	0	2	0	1	0	4	2.00
	Supervisors	1	0	3	0	0	1	5	2.20
	Telecommunicators	1	1	3	1	3	3	12	3.08
	Technicians	1	0	0	0	0	0	1	0.00

8. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.		0	1	2	3	4	5	Total	Average
	Comprehensive	3	1	10	3	3	2	22	2.36
	Administration	0	0	2	0	2	0	4	3.00
	Supervisors	2	0	3	0	0	0	5	1.20
	Telecommunicators	1	0	5	3	1	2	12	2.75
	Technicians	0	1	0	0	0	0	1	1.00

9. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.

	0	1	2	3	4	5	Total	Average
Comprehensive	4	1	9	3	4	1	22	2.23
Administration	1	0	2	0	1	0	4	2.00
Supervisors	2	0	3	0	0	0	5	1.20
Telecommunicators	1	1	3	3	3	1	12	2.75
Technicians	0	0	1	0	0	0	1	2.00

10. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear when someone is calling them.

	0	1	2	3	4	5	Total	Average
Comprehensive	6	3	4	4	3	2	22	2.05
Administration	1	1	1	0	1	0	4	1.75
Supervisors	4	0	0	1	0	0	5	0.60
Telecommunicators	1	1	3	3	2	2	12	2.83
Technicians	0	1	0	0	0	0	1	1.00

11. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).

	0	1	2	3	4	5	Total	Average
Comprehensive	6	1	8	3	2	2	22	2.00
Administration	2	0	0	1	1	0	4	1.75
Supervisors	3	0	2	0	0	0	5	0.80
Telecommunicators	1	0	6	2	1	2	12	2.67
Technicians	0	1	0	0	0	0	1	1.00

12. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.

	0	1	2	3	4	5	Total	Average
Comprehensive	10	0	2	3	2	4	21	1.95
Administration	1	0	1	0	1	0	3	2.00
Supervisors	5	0	0	0	0	0	5	0.00
Telecommunicators	4	0	1	3	1	3	12	2.50
Technicians	0	0	0	0	0	1	1	5.00

13. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.

	0	1	2	3	4	5	Total	Average
Comprehensive	9	1	4	4	3	1	22	1.73
Administration	1	0	0	2	1	0	4	2.50
Supervisors	2	1	2	0	0	0	5	1.00
Telecommunicators	5	0	2	2	2	1	12	1.92
Technicians	1	0	0	0	0	0	1	0.00

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
14. Cumbersome Operation- the user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.								
Comprehensive	10	1	5	1	2	3	22	1.68
Administration	3	0	0	0	1	0	4	1.00
Supervisors	4	0	1	0	0	0	5	0.40
Telecommunicators	3	1	4	1	1	2	12	2.17
Technicians	0	0	0	0	0	1	1	5.00

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
15. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.								
Comprehensive	14	3	2	1	1	1	22	0.86
Administration	3	0	0	0	1	0	4	1.00
Supervisors	5	0	0	0	0	0	5	0.00
Telecommunicators	6	3	1	1	0	1	12	1.08
Technicians	0	0	1	0	0	0	1	2.00

Future System Requirements & Goals

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
1. Coverage- The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."								
Comprehensive	0	0	0	1	2	16	19	4.79
Administration	0	0	0	0	0	4	4	5.00
Supervisors	0	0	0	0	1	4	5	4.80
Telecommunicators	0	0	0	1	1	8	10	4.70
Technicians							0	

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
2. Survivability- The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.								
Comprehensive	0	0	1	0	2	16	19	4.74
Administration	0	0	0	0	0	4	4	5.00
Supervisors	0	0	0	0	0	5	5	5.00
Telecommunicators	0	0	1	0	2	7	10	4.50
Technicians							0	

	0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
3. Reliability- The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.								
Comprehensive	0	0	1	1	4	13	19	4.53
Administration	0	0	0	0	0	4	4	5.00
Supervisors	0	0	0	1	1	3	5	4.40
Telecommunicators	0	0	1	0	3	6	10	4.40
Technicians							0	

4. Power Backup- All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	0	0	1	3	14	19	4.47
Administration	0	0	0	0	0	4	4	5.00
Supervisors	0	0	0	0	0	5	5	5.00
Telecommunicators	1	0	0	1	3	5	10	4.00
Technicians							0	

5. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	2	0	6	11	19	4.37
Administration	0	0	0	0	1	3	4	4.75
Supervisors	0	0	0	0	3	2	5	4.40
Telecommunicators	0	0	2	0	2	6	10	4.20
Technicians							0	

6. Capacity- the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	0	2	9	8	19	4.32
Administration	0	0	0	0	3	1	4	4.25
Supervisors	0	0	0	1	2	2	5	4.20
Telecommunicators	0	0	0	1	4	5	10	4.40
Technicians							0	

7. Intercommunications- The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	1	2	6	10	19	4.32
Administration	0	0	0	1	1	2	4	4.25
Supervisors	0	0	0	1	2	2	5	4.20
Telecommunicators	0	0	1	0	3	6	10	4.40
Technicians							0	

8. Console Features- Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	2	2	3	12	19	4.32
Administration	0	0	0	0	2	2	4	4.50
Supervisors	0	0	0	1	0	4	5	4.60
Telecommunicators	0	0	2	1	1	6	10	4.10
Technicians							0	

9. Training- The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	1	2	7	9	19	4.26
	Administration	0	0	0	0	3	1	4	4.25
	Supervisors	0	0	0	1	1	3	5	4.40
	Telecommunicators	0	0	1	1	3	5	10	4.20
	Technicians							0	

10. Immunity from Interference- The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	1	4	5	9	19	4.16
	Administration	0	0	0	0	1	3	4	4.75
	Supervisors	0	0	0	3	1	1	5	3.60
	Telecommunicators	0	0	1	1	3	5	10	4.20
	Technicians							0	

11. Monitoring- Supervisors shall have the ability to monitor communications on all talk paths.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	0	0	5	1	12	19	4.16
	Administration	0	0	0	2	0	2	4	4.00
	Supervisors	0	0	0	0	0	5	5	5.00
	Telecommunicators	1	0	0	3	1	5	10	3.80
	Technicians							0	

12. Interoperability- The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	3	2	4	10	19	4.11
	Administration	0	0	2	0	0	2	4	3.50
	Supervisors	0	0	0	0	2	3	5	4.60
	Telecommunicators	0	0	1	2	2	5	10	4.10
	Technicians							0	

13. Maintainability- The system shall be designed for a mean-time-to-repair of not more than two (2) hours.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	0	0	3	6	9	19	4.11
	Administration	0	0	0	1	1	2	4	4.25
	Supervisors	0	0	0	0	3	2	5	4.40
	Telecommunicators	1	0	0	2	2	5	10	3.90
	Technicians							0	

14. No Internal Congestion- The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	1	4	7	7	19	4.05
	Administration	0	0	0	1	1	2	4	4.25
	Supervisors	0	0	0	2	3	0	5	3.60
	Telecommunicators	0	0	1	1	3	5	10	4.20
	Technicians							0	

15. **Emergency Access-** The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	1	6	4	8	19	4.00
	Administration	0	0	0	0	1	3	4	4.75
	Supervisors	0	0	0	4	1	0	5	3.20
	Telecommunicators	0	0	1	2	2	5	10	4.10
	Technicians							0	

16. **Dispatch Operational Concept-** The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	2	3	7	7	19	4.00
	Administration	0	0	0	1	0	3	4	4.50
	Supervisors	0	0	0	1	3	1	5	4.00
	Telecommunicators	0	0	2	1	4	3	10	3.80
	Technicians							0	

17. **Future Expansion-** The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	1	0	4	8	6	19	3.95
	Administration	0	0	0	1	1	2	4	4.25
	Supervisors	0	0	0	0	4	1	5	4.20
	Telecommunicators	0	1	0	3	3	3	10	3.70
	Technicians							0	

18. **Support New Technologies-** The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	1	6	5	7	19	3.95
	Administration	0	0	0	1	2	1	4	4.00
	Supervisors	0	0	0	3	1	1	5	3.60
	Telecommunicators	0	0	1	2	2	5	10	4.10
	Technicians							0	

19. **System Operational Transparency-** The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	0	1	4	4	9	19	3.95
	Administration	0	0	0	1	1	2	4	4.25
	Supervisors	0	0	0	2	1	2	5	4.00
	Telecommunicators	1	0	1	1	2	5	10	3.80
	Technicians							0	

20. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	3	5	4	7	19	3.79
Administration	0	0	2	0	0	2	4	3.50
Supervisors	0	0	0	4	1	0	5	3.20
Telecommunicators	0	0	1	1	3	5	10	4.20
Technicians							0	

21. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	0	4	2	2	10	19	3.79
Administration	0	0	1	1	0	2	4	3.75
Supervisors	0	0	2	0	2	1	5	3.40
Telecommunicators	1	0	1	1	0	7	10	4.00
Technicians							0	

22. Operational Boundary Flexibility- Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.

	0	1	2	3	4	5	Total	Average
Comprehensive	1	0	1	4	8	5	19	3.74
Administration	0	0	0	1	2	1	4	4.00
Supervisors	0	0	0	0	5	0	5	4.00
Telecommunicators	1	0	1	3	1	4	10	3.50
Technicians							0	

23. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.

	0	1	2	3	4	5	Total	Average
Comprehensive	0	0	4	8	1	6	19	3.47
Administration	0	0	1	1	1	1	4	3.50
Supervisors	0	0	0	5	0	0	5	3.00
Telecommunicators	0	0	3	2	0	5	10	3.70
Technicians							0	

24. Commonality of Equipment- A single vendor shall supply and install all radio system infrastructure equipment.

	0	1	2	3	4	5	Total	Average
Comprehensive	2	0	5	1	5	6	19	3.32
Administration	0	0	2	0	1	1	4	3.25
Supervisors	0	0	1	1	2	1	5	3.60
Telecommunicators	2	0	2	0	2	4	10	3.20
Technicians							0	

25. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.

	0	1	2	3	4	5	Total	Average
Comprehensive	3	2	2	2	5	5	19	3.00
Administration	0	0	0	0	3	1	4	4.25
Supervisors	0	0	1	1	2	1	5	3.60
Telecommunicators	3	2	1	1	0	3	10	2.20
Technicians							0	

26. Long-Term Cost- The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.

	0	1	2	3	4	5	Total	Average
Comprehensive	5	2	1	1	7	3	19	2.63
Administration	0	0	1	0	2	1	4	3.75
Supervisors	1	0	0	0	2	2	5	3.60
Telecommunicators	4	2	0	1	3	0	10	1.70
Technicians							0	

27. Initial Cost- The initial cost of the system to Lehigh County and its affiliated users is a prime concern.

	0	1	2	3	4	5	Total	Average
Comprehensive	7	1	1	1	7	2	19	2.32
Administration	1	0	1	0	1	1	4	2.75
Supervisors	1	0	0	0	3	1	5	3.40
Telecommunicators	5	1	0	1	3	0	10	1.60
Technicians							0	

APPENDIX F - OTHER SYSTEM USER ANALYSIS

Other stakeholder representatives from Lehigh County agencies contributed 15 survey responses (7.0% of the total participation). The table below identifies their role:

Role	#	Pct.
Emergency Mgt.	9	60.0%
FM/EMA/EMT	1	6.7%
Roads/EMA	1	6.7%
Bldg. Supt.	1	6.7%
Corrections	1	6.7%
Roads/Maint.	1	6.7%
Firefighter	1	6.7%
Total	**15**	

Participation was distributed among the following local government entities:

Agency	#`	Agency	#
Allentown	1	Lower Macungie Twp.	1
Catasauqua Boro	1	North Whitehall Twp.	1
Emmaus Boro	2	South Whitehall Twp.	2
Heidelberg Twp.	2	Upper Milford Twp.	1
Lehigh County	3	Whitehall Twp.	1
		Total:	**15**

The following tables outline the comprehensive survey responses within the "other user" environment; no effort has been made to analyze the difference between roles of these responders. Both the "Current System Observations" and "Future System Requirements & Goals" have been ordered in their importance only to this group; refer to Appendix A for a comparison with the comprehensive ranking and other stakeholder groups.

Current System Observations

		0	1	2	3	4	5	Total	Average
1. Lack of Local Interoperability- An inability to communicate between different agencies within the jurisdiction or operating scene.	Comprehensive	5	0	3	4	1	2	15	2.13

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
2. Lack of Regional Interoperability- The system does not allow a user to easily communicate with agencies outside the normal operating jurisdiction.	Comprehensive	5	0	2	6	2	0	15	2.00

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
3. Mobile to Mobile- Users cannot talk between mobile units over more than a short distance.	Comprehensive	4	1	2	7	1	0	15	2.00

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
4. Limited Coverage- Dead spots regularly occur, particularly between the dispatcher and the radio user.	Comprehensive	3	2	4	5	1	0	15	1.93

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
5. Lack of Ability to Support New Technologies- The system infrastructure cannot readily support new technologies such as digital voice, automatic vehicle location, mobile data, encryption, etc.	Comprehensive	5	2	3	2	1	2	15	1.87

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
6. Dispatcher Access- For whatever reason, the dispatcher and user cannot gain access to each other on a routine basis. This would include one user having to compete with other users for the dispatcher's time or the dispatcher being unable to reach the user because it is operating on another radio channel or system.	Comprehensive	6	1	2	3	2	1	15	1.80

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
7. Capacity- The system has insufficient capacity to support traffic during peak or emergency conditions.	Comprehensive	6	0	5	2	1	1	15	1.67

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
8. Not Portable Based- Portable units cannot generally and reliably be used on the system, particularly indoors.	Comprehensive	5	1	5	1	1	1	14	1.64

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
9. Reliability- Frequent breakdowns of old or poorly-maintained fixed network infrastructure equipment (i.e.: not user mobile or portable radios).	Comprehensive	5	1	6	3	0	0	15	1.47

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
10. Channel Crowding- Too many users are on a channel; a user cannot gain access to the channel when the situation requires communications with other units or the dispatcher.	Comprehensive	6	1	3	3	1	0	14	1.43

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
11. Channel Congestion- Too many unrelated functions use the same channel; users tend to turn the volume down unless they specifically need to reach someone and may not hear when someone is calling them.	Comprehensive	6	1	3	3	1	0	14	1.43

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
12. Local Interference- Lehigh County users regularly step on each other forcing repeated messages or overriding critical communications.	Comprehensive	6	1	4	2	1	0	14	1.36

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
13. Maintainability- Maintenance is inadequate on user equipment (e.g.: mobiles, portables, desktop equipment, etc.). Equipment needs to be returned regularly to fix the same problem.	Comprehensive	7	3	4	1	0	0	15	0.93

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
14. Cumbersome Operation- the user needs to learn the characteristics of the system in order to use it which causes difficulty in high pressure situations.	Comprehensive	8	1	4	0	1	0	14	0.93

		0	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
15. Foreign Interference- Other users in locations outside Lehigh County interfere and step on local users forcing repeated messages or overriding critical communications.	Comprehensive	12	0	2	0	0	0	14	0.29

Future System Requirements & Goals

1. **Coverage-** The radio system should provide a signal availability of 95% confidence to all mobile and portable radios, including medium-density in-building coverage. This should be evenly distributed throughout Lehigh County, and the goal should be to eliminate "dead spots."		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	2	1	10	13	4.62

2. **Reliability-** The radio system and equipment shall be designed to ensure that single-mode failures to not perceptibly impact routine system operations.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	2	4	7	13	4.38

3. **Power Backup-** All infrastructure shall require backup power capabilities with automatic transfer and which can handle 100% of the loading of all equipment. Uninterruptible power capability shall be provided to ensure seamless transition from utility to emergency power and vice versa.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	1	1	3	7	12	4.33

4. **Intercommunications-** The system shall provide unit-to-unit communications between all users who are working together in a common endeavor, and shall be consistent throughout Lehigh Valley.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	3	3	7	13	4.31

5. **Survivability-** The system shall be designed to survive in severe weather or emergency conditions, including if dispatch operations are relocated to an alternate or remote location.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	1	0	0	1	3	8	13	4.23

6. **Training-** The system vendor shall supply formal training resources for all personnel using the system including, but not limited to, dispatchers, field users and maintenance technicians.		**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
	Comprehensive	0	0	0	4	4	5	13	4.08

7. **Emergency Access-** The system shall provide a universal emergency access that provides highest priority and channel exclusivity during an emergency. Emergency calls should not impact communications on other channels, however.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	0	4	5	4	13	4.00

8. **Capacity-** the system shall have sufficient talk paths to prevent channel overcrowding and to ensure that current routine, peak and emergency crowding conditions can be alleviated.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	1	1	2	3	6	13	3.92

9. **Interoperability-** The system shall enable continued or improved interoperability among all system users. Interoperability shall also be facilitated with adjacent counties, the Commonwealth of Pennsylvania and federal agencies.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	1	4	4	4	13	3.85

10. **Future Expansion-** The system shall be capable of future expansion of both the number of talk paths and transmit sites. The system shall facilitate the expansion of subscriber equipment for a minimum of 20 years without a need to expand or replace fixed infrastructure equipment.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	1	5	2	5	13	3.85

11. **Support New Technologies-** The system shall be capable of supporting evolving new technologies such as digital voice, automatic vehicle location, mobile data, etc.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	1	3	6	3	13	3.85

12. **No Internal Congestion-** The system shall have sufficient talk paths to allow groups or agencies with difficult functions to have an exclusive channel assignment without experiencing or causing interference with non-related groups or functions.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	2	3	5	3	13	3.69

13. Flexibility in Personnel Allocation- The system shall provide the ability to shift personnel to support different radio groups based on workload, and emergency operations shall not be constrained by system limitation.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	3	2	4	4	13	3.69

14. Monitoring- Supervisors shall have the ability to monitor communications on all talk paths.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		1	0	1	3	4	4	13	3.62

15. Maintainability- The system shall be designed for a mean-time-to-repair of not more than two (2) hours.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	1	1	3	5	3	13	3.62

16. Immunity from Interference- The system shall eliminate unwanted interference from other system users and outside sources to prevent "cross-talk," "chatter" or "stepping on calls."	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	1	0	5	5	2	13	3.54

17. Non-Fixed Radio Features- User equipment shall include a variety of features intended to improve operational experience. Examples include emergency call capability, automatic unit identification, audible function tones, intrinsically-safe operation, over-the-air-rekeying, remote programming, etc.	Comprehensive	**0**	**1**	**2**	**3**	**4**	**5**	**Total**	**Average**
		0	0	1	7	3	2	13	3.46

18. **Console Features-** Dispatch consoles shall consist of public-safety grade equipment that includes ruggedized human interface capabilities and features such as paging, computer-assisted dispatch support, audio-visual controls, audio-visual emergency alerts, instant call recorder, cross-patching capabilities, etc.	Comprehensive	**0** 0	**1** 1	**2** 1	**3** 6	**4** 1	**5** 4	**Total** 13	**Average** 3.46

19. **Long-Term Cost-** The long-term cost to use and maintain the system, including mobile and portable user equipment, is a prime concern to Lehigh County and its affiliated users.	Comprehensive	**0** 0	**1** 1	**2** 2	**3** 3	**4** 4	**5** 3	**Total** 13	**Average** 3.46

20. **System Operational Transparency-** The system shall transmit/receive traffic from multiple sites with switching operations that are transparent to the radio user or dispatcher (i.e.: a user or dispatcher will not need to manually switch channels based on location within Lehigh County).	Comprehensive	**0** 1	**1** 0	**2** 2	**3** 4	**4** 2	**5** 4	**Total** 13	**Average** 3.38

21. **Operational Boundary Flexibility-** Changes to an agency's operational boundaries shall be transparent to radio users anywhere within the Lehigh County service area.	Comprehensive	**0** 1	**1** 1	**2** 1	**3** 3	**4** 3	**5** 4	**Total** 13	**Average** 3.38

22. **Initial Cost-** The initial cost of the system to Lehigh County and its affiliated users is a prime concern.	Comprehensive	**0** 1	**1** 0	**2** 3	**3** 2	**4** 3	**5** 4	**Total** 13	**Average** 3.38

23. **Commonality of Equipment-** A single vendor shall supply and install all radio system infrastructure equipment.	Comprehensive	**0** 0	**1** 1	**2** 2	**3** 4	**4** 5	**5** 1	**Total** 13	**Average** 3.23

		0	1	2	3	4	5	Total	Average
24. Tone Voice & Paging- The system shall support tone and voice paging for fire, EMS and other personnel.	Comprehensive	0	1	3	3	5	1	13	3.15

		0	1	2	3	4	5	Total	Average
25. Competitive Procurement Process- Radio equipment shall be procured in accordance with Commonwealth of Pennsylvania, Lehigh County and local requirements, preferably in a non-restrictive and competitive manner in which an award is made for the most cost-effective system that meets the necessary operational and functional requirements.	Comprehensive	0	3	1	4	1	4	13	3.15

		0	1	2	3	4	5	Total	Average
26. Dispatch Operational Concept- The system shall be capable of dispatching from a central location or remote locations using console equipment provided by a vendor other than the radio system vendor.	Comprehensive	0	1	4	4	2	2	13	3.00

		0	1	2	3	4	5	Total	Average
27. Encryption- The system shall facilitate a non-proprietary "advanced encryption standard" (AES) that can be assigned on a permanent or temporary basis to specific talk paths or the entire system as determined by Lehigh County and the system stakeholders.	Comprehensive	1	2	4	4	1	1	13	2.38

APPENDIX G - SURVEY PARTICIPANT COMMENTS

Note: *Some survey participant comments have been lightly edited to correct spelling, punctuation and grammar or to provide clarity. The substance of the comments, however, remains unchanged.*
         Also, some comments were unrelated to this survey and have been removed from this report. However, <u>all</u> such unrelated comments have been referred to Lehigh County administrators for review and consideration.

Discipline	Role	Comment
Communications	Administration	*Creating a countywide Public Safety Radio system is a large endeavor, and needs to consider the needs of all system users, not just one subset. Also, while cost containment is very important, it is of my opinion that we have one opportunity to do this the right way, and we owe it to our constituents to do that. Sometimes the low price attraction is tarnished by the lack of desired features or degraded performance in the long run.*
Communications	Supervisor	*LVIA (ABE) is a unique entity, and radio communications is always identified as an area for needed improvement in after-action reports. We are willing to discuss and explore options which will enhance the response mission and improve operational communications and how our radio system can integrate with both Lehigh and Northampton counties. With mutual aid being prominent, and the crossing of jurisdictional boundaries prevalent for many responders, a regional approach to incorporate redundant means to communicate via radio more expeditiously (before mobile command/communications support vehicles, etc. arrive) would be helpful.*
Communications	Supervisor	*Expansion of available channels for police, fire and EMS as well as the ability to monitor channels that are currently unavailable on the current radio system are extremely important as well as better county wide coverage with the elimination of dead zones.*
Communications	Telecommunicator	*I feel that there should be a CAD toning interface that allows the dispatcher to view the recommendations and hit "accept" which will automatically send tones. This will speed up the fire and EMS dispatching process drastically. There also needs to be county wide OPS channels that are monitored by DES at all times. No use (of) private channels on scenes.*
Communications	Telecommunicator	*System should have gateways from high-band VHF, UHF, and 800MHz federal interoperability TAC and CALL frequencies, as well as from legacy Lehigh County 9-1-1 frequencies (at least 1-per agency type; such as Fire North, Police North, and EMS A5; so agencies from neighboring counties can access the system from their current radios). Federal interoperability TAC channels should be repeated county-wide, if possible. System should allow for easy patching between all interoperability channels and system-based frequencies/talk groups (based on system-type, hereinafter referred to as channels) at the communication center console.* *If a trunked system, system should have geodiverse prime sites with an automatic rollover of prime site in case of failure, and should also support a failsoft mode and site trunking, if applicable to the system. Communication links between tower sites should be of a loop or web nature, allowing for links to fail without loss of a tower site.*

Discipline	**Role**	**Comment**
Communications	Telecommunicator (continued)	*System coverage should allow for coverage in high-traffic, high-density buildings that would not be covered by traditional towers. Coverage may be obtained by fixed repeaters placed inside buildings such as hospitals or vehicle-based repeater systems that may be toggled on or off based on need/location.*
		In addition to dispatch/hailing channels, system should have tac channels for scene-operations by agency type for all agencies (Fireground 1, EMS Ops 1, Law Ops 1), talk around channels by region (such as an "Upper Saucon Regional" for use by Upper Saucon, Coopersburg, Lower Milford FD/PD/EMS agencies for private functions or training), and large scale incident tac channels (City Wide, County Wide). When considering number of each type of tac or talk around channel worst-case scenarios should be considered.
		System should be designed to accommodate current Lehigh County & City of Allentown users so everyone is on a common system.
		Console should have easy to view callstacks/activity logs for selected channel(s) and system-wide transmissions.
		Console should have easy to activate channel marker and channel marker should not cut out field user transmissions.
		System implementation should include a period of at least 1 month where field users are encouraged to use it for training and general use purposes during which vendor/installer tunes audio to ensure transmissions are clear. When properly using equipment and barring any user error, a majority of transmissions should have a rating of 5 for readability and 8-9 for strength on a typical R-S-T scale.
		If selected frequency band/system type does now allow for transition of alerting/paging channel due to limitations of portable pagers, the current alerting/paging channel should be simulcast to a channel on the new system.
		If encryption is used for any primary dispatch channel, system should allow for streaming audio to be played online on a delay that can be cut out by the communication center supervisor if needed.
LEA	Chief	*I believe it is time to move from the analog to digital encrypted system.*
LEA	Chief	*The only way you will have consistency in radio equipment and functionality is to have Lehigh County purchase the system and all the radios for each department.*
LEA	Supervisor	*There are currently too many dead spots in buildings which hamper communications.*
LEA	Supervisor	*A radio system that is crystal clear and has no dead spots, and a system that can also transmit from inside buildings.*

Discipline	Role	Comment
LEA	Supervisor	*Portable coverage area (especially in buildings) is a key concern. The ability to encrypt certain talk groups is very important, and we prefer to not be locked into a single vendor with proprietary equipment/technology. Tactical channels/on-scene talk groups would be particularly helpful for interagency operations and aid in incident management (to include public works). Our township is open to hosting tower sites and/or working with its partners to help Lehigh County secure locations for head-end equipment.*
LEA	Supervisor	*My biggest request is to have all county agencies be able to communicate including south, north and city. Also, radio channels that are encrypted, but equipment reasonably priced so all agencies can afford it.*
LEA	Supervisor	*(The concern is) not being able to communicate with surroundings agencies. ex. State Police, Allentown City, etc.*
LEA	Investigator	*The system should consist of non-proprietary end-user equipment to include portable and mobile radios. Careful consideration should be given to the selection of the frequency band to be used, including coverage studies done at the appropriate time (summer not winter). AES voice encryption should be available on some police and EMS channels for the relaying of confidential information.*
LEA	Patrol Officer	*A couple items to add onto some of the questions asked:* *Outside organizations using the same channel tying up radio traffic such as the Coroner's Office using Police North.* *(With) communication between the dispatcher and mobile units, it's frequent that the dispatcher will cut out and you don't get their full message including when the dispatcher calls your unit number (and) you can't hear the full unit number pretty often.* *Having other channels would also be beneficial for departments that use Police North to communicate with each other for unrelated matters as it's a private channel.*
LEA	Patrol Officer	*I believe it is of paramount importance to switch to an encrypted radio system. This will allow for more safety for first responders. Given the current climate, it's easy for individuals to listen to our communications via a variety of different technologies. This will allow more secure operations, and cut down on calls to dispatch for warrants and sensitive information.*
LEA	Patrol Officer	*- Reliable Coverage.* *- Clear Communications.* *- Encryption.*
LEA	Patrol Officer	*I would like to see the current radio system improved upon. Current radios often have dead spots within the township and buildings. Reception is spotty and inconsistent. It is often difficult to make out radio transmissions and (you) often rely on CAD notes for what was said. Local department channel has extremely short radio length and is mostly unusable.*
LEA	Patrol Officer	*I have found the reliability of F3 to be a concern during long periods of air clearance on primary channels or during regular communications.*

Discipline	Role	Comment
LEA	Patrol Officer	*(There is a) need to eliminate radio cutting in and out. (It) would also be nice to have GPS location on portables only used to locate officers in emergency situations.*
Fire	Chiefs	*We need a system that will provide coverage across the board with portable radio communications. We also need a system where on the fire ground we do not need multiple radios to communicate with the scene and county. The cost to "all volunteer" departments is also important and it should be considered not to get suckered into a new system which is priority to only one vendor so each department continues to get raped with costs for years to come on future purchases.*
Fire	Chiefs	*Funding for volunteer agencies is a must (as) this will be (a) very costly project.*
Fire	Chiefs	*(We need) the ability for the county to monitor fire ground channels and also talk on them if need be.*
		Current fire ground channels don't always work in certain areas, leaving the user designated a channel by the county that is useless.
		Higher security features (would) help keep everyone safe both over the air and in the field.
Fire	Chiefs	*Challenges with being heard by the dispatcher are increasing. It seems the dispatchers are having to monitor too many channels, and that means they miss hailing on a fire channel. The system should be designed to help the dispatchers manage multiple channels more easily, even combining users to a single fire channel when call volume is light so one user can hear the dispatcher is helping another user and simply wait their turn.*
Fire	Chiefs	*Communication capabilities in the western part of the county need to improve. There are many dead spots. The delay between Berks & Lehigh dispatching needs to be reduced. It would be helpful if we could easily and directly communicate with state police and EMS on incidents.*
Fire	Chiefs	*Single source (procurement) is probably not the best option. Users should have access to open architecture to avoid being forced to use one manufacturer's product/solution. VRS and interface options should be considered to reduce initial costs to each user. On the fire side, it is not critical to have individual IDs per unit because the average user isn't radio savvy. I see the benefit of this for police and EMS because they are typically only one or two people.*
Fire	Chiefs	*(The) County needs to pick up the cost of end users' needed equipment. A FD that needs dozens of portables and multiple mobile radios will generally not be able to afford what that will cost.*

Discipline	**Role**	**Comment**
Fire	Chiefs	*While Lehigh County Radio and its users must be able to afford this project, the proposed solution must be able to improve the current radio system performance to ensure a return on the likely substantial investment needed.*
		There are some dead spots in rural areas, especially in areas with valleys, and inside large buildings. The use of mobile radios often overcomes these limitations, but this does restrict the availability and reliability. As Lehigh County continues to develop, the inability to communicate inside large buildings using portable radios is becoming increasingly challenging. This development is unlikely to cease in the next 20-years and should be incorporated in the project scope.
		While coverage should be enhanced, an even greater concern is the current lack of scalability. During low-volume times when a single dispatcher is monitoring several channels, communications are missed when users on separate channels, who can't hear each other, transmit. The current system does not allow communications to be condensed so that users, who may be geographically dispersed, can hear each other and wait for the dispatcher. Conversely, the system does not offer the ability to separate communications when call volume dictates and staffing allows. For example, additional dispatchers can be staffed, but there is still limited air time available since additional channels are not available to be placed in service. A radio system that can expand or contract operational channels to balance dispatcher availability and user volume on demand would greatly enhance operations and ensure resources are used effectively and efficiently.
		The current communication system does not allow incident commanders or dispatchers to reliably monitor communications inside buildings. System limitations combine with missed communications to place responders at risk for injury or death. While it will be challenging to eliminate all missed communications, any solutions to improve the operating conditions will enhance these critical communications, especially during low-frequency, high-risk incidents such as active assailants or other multiple casualty incidents.
Fire	Chiefs	*If the system is switched to a different frequency band please design the system around portable radios. Our current system is not designed that way and our portables are sometimes useless for communications. Find a radio that will transmit from inside of a building to the exterior. We run into Bucks County and there digital radios are not very good at doing this.*
Fire	Chiefs	*Equipment must be able to reach all corners of the county equally. Dead spots behind hills, mountains and buildings is a very big concern.*
Fire	Chiefs	*Interoperability between counties, police, fire and EMS, as well as State and Federal agencies. Coverage and the capability to grow and advance the system as needed are vital to this system. Do not compromise the system by thinking 5 years out; look to the 10, 15 and 20 year marks.*

Discipline	**Role**	**Comment**
Fire	Chiefs	*The cost (is an issue); who's going to pay for it? How much will it cost, and how much will it cost the departments? Smaller departments and municipalities will struggle with the high cost of purchasing enough equipment to cover the personnel and equipment.*
Fire	Chiefs	*Any contract that is awarded should not be an exclusive contract where you can only buy that radio model from that distributor/installer. Example: the system should work with any model radio whether it is a Motorola, Harris or Kenwood etc...as long as that radio has the capabilities to support any upgrades.*
Fire	Chiefs	*Interoperability with Northampton County is imperative.*
Fire	Line Officers	*Dead spots are of concern in our coverage area. We also serve at the Lehigh/Berks border; communications with both Lehigh and Berks on those calls could be improved. We should be able to have interoperability between Lehigh and Berks to avoid excessive channel switching and radio use. We should be able to focus on planning for the call and getting to the call safely as opposed to all that PLUS dealing with the radio workload.*
Fire	Line Officers	*Interoperability with online, web-based, mobile phone accessible features would be nice. For example, text/mobile phone paging is very useful. Additionally, real time online feeds for monitor-only that are accessible only to authorized system users would be very helpful for times when radio equipment is out of service (batteries etc) or not available.*
Fire	Firefighters	*Maybe since we copied Berks' dispatching format, we could also include the pre-alerts that Berks does for all reported fires. Fire police should be operating on their own channel, not the channel fire units are on. EMS and fire should be on the same channel for MVA calls. Fire ground channels should be assigned and monitored by the dispatcher. Direct phone lines to individual dispatchers (county fire, county EMS, PD4, PD2, APD, city fire, etc). Dispatchers should be documenting staffing reported by apparatus. Hospitals should have their own channels with patches constantly open as they do for the city EMS units.*
Fire	Firefighters	*Improving the southern Lehigh edge of the county for radio transmit and pagers to open up.*
Fire	Firefighters	*Ability for agencies to purchase additional equipment at reasonable cost through something like a cost center, such as bank chargers etc.* *One of the biggest challenges is keeping portables charged and ready while maintaining the service life on the batteries.*
Fire	Other	*Top areas of concern - 1. Inter-agency operability. 2. Increased functionality of portable radio reception. 3. Dispatcher monitoring of fireground frequencies.*

Discipline	Role	Comment
EMS	OIC	*While filling this out I agree that almost everything is critical and should be a priority but on the county side, I am not sure if what is needed or feasible. Everything needs to be compatible and "state of the art" for everyone to succeed in their work.*
EMS	OIC	*Allentown shall, in my opinion, remain on our private channels.*
EMS	OIC	*The ability to have communications for EMS that match Fire North and F4 (North Police) - no reason why we are in the same county and lack the ability to have the same communication. The north is horrible and in need of immediate attention before someone gets injured or crews require resources with inability to request via radio.*
EMS	OIC	*Choosing a radio system that will not be obsolete in 10 years is important.* *The choices to explain costs and vendors didn't make sense. Cost is important, but so is value. Having an excellent system is better than having the cheapest.* *The addressed dead spots seem to only occur for us with mutual aide into station 67 coverage area.* *With the potential for disaster, the system needs the remote dispatch and flexible dispatch as part of the system.* *The tone and voice dispatch is still important to us. The responding, on scene and enroute to hospital can all be done via tablet.* *(Our) largest concern in inter-region communications at the airport.*
EMS	OIC	*Single vendor proprietary systems are cost prohibitive for most service providers, causing more problems than they are intended to fix. If you cannot afford to be on the radio system, you sacrifice safety and security for cash.*
EMS	Supervisor	*(The) radio system needs to be able to provide station alerting to ALL agencies in the jurisdiction with the necessary means to actually allow you to accomplish this task.*
EMS	Supervisor	*Our area currently experiences poor A-5 coverage indoors and on portable radios, and especially poor coverage to AEMS mutual aid east the Susquehanna/Broadway intersection. We've been told Fire South is an alternative, in the same way NOVA uses Fire North, but that interrupts a fire operations channel. LC Dispatch is almost unintelligible inside the hospital so we rely on text/Active911 for notifications. PD F2 doesn't seem to have these problems.*
EMS	Medic/EMT	*10/95 checks go unheard on A-5; however, are heard clearly when LCR requests on police channels, even when EMS is standing with PD.*
EMS	Medic/EMT	*Having the ability to operate on one standard channel and move ongoing incidents to a separate operations channel. I also feel that having the ability to contact the hospitals from a portable radio can be just as vital if not more important. Right now, a lot of EMS professionals utilize their cell phones because communications with the radios are not always available.*

Discipline	Role	Comment
EMS	Medic/EMT	*The current system is inefficient and barely effective and I'm glad improvements are in the works.*
EMS	Medic/EMT	*We have large areas of dead spots even when outside a residence that requires us to stop what we are doing and get in the truck to communicate with dispatch. This is a problem because of two reasons: it pauses patient care and if something goes wrong, we can't call for help. We also can't call from inside a residence ever, creating a similar problem. Any new system needs to have capabilities that allow communication with dispatch no matter where the radios are located in order to keep crews safe. Additionally, we currently struggle to communicate with other counties like when providing mutual aid. We need to have a better way to communicate than changing to a channel the other counties don't monitor and calling for them dozens of times unsuccessfully. In order for that to change, our radio systems would have to be compatible with each other so we can access more channels that the other counties use more frequently. These are probably the most mission critical changes needed.*
Other		*Part of the consultant's work should be design the system from scratch for the best coverage. As the design parameters are input, allow the county to decide whether to build new tower sites to get the best possible coverage or use nearby County owned or leased towers with slightly compromised coverage. Also, if staffing allows, we should have North, South and Central Zones.*
Other		*Ensure Emergency Management has talk groups for both individual agencies or regional groups. Currently we have our own radio frequency and would like to have a separate talk group.*
Other		*1. Radio vendors potentially bidding on this project or potentially successful in supplying any component of this system should not be a consultant on system design. System design should be independent of any potential suppliers and final acceptance testing subject to the design consultants review. There is a potential conflict of interest in current procurement and design.* *2. It is imperative the county procure funds for end user radio equipment. Envisioned system's portable and mobile equipment is beyond the financial capability of the end user municipalities. A fancy radio system is great but solves nothing if the municipalities cannot afford the equipment or volumes of equipment they need to support public safety on the local level.* *3. New system should support components made for the system, not band-aided together as today such as ID, MDT capabilities, access to CAD etc.* *4. The county needs to hire personnel to support a built-out system.* *5. The county should always be monitoring county-provided fire ground channels. Field units should never operate in an unmonitored environment.* *6. New system needs to consider interfaces to municipalities' other functions not covered by the county such as public works departments.*

Discipline	**Role**	**Comment**
Other	*(continued)*	*7. If funds are not procured for municipalities, I would suggest the county owning all the radios and providing staff for all radio maintenance similar to what Montgomery County provides.*
		8. Interfaces to surrounding counties is a must, especially with Northampton County.
		9. New system should also provide communications between county and city units.