Interoperability Assessment

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EXECUTIVE SUMMARY

1.1   Purpose and Objective of the Study

Lexington-Fayette County Urban Government tasked RCC Consultants with assessing the current interoperability situation in the County, providing recommendations for improving the situation and providing basic budgetary estimates to be used in the potential future procurement process.

1.2   Current Environment

Four primary systems are currently being used by the County's first responders:

1. Division of Police's complex analog conventional VHF system. Started in 1969, expanded and updated over the years, the system is used by about 750 subscribers utilizing 1500 radios.
2. An 800 MHz EDACS system supplied by Ericsson initially to UK in 1997, later expanded with additional sites, channels and users. This is the primary communications system for virtually all first responders in the County other than the Division of Police. This system is operated by the Division of Fire and Emergency Services.
3. Conventional, 4-channel UHF system used by the Blue Grass Airport.
4. Conventional 800 MHz system used by Fayette County Sheriff.

There are also some secondary systems in use by some smaller agencies, such as, for example, UHF systems used by the Physical Plant at the UK.

Lexington-Fayette County is adjacent to six other counties: Scott, Bourbon, Clark, Madison, Jessamine and Woodford. Jessamine, Woodford and Bourbon operate primarily on Kenwood's digital proprietary Nexedge technology. Scott County operates its own 800 MHz EDACS system, also a proprietary technology developed by GE Mobile Communications in the late 80's, and is considering upgrade to P25 standard. Madison County operates a new P25 Phase I digital trunked 800 MHz system that became operational late in 2010. Both Madison and Scott counties provide some coverage within Fayette County (see Appendix B). Clark County operates on VHF conventional frequencies and is planning to move to conventional P25 operation on the existing channels.

Currently, there are no state-wide plans in Kentucky for a radio network with sufficient coverage and capacity to solve Lexington-Fayette County's interoperability problems. The State has a basic conventional interoperability plan.

1.3 Existing System Problems and Shortcomings

Lexington-Fayette Urban County Division of Police's VHF conventional network:

- Insufficient channel capacity
- Lacks any advanced public safety functionality
- Obsolescence and compliance with narrowbanding mandate: approximately 50% of the radios currently in use will not be allowed after 12/31/2012 and the cost of compliance in the simplest form is likely to be in the $1M range.

Lexington-Fayette Urban County Division of Fire/UK 800 MHz EDACS system:

- Insufficient coverage (Fire)
- Obsolescence (maintainability)
- Proprietary technology/cost of replacement radios

Blue Grass Airport's UHF conventional system:

- Limited interoperability (with Police and Fire)
- Coverage limited to the Airport and close vicinity
- Limited functionality

1.4 Recommendations

At this stage of the project, the recommendations are divided into three phases:

1.4.1 Minimalistic Incremental Improvements to the Existing Infrastructure

Starting immediately, make simple incremental changes to the existing systems, update subscriber radios used for interoperability, create appropriate interoperability plan(s), conduct regular basic training.

These steps will not solve other serious issues reported by the users of the current systems, including compliance with the narrowbanding mandate which will force the Division of Police to replace over 700 radios by 12/31/2012.

This phase of the project is not expected to cost more than $50K (excluding internal labor).

1.4.2 Integrated County-Wide System

Build a county-wide integrated system with sufficient capacity for all first responders, include provisions for interoperability with current systems in adjacent counties and provisions for future system expansion into adjacent counties. This will solve virtually all of the LFUC's in-County problems uncovered in the course of this project. With 22 800 MHz channels licensed to the Fire and UK, there is more than enough capacity to accommodate all first responders and current users of the existing systems in the County. The three sites currently used by Fire and UK provide a good starting base for expansion.

Upon implementation of this phase, the first responders will experience significant and noticeable improvements in functionality, coverage, capacity and, of course, interoperability. The preparations for this phase need to start immediately so that some significant and unnecessary expenses required to comply with FCC requirements can be avoided (see the Narrow-banding sections for additional information; the new system must be up and running by 12/31/2012).

Based on similar recent projects, RCC expects that procuring infrastructure for this phase of the project should cost between $5M and $15M depending on selected scope, options and vendor. Subscriber equipment prices vary between $1K and $7K per unit and are included within the stated price projections in section 12.1.2 of this report.

1.4.3 Region-Wide Network

There may be a unique opportunity to build a large region-wide radio communications system for first responders. There are several factors that make this idea worthy of pursuing:

- The vicinity of the chemical stockpile in Madison County requires exceptionally high level of coordination and interoperability and provides opportunity for related federal funding;
- Scott and Madison counties' 800 MHz systems combined with Fire/UK's EDACS could be used as a solid base for the future potential region-wide system;
- Lexington-Fayette County is a hub for the adjacent counties. It acts as the local commercial center, providing entertainment, educational, health care among others. Often, the first responders from Fayette County are involved in major planned or unplanned incidents in the adjacent counties. Many of the personnel live in those counties.

- Department of Homeland Security (DHS) is openly promoting such region-wide initiatives and providing funding for implementation of systems that serve multiple jurisdictions.

Taking into consideration the high level of satisfaction with their current technology, Nexedge, and relative self-containment of operations in Jessamine, Bourbon and Woodford counties, as well as Clark County's planned move to VHF conventional P25 operations, the most pragmatic approach may include a hybrid solution where Scott, Fayette and Madison counties build a highly integrated 800 MHz P25 network based on their existing systems and the remaining counties continue using their conventional digital Nexedge (or conventional P25) systems.

Technology-wise, a region-wide system is not significantly more challenging than a county wide system. Financially, a regional network may be less costly for the LFUCG than limiting the project to LFUC if appropriate additional federal funding can be secured. A shared regional system will likely reduce the burden of recurring costs to the participating agencies.

The most serious and often underestimated challenges around building multi-jurisdiction region-wide systems are in the areas of governance, logistics and local politics. It would therefore be unrealistic to expect to build a region-wide network before the narrow-banding deadline of 12/31/2012.

Based on similar recent projects, RCC expects that this phase of the project should cost between $5M and $25M depending on selected scope, options and vendor.

RCC recommends that the County gives due consideration to the proposed third phase, region-wide network, as it starts procurement of the county-wide integrated system for LFUC.

2. RF INFRASTRUCTURE

Current infrastructure in the Lexington-Fayette Urban County includes the following major equipment *(please note – the table below is not meant to be a complete inventory of all equipment, just the fundamental elements of the primary systems used by the first responders)*:

Site/System	Channel	Equipment	Comment, Useful life
Patterson Office (UK)	8 x 800 MHz	EDACS primary site	Very good location for Lexington coverage, ample space for additional equipment, reliable back-up power.

Site/System	Channel	Equipment	Comment, Useful life
WKYT	8 x 800 MHz	EDACS site	Very good location for back-up purposes and for covering east side of the county as well as penetrating the east side of the city. Originally a back-up site for VHF equipment.
	154.815/155.595 MHz PD repeater and satellite RX site for all other PD channels	Motorola	Very good location and facility.
WDKY	6 x 800 MHz	Supplementary EDACS site	Created in response to a tragic turn of events in which a member of the EMS team lost her life. The site provides good coverage in the challenging topography of southern-most end of the Fayette County.
Fire Dispatch Center	N/A	C3 Maestro consoles (5 units); central electronics for EDACS interfaced with multiple radios (1xVHF, 1xUHF, 3x800MHz); large ACU 1000 with multiple (4xVHF, 2xUHF and 4x800 MHz) radios installed and connected to the consoles (via EDACS switch); 1 mobile command post with additional ACU 1000 and 15 radios	A cramped and outdated facility.
Blue Grass Airport	4 x UHF	Conventional Motorola repeaters	These base stations are for the first responders at the airport. Good potential location for additional 800 MHz site.
		MIPS 5000 dispatch console	The console system was defective at the time of the interview (audio delays make patching unusable despite theoretical capability to patch LFUCG Police and Fire,, UK Police, KSP, Versailles and Woodford County).
Kirwan Tower	151.160/155.610 MHz and 154.875/156.090 MHz	Motorola repeaters	Police site - not visited

Site/System	Channel	Equipment	Comment, Useful life
Blanding Tower	154,845/155.565 MHz	Motorola repeaters	Police site - not visited in the course of this project
Park Plaza	156.210/153.920 MHz; 155.790/153.980 MHz and 155.520/153.485 MHz	Motorola repeaters	Police site - not visited
WLEX	Satellite RX only	Motorola equipment	Good location near the center of Lexington
Fayette Mall Cell Tower	Satellite RX only	Motorola equipment	Police site - not visited; 5 channels only, the site is specifically designed to serve the Fayette Mall.
Armory	Satellite RX only	Motorola equipment	Police site - not visited
Athens	Satellite RX only	Motorola equipment	Police site - not visited
Police Dispatch Center	N/A	Ten (10) Gold Elite consoles, Motorola comparator for the VHF conventional satellite RX system, Lexington Streets and Roads, Fayette County siren system (VHF), Lexington Fire/EMS (2 radios), Ham station, P25 for Madison County	Ample space, minimum three dispatch positions out of ten available manned at any time.
DEM	Multiple desktop stations	EDACS, P25, conventional VHF, Ham radio, EFJohnson (National Guard)	No direct wireline connections with other dispatch centers. No power backup!
UK Fixed Dispatch Point	800 MHz conventional (SO interface) and VHF (for PD interface)	2 C3Maestro Consoles	Interoperable with Police, Airport, SO and KSP (in addition to all EDACS users).
School District	EDACS	Desktop stations at two different locations	No wireline consoles, connections with other agencies via phone or Emergency call on the radio only.
LexTran	EDACS	Dispatched from LexTran's HQ in downtown Lexington	No wireline consoles, connections with other agencies via phone or Emergency call on the radio only.

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Site/System	Channel	Equipment	Comment, Useful life
Fayette Co Sheriff Office			SO did not provide any information for this project.

Figure 1 – EDACS repeaters, combiners and Site Controller at the Patterson Office site at UK

Figure 2 – Motorola Securenet – comparator for satellite receiver conventional system used by Division of Police.

3. PSAP'S

The two major Public Safety Answering Points (PSAP) are operated at the Fire and Police Headquarters within separate facilities. These two PSAP's are not connected directly via their radio systems – whenever necessary, the dispatchers communicate with each other via telephone even though it is possible to use radios (the consoles at each PSAP can access both systems).

In addition, UK operates its own dispatch center, DEM is equipped with several desktop radio units for dispatching, Fayette County school buses are managed from its own two dispatch centers, LexTran is dispatching from its HQ via desktop stations and the Airport has its own console (not fully functional at the time of the interview).

Despite some technical capabilities, the basic mode for connecting from any one dispatch center to another is via telephone.

The methods of communications between the dispatch centers need to be improved; both dispatch centers should operate on the same radio system and effectively act as back-ups for each other.
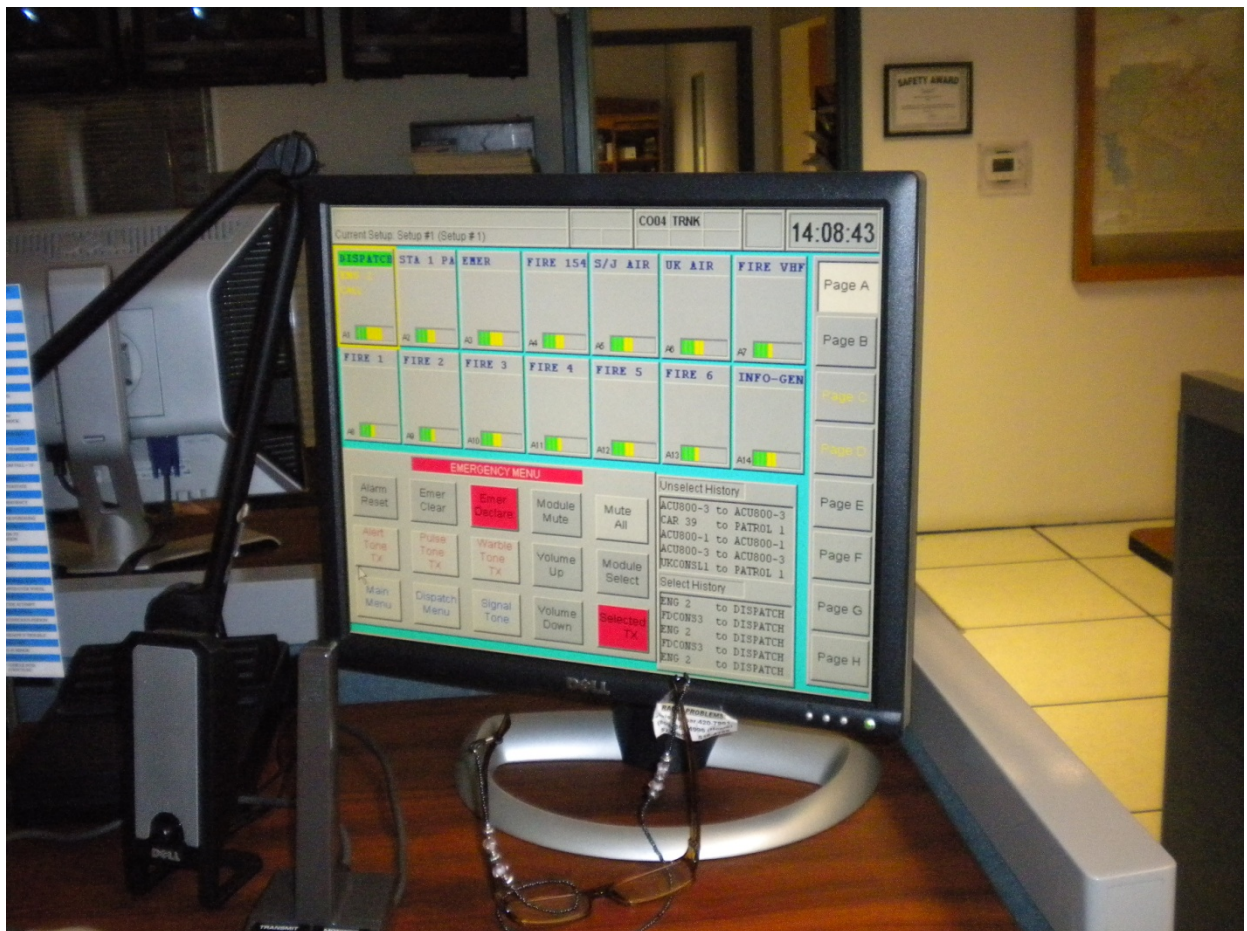

Figure 3 – Primary operating set-up of C3 Maestro Console at PSAP located at the Fire Headquarters.

4. RF COVERAGE ANALYSIS – EDACS

Current users of the EDACS system have dissimilar views on how the system performs in terms of providing adequate coverage. This is understandable when their operational needs are taken into consideration. For example, the school buses experience almost no issues with the coverage. This is because they operate only within the County and use only mobile radios with antennas mounted on the busses' roofs, thus providing optimal subscriber unit performance.

UK users are satisfied with the coverage within the main campus, but the University has several properties in the adjacent counties where coverage is non-existent or, at best, weak.

However, the most critical user of the current EDACS system is the LFUCG Division of Fire. Coverage provided by the current system is inadequate. Fire fighters need to be able to operate the portable radios in buildings. While the current technology is capable of providing good in-building coverage, the LFUC system has not been designed for that purpose – the number and location of tower sites has not been optimized for in-building coverage.

The following four maps illustrate and explain why the mobile users are satisfied with the coverage, and why firefighters are rightfully concerned. The maps in Figures 4 and 5 are a different scale than Figures 6 and 7 because in-building coverage is considered critical by the Fire Department in the area marked on the map. Figures 6 and 7 were provided for arbitrary 20 dB attenuation; some of the buildings in Lexington likely exceed that limit, while a great majority of the construction provides less than 20dB attenuation.

The areas marked red on the maps are expected to provide certain probability of obtaining good quality communications – 95% of the time within 95% of the marked up area. Consequently, the unmarked areas do not necessarily represent total lack of signal.

Please note that all of the coverage maps in this report are presented for comparative purposes, i.e. to compare different options rather than to present as accurate as possible actual areas of coverage.
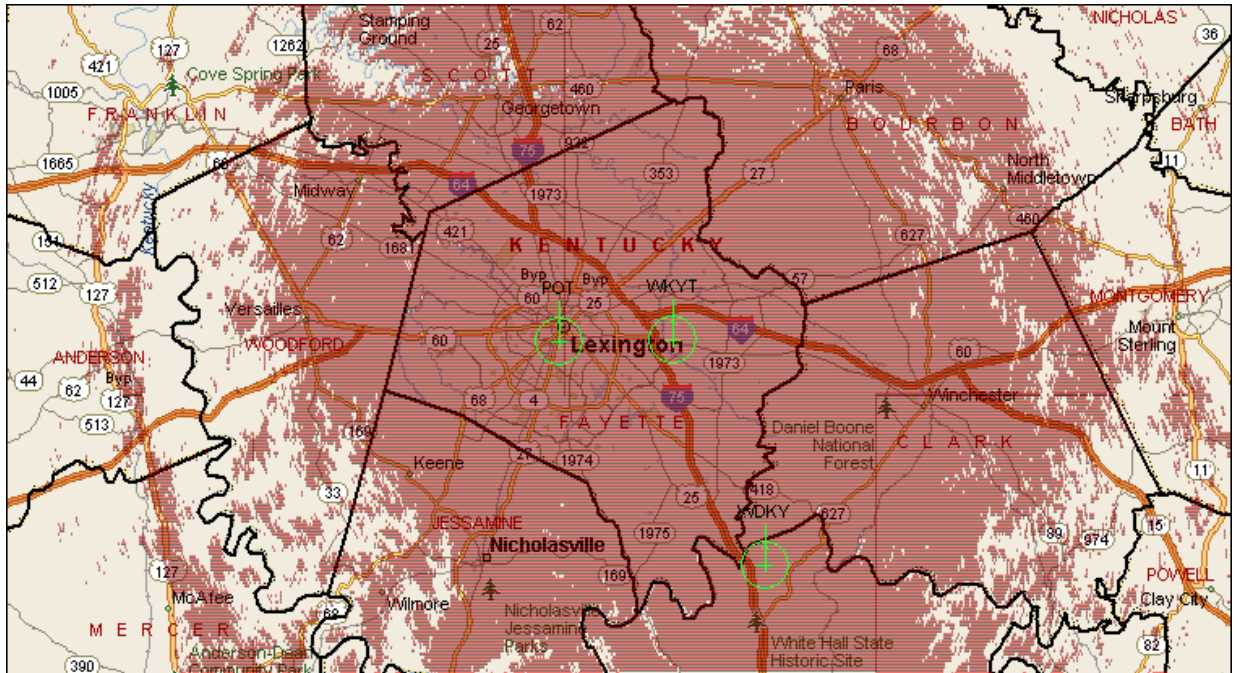
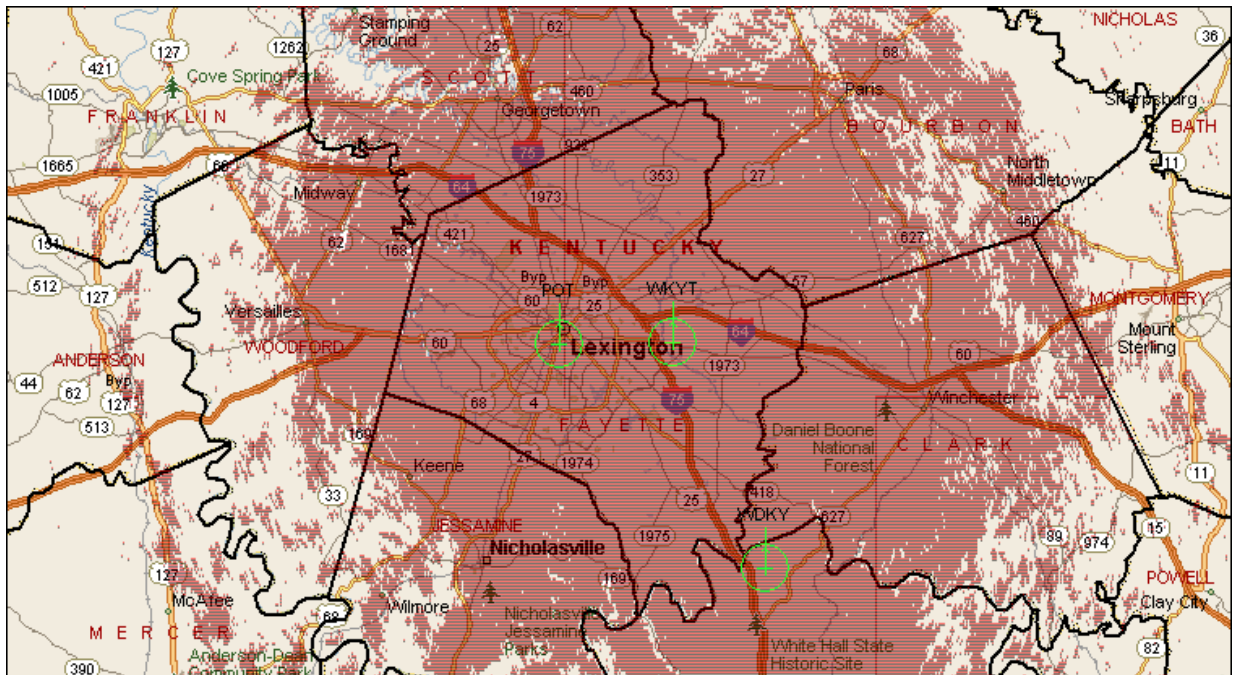Figure 4 – Existing EDACS system - Mobile Talk-Out

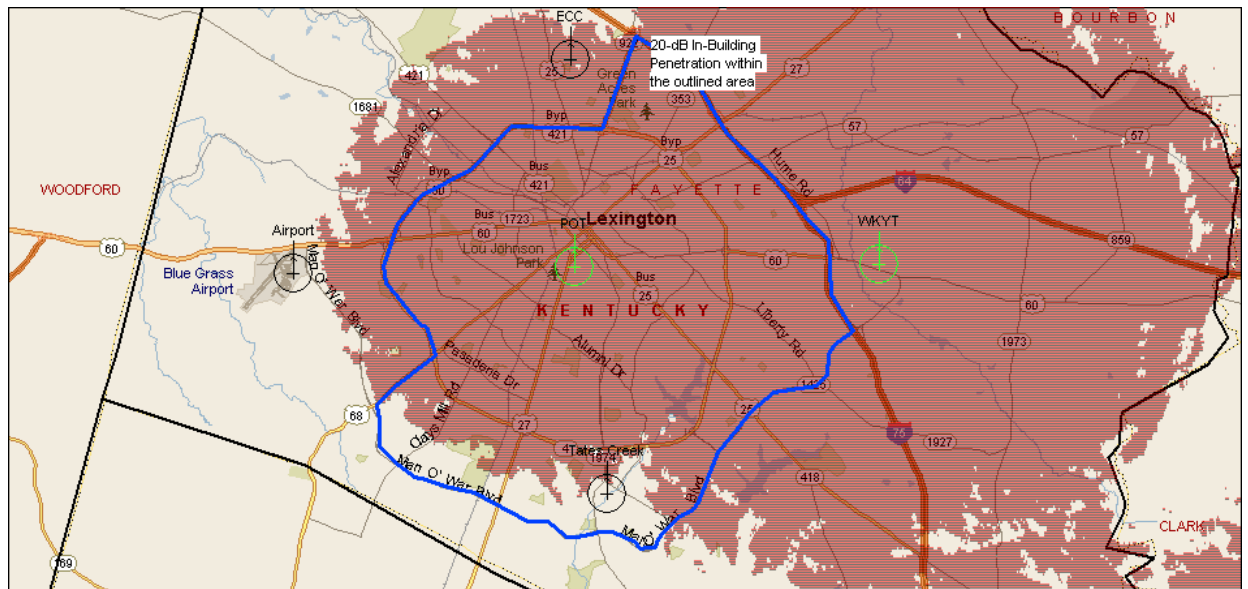Figure 5 – Existing EDACS system - Mobile Talk-In

Figure 6 - Existing EDACS system - portable talk-out (industrial/commercial buildings with 20dB attenuation)
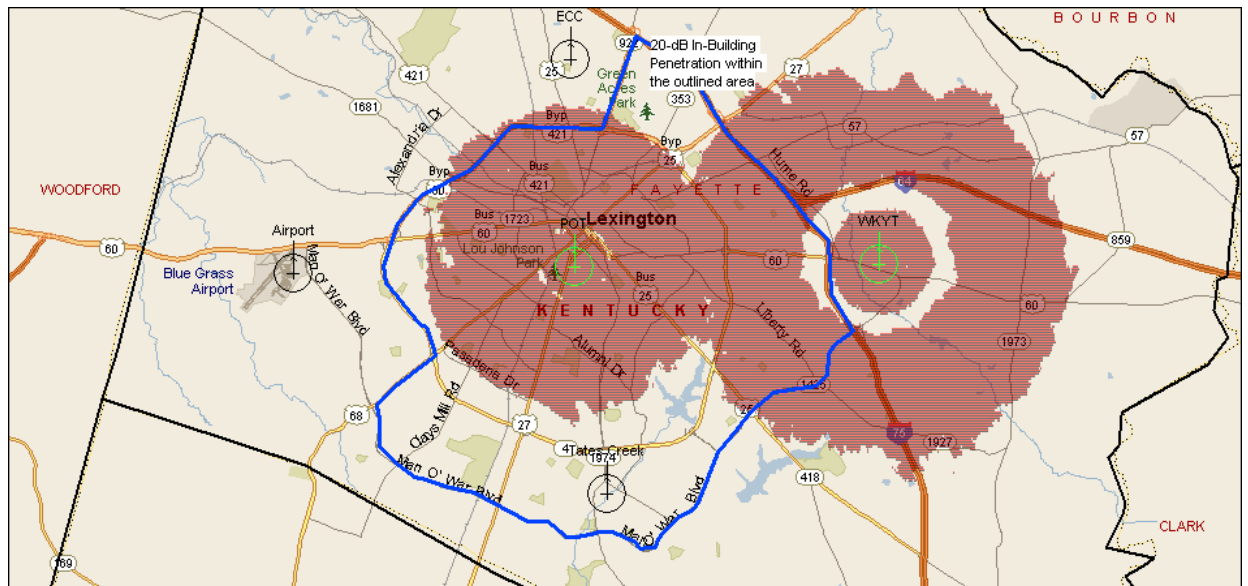

Figure 7 - Existing EDACS system - portable talk-in (industrial/commercial buildings with 20dB attenuation)

5. RF COVERAGE ANALYSIS – VHF CONV

For its 7 VHF conventional channels the Division of Police's system uses 5 separate transmitter sites and satellite receivers in 4 additional locations. The transmitters are spread out geographically and not all of the channels are included at all satellite RX locations. The coverage is thus different for each of the channels, resulting in a complex and somewhat cumbersome manual roaming system, requiring that each user knows the areas of good and poor coverage for each of the channels he/she may be using.

The area of operations is divided into three sectors served by specific repeaters and, in principle, all users within the given area operate on that channel, regardless of their function/organizational assignments. Each channel/sector is assigned to a separate dispatch position at the PSAP.

No major coverage holes were reported by the Police, although in general the coverage in all outlying areas of the County for portable radios is considered spotty.

The biggest coverage issue is operational – radio users traveling from one segment to another forget to switch the channels or switch to the wrong one. These are typical issues attributed to systems with manual roaming.

Coverage maps for the VHF system have not been run and provided in the report due to the fact that RCC Consultants do not consider VHF a viable option for the issues identified in the report.

5.1   Current System Comparison of Wideband vs. Narrowband

It needs to be noted that the expected effect of narrowbanding is detrimental. Should the Police stay on the current VHF channels and simply switch to analog 12.5 KHz operation, it is assumed that the coverage will worsen by 3dB. In practical terms it should be assumed that the areas where coverage is unreliable now it will become significantly worse. The areas where coverage is good will experience some degradation, although in many places, it may not be noticeable at all.

Instead of simply narrowbanding existing systems, many organizations use the mandate to update their systems to digital operations; they use the same channels before and after narrowbanding, but, instead of continuing to use analog technologies, they switch to digital ones such as P25, Nexedge or MotoTrbo. Many of the users report improvements in coverage performance of their systems after switching from analog to digital modulation, but the actual results require careful consideration and planning – simply switching to a digital modulation is not a guarantee of improvement. Considerations must also be given to potential implications to interoperability with other agencies when switching to digital systems.

6. CAPACITY OF THE EXISTING SYSTEMS

There were no complaints about channel congestion on the EDACS system from any of the users (LexTran was the sole exception, but the complaints were traced to operational issues rather than actual system congestion), but the traffic records examined by Major Paul See at the Division of Fire indicate that at some peak times, there is no spare capacity. The system operates in multi-site configuration with 8 channels at two of the sites and 6 channels at the third (WKDY). From the perspective of radio traffic handling capacity, the current system configuration is in-efficient with significant room for improvement. Telecommunications theory, using the Erlang C traffic model, indicates that using the 22 available channels in alternative configurations (such as switching to simulcast configuration or to P25 Phase II) would yield drastic increase in capacity, widely exceeding any foreseeable needs in the County.

The number of channels and the system configuration in use by the Division of Police result in significant congestion at critical times. Using rough general rules of thumb calculations, 750 subscribers of the Police's system require 10 traffic channels in trunked configuration for traffic handling capacity meeting the generally accepted public safety guidelines (1% GOS, meaning that during the busy hour 1 call per hundred may be placed in a queue). Currently there are only 7 channels available to PD users, and there are only 3 dispatchers available at any given time (one per sector) making the situation even more inadequate. The situation is further exacerbated by the fact that one of the channels used by the Police is also used by DEM for siren activation and control and another channel is shared with (and actually licensed to) DoH.

7. MOBILE DATA

While mobile data was not part of the scope of this study, it needs to be noted that Mobile Data interoperability presents a very different set of issues from voice interoperability. While voice interoperability typically focuses on user-user direct connection achieved either directly via air interface or through a variety of network interfaces, the nature of data communications is such that the focus is on compatibility of databases used by different subscribers.

A properly configured mobile data system can relieve a lot of stress from associated voice communications systems. Recent developments in the area of broadband wireless data for public safety carry a lot of promise for potential nation-wide network. However, given the state of regulatory affairs, technology development, technical standards and funding, RCC recommends that these events should have no impact on efforts to improve interoperability in the near- or mid-term future.

8. NARROWBANDING CHALLENGES

According to the information provided by the Division of Police, approximately 50% of its mobiles and portables cannot be narrow-banded. This means that over 700 radios will have to be replaced by 12/31/2012. Such a high number translates into a significant capital expenditure. The total cost of basic compliance for the Police system is likely to exceed $1M, significantly more if change in technology, for example, upgrade to digital operation, is contemplated.

Contrary to the opinions expressed by some interviewees, there is no legal requirement to upgrade the equipment to P25 digital standard; the operations must merely switch from 25KHz to 12.5KHz.

Users of the 800 MHz EDACS system are not affected by the narrowbanding mandate. The rules apply only to the radios and systems operating in the 150-512 MHz.

The system currently used at the Airport is subject to narrowbanding requirements, but, as the Airport is moving to 800MHz in early 2011, no practical impact is expected.

8.1 Overview

Historically, Land Mobile Radio (LMR) systems have used 25 kHz-wide channels. In December 2004, the Federal Communications Commission mandated that all private LMR users operating between 150 MHz and 512 MHz move to 12.5 kHz narrowband voice channels by January 1, 2013.

Using narrowband channels will ensure that agencies take advantage of more efficient technology and, by reducing channel width, will allow additional channels to exist within the same spectrum space, as illustrated below:
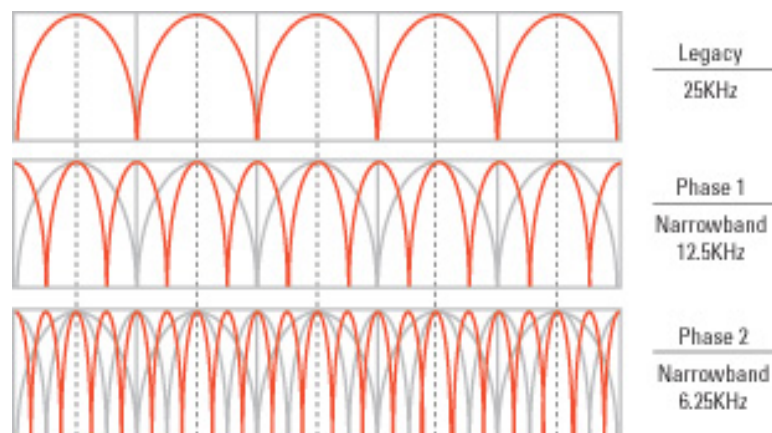
Narrowband channels will allow additional channels to exist in the same spectrum.

8.2 Deadlines

To phase in the migration deadline of January 1, 2013, the FCC has established interim deadlines. The first important deadline is January 1, 2011, after which:

- The FCC will not grant applications for new voice operations or applications to expand the authorized contour of existing stations that use 25 kHz channels. Only narrowband authorizations will be granted.

- The FCC will prohibit manufacture or importation of new equipment that operates on 25 kHz channels. This will reduce the availability of new equipment for legacy radio systems and will affect how agencies maintain and upgrade older systems.

8.3 Obtaining New or Modified Licenses

To move to narrowband operations, agencies must modify existing licenses to accommodate the narrowband emissions. An agency that is licensed for a 25 kHz-wide channel is not licensed for two 12.5 kHz channels. To narrowband an existing wide-band channel does not require frequency coordination, but does require the Licensee to file the modification of license request directly with the FCC utilizing the Universal Licensing System.

If a Licensee desires to license a second channel that occupied its existing 25 KHz bandwidth, they will have to justify to the FCC why they need additional channels. Such requests will require the current channel to be modified to one of the two offset channels and the addition of the other offset channel to the subject authorization. Careful evaluation of splitting one 25 KHz channel into two 12.5 KHz channels will be necessary to determine if interference will be caused to receivers etc. due to the two new co-located channels being adjacent to each other. Consideration of applications for new narrowband licenses will follow the same process as a new license application. As agencies migrate to narrowband operation, however, the pool of available frequencies will increase.

8.4 Expected Effects

In general, narrowbanding in its simplest form (switching from operating on 25 KHz channels with analog modulation to 12.5 KHz channels with analog modulation) is expected to degrade coverage experienced by the users. The degradation may be insignificant in some locations and unacceptable in the areas where the coverage is already poor.

The effects of narrowbanding on coverage will vary from one case to another. On the average, the penalty of narrowbanding is expected to be around 3 dB, but depending on the equipment and system configuration the final effect may be anywhere from negligible to dramatic. Switching to some digital technologies might actually improve the coverage.

8.5   Narrowbanding Recommendations

Roughly 50% or 716 of Police's radios are narrowband capable. These units and the existing system should be upgraded to meet narrowbanding requirements and the licenses modified accordingly for a number of reasons:

1. Provide emergency back-up for the proposed integrated 800 MHz system
2. Provide alternative communications for some less critical users that do not need to switch to P25
3. Preserve the existing licenses
4. Preserve the investment

The main operation of the Division of Police should, however, move to the proposed integrated 800 MHz P25 system by 12/31/2012.

The Airport might consider narrowbanding its existing system and selected subscribers for the same reasons.

9. INTEROPERABILITY:
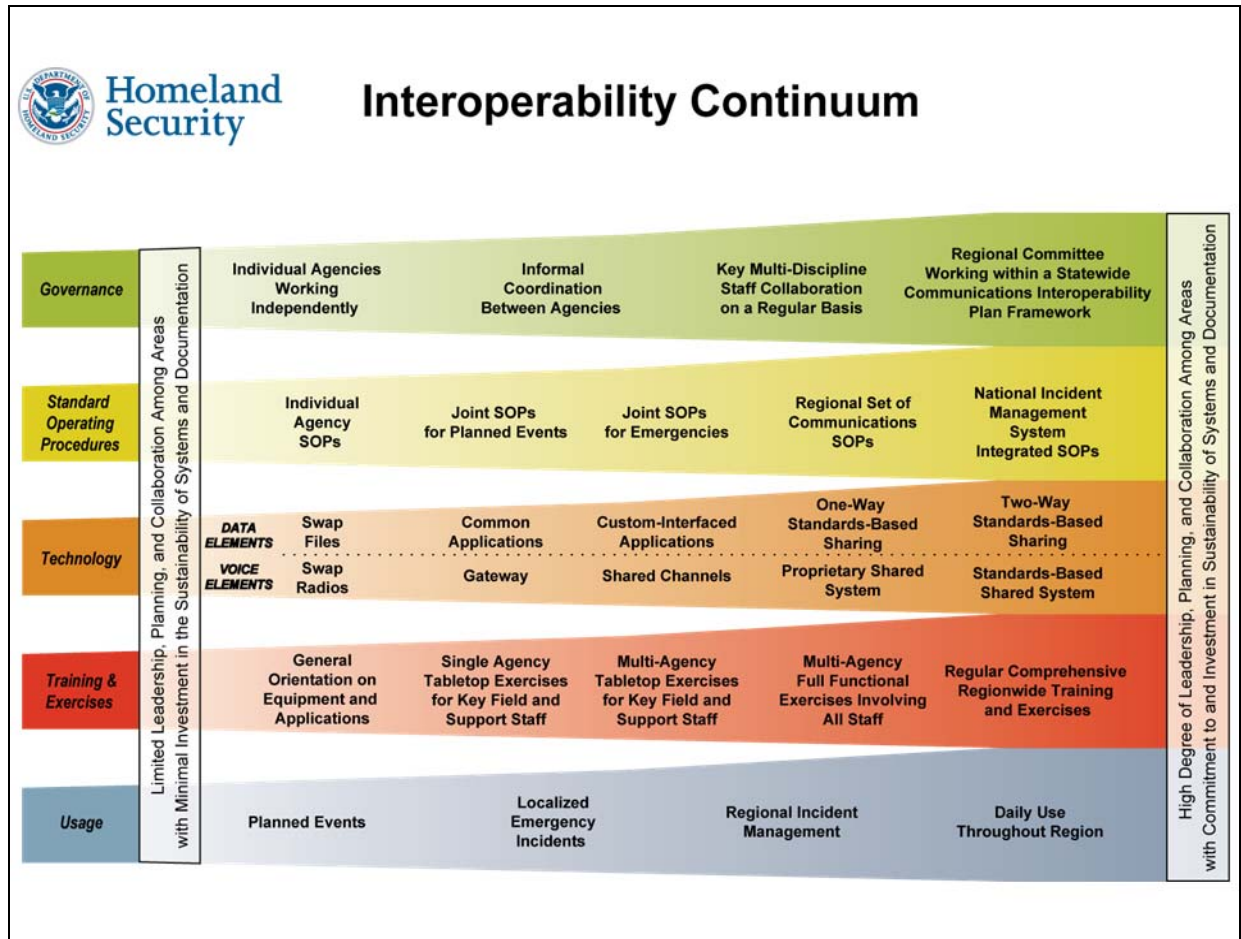
Figure 8: Department of Homeland Security Interoperability Continuum

The above diagram represents DHS's comprehensive view of interoperability. Technology, which is the main area of this study, is considered just one of the 5 important components of public safety interoperability.

In DHS's view, the ultimate goal of interoperability is the situation when

- the governance is provided by a regional committee working closely with a statewide interoperability committee (there is no regional committee in place in the Lexington area at this time)
- the standard operating procedures for participating entities are organized in accordance with National Incident Management System (none of the interviewed entities have interoperability-focused SOP's, with the exception of the state-wide document)
- the technology is standard based shared system(s)

- regular comprehensive regional interoperability training program is in place (most of the agencies provide some training, but there is no comprehensive regular region-wide interoperability training in place)
- the shared system(s) are in daily use throughout the region (this statement is true for some shared systems in the region)

While the gap between the ideal state and current status quo is significant, most of the organizations covered by this project managed to work out methods of communicating with the entities with which they need to communicate. For example, Madison County installed its desktop stations at the PHQ PSAP and DEM; an IP console for Madison County's system is in the process of being installed at the Lexington Fire Dispatch. Consoles at PHQ can patch users of disparate systems; and those at FHQ have similar capabilities; several radios from Madison and Scott counties are authorized to operate on the Lexington EDACS system. Radio swaps are commonplace and command vehicles are equipped with multiple units.

Figure 9: Some of the interoperability units installed in Division of Police's command vehicle.

With some notable exceptions (for example Woodford, Jessamine and Bourbon County Nexedge channels), Lexington-Fayette County's first responders found ways to get by and communicate with each other and with their neighbors. This patchwork of approaches is antiquated, unreliable and inefficient, nevertheless, mostly sufficient for every day operations.

There are some disturbing gaps. For example, some agencies, like DEM and DoH, rely heavily on cellular phone connections. Reliance on cell phones is highly undesirable, especially under emergency situations. The 60 VHF portable units owned by DoH are used about 5 days per year for exercises rather than for daily communications, as the intended users are not sufficiently familiar with the technology and prefer lighter cell phones. The primary mode of communications between dispatchers located at Police and Fire HQs is the telephone – slow and unreliable under emergency circumstances.

The PD command vehicle is equipped with several radios that in theory should enable communications with all neighboring entities. Unfortunately, some of the radios are obsolete and radios capable of communicating with Madison County's P25 system or Jessamine, Woodford and Bourbon counties' Nexedge system have not been installed when the unit was visited at the end of 2010.

Both Police and Fire have the technology to provide either permanent or on-demand patches between their systems. The level of awareness of these technical capabilities among potential users is low, because the patches are seldom used. Standard operating procedures call for the field units to communicate up through their chain of command and the connections are made through liaisons (officers, managers, dispatchers, delegates) rather than through any direct modes of communications.

9.1   In-County Interoperability

In-County interoperability varies from agency to agency. All agencies on the EDACS system can talk freely to each other although the level of awareness of the capabilities varies greatly. It is not exercised very often because of standard operating procedures and because of limited understanding of the capabilities of the system, but the technology enables anyone to talk to anyone else without intervention of any third parties.

Interoperability between the EDACS users and the Police's system is all manual and requires human intervention. While the equipment and software owned by both agencies would allow a permanent or on-demand patching of the users on these two systems, it is not practiced and it is not practical given the severe limitation on the number of channels and limited number of dispatchers on Police's system.

Interoperability between the Airport and any other agencies is currently limited to swapping radios. The Airport owns console equipment with patching capability but it was not operating properly at the time of the site visit (the end of 2010) and therefore not in use. At the time of the interview, the Airport was testing EDACS coverage on its premises, reporting satisfying results and planning to switch all of the first responders on to that system within the next few months. This will provide full interoperability with all agencies in the County with the exception of the Police and the Sheriff's Office.

School buses and LexTran are self sufficient. The interoperability needs are minimal and are considered fully met by the management.

DEM has to scramble more than any other agency in the County. The primary system for its own needs is the Fire's EDACS (with its coverage limitations). DEM has a cache of EDACS portables; in addition it has a smaller cache of Police portables. It has P25 units to talk to the Madison County and a separate radio for National Guard, Civil Air Patrol and Amateur communications.

DoH is sharing a channel with Police. While DoH holds the license, the channel is used by the Police in talk-around mode. Both DoH and Police use different CTCSS tones. DoH intends to use 60 recent VHF portable radios to communicate with the others; for day to day convenience, it relies on personal cell phones instead.

UK is self contained on a daily basis, manages to cope with major planned events such as UK football games, but is very concerned about interoperability with the PD, especially in case of a major unplanned event or emergency, such as the Virginia Tech massacre.

Overall, the first responders within the County get by with their standard routine interoperability needs on a mix of ingenuity, operating procedures and technology, but there is great room for improvement and moving all users onto one integrated system has the potential of tremendous improvement for everyone by the virtue of eliminating multiple radio systems and enabling the users to talk to any group or individual with a turn of a knob or the push of few buttons.

9.2   Inter-County Interoperability

Interoperability between Lexington-Fayette Urban County and the adjacent counties is severely limited.

County	Methods of interoperability with Lexington-Fayette Urban County	Comments
Scott	Several law enforcement and EMS radios authorized to	Situation opposite to Lexington-Fayette County – the Fire Departments operate

	operate on Lexington EDACS	on conventional VHF while law enforcement uses 800 MHz EDACS. Interested in close interoperability with Lexington-Fayette County and planning on moving to P25.
Bourbon	Bourbon County is interoperable with Lexington-Fayette via statewide interoperability channels. Lexington-Fayette's units have Bourbon County's frequency programmed and use the system occasionally (seldom). Bourbon County's radios are not programmed to operate on LFUCG frequencies. There is no wireline connection between the PSAP's (other than public telephone system)	Bourbon County is self-contained and not concerned about limited interoperability options with LFUCG.
Clark	Direct radio-to-radio (cross-programming)	Clark County's concern about interoperability with Lexington-Fayette Urban County is minimal.
Madison	Some of the Madison County's P25 radios can roam onto Lexington's EDACS system. Lexington's agencies have Madison County desktop radios and IP console at Fire HQ.	Having all of Madison County's users on one system with a single PSAP makes achieving a very high level of interoperability possible.
Jessamine	Jessamine County reports never using Lexington's systems. Lexington's VHF radios have Jessamine County's frequency programmed in them and occasionally roam on their system. The situation is deteriorating as Jessamine County is in the process of moving its users to a	Jessamine County is a part of the area covered by the Chemical Stockpile Program and, with external funds available, would be willing to move to P25.

	proprietary digital system (Nexedge).	
Woodford	Woodford County has an abundance of VHF channels with some of them used for interoperability. This is particularly important due to the fact that Woodford County is also in the process of moving to Nexedge (advanced further than Jessamine County).	Woodford County, with external funds available, would be willing to move to P25.

10. NEEDS ANALYSIS SUMMARY

The most important unmet needs and challenges uncovered during the interviews and analysis are:

- Division of Fire: portable in-building coverage; getting away from proprietary system to avoid high prices of user equipment; equipment obsolescence
- Division of Police: system congestion; manual roaming; state of the art functionality
- UK: interoperability in case of a major emergency
- Airport: interoperability
- DEM: interoperability; coverage in some areas, especially schools, sharing a channel with PD for siren activation and control

11. RECOMMENDATIONS

RCC's recommendations are divided into three different phases:

- Phase 1: Incremental improvements
- Phase 2: County-wide integrated system
- Phase 3: Region-wide integrated system

Incremental improvements can be implemented relatively quickly and inexpensively and should be commenced in the near future.

The second phase, a County-wide integrated system, is the core of the recommendations and necessary because the short term incremental improvements will not solve many of the current challenges (coverage, channel capacity, functionality and interoperability). The integrated system will put all of the first responders on an 800 MHz trunked network. Some of the current users (school buses, LexTran) may remain on a reduced number of EDACS channels operating at the University site, at least initially to preserve the current investment; this approach is acceptable because their operations are predominantly self-sufficient. The main part of the system will be replaced by (or upgraded to) P25 Phase I or II standard technology. 2-5 antenna sites will need to be added to achieve the desired coverage and the entire system will be configured as a single simulcast "cell".

A Region wide system would be an extension of the county-wide concept with 4-10 sites in addition to those acquired in Phase II to provide coverage in the counties adjacent to Fayette (and, potentially, Estill County as the participant in the CSEPP – Chemical Stockpile Emergency Preparedness Program). Willing participation of adjacent counties would have additional benefits – at least in theory, the LFUCG system could operate on switches owned by Scott and Madison counties instead of procuring its own, at savings of about $1M. The two existing switches could be configured as each others' respective standby back-up. Also, it would be possible to eliminate either the Clay Ferry site belonging to Madison Count or WDKY site leased to LFUCG, as these are very close to each other and provide virtually identical coverage.

11.1 Interoperability

The fact that, after the Airport moves its operations to the EDACS system in the near future, virtually all of Lexington-Fayette County's first responders will be operating on just two basic systems means that, from the point of view of technology, providing interoperability for everyone is as simple as providing interoperability between these two systems – Police's VHF network and Fire/UK's EDACS.

The good news is that both systems are already technically capable of providing such interoperability. The bad news is that there are several related and underlying problems that make such a simple solution unsatisfactory and, in the long term, inappropriate. The two main issues are:

- Channel congestion on the Police's system; ruling out setting up a permanent interoperability patch between the two systems
- Coverage limitations of both systems

Short-term interoperability improvement can be achieved relatively easily by combination of technology refreshment and training. All of the PSAP's (PHQ, FHQ, UK, Airport) and command vehicles need to undergo an inventory of the installed equipment and the obsolete units need to be re-programmed whenever possible and replaced whenever necessary. For example, the Police command vehicle needs to have an 800 MHz trunked P25 mobile for communications with Madison County, a VHF conventional P25 mobile for Clark County and Nexedge unit(s) for communications with Jessamine, Woodford and Bourbon counties.

The existing PSAP's need to have their current set-ups checked, tested and updated as necessary to provide correctly functioning on-demand patching between the systems. The companies that currently maintain the dispatch centers need to be tasked with making sure that the consoles have proper interfaces and updated radios connected to them and that the consoles are programmed so that all dispatchers know how to patch the dissimilar systems as necessary.

Entity	Recommendation
Division of Police	Add Nexedge capability for talking to Jessamine and Woodford counties to the consoles at the PSAP. Update the radios in the command vehicle(s) (add Nexedge and P25). Add intercom connections for direct communications with FHQ, UK and Airport PSAP's
Division of Fire	Add Nexedge capability for talking to Jessamine and Woodford counties to the consoles at the PSAP. Update the radios in the command vehicle(s) (add Nexedge and P25). Add intercom connections for direct communications with PHQ, UK and Airport PSAP's
UK	Add intercom connections for direct communications with PHQ, FHQ and Airport PSAP's
Airport	Fix the existing console's patching capabilities and ensure it operates on the PD channels. Add intercom connections for direct communications with the PHQ, FHQ and UK PSAP's
DEM and DoH	Rigorous user training

School buses	None
LEXTRAN	None

It is also recommended that all radio users undergo basic training that will enable them to understand the most fundamental building blocks of the radio systems they use and, consequently, understand how the system can be used to improve interoperability. There is a dire need to provide such training in the case of relying on the short-term solutions (once the integrated county-wide trunked system is implemented, interoperability issues will require less understanding). Relying on cell phones is unacceptable as these devices cannot be expected to provide dependable communications in case of major emergency.

It should be possible to implement the short-term recommendations for less than $50K (excluding the cost of labor – the time spent by all radio users in training). Please note that this expense will not address the cost of compliance with the narrowbanding mandate. Should Police decide to move to P25 conventional operation on the existing channels, the cost may be up to several million dollars.

The approach described above will bring some quick relief, but it will not address any other serious problems observed in the course of this study (lack of coverage, congestion, low level of functionality).

The recommended solution for in-county interoperability is to move all users to a single integrated trunked digital system by 12/31/2012 providing interoperability limited only as designated by system administrators.

11.2 Coverage

For a number of reasons such as:

- Limited availability of additional VHF channels
- High risk of external interference on VHF channels
- Incompatibility with the most densely populated adjacent counties

RCC Consultants recommends that the existing VHF infrastructure will not be used as the basis for future county- or region-wide system; instead, the existing 800 MHz trunked system should be used for that purpose.

Improving coverage of the existing system is assumed to be combined with upgrading the system to non-proprietary P25 technology.

Some agencies are perfectly content with the functionality and performance of the current EDACS system and they have no compelling reason to move to P25, at least not in the short- to mid-term. These users, especially the school buses and LexTran, overwhelmingly use mobile rather than portable radios and the coverage from the existing University site might be considered to be sufficient now.
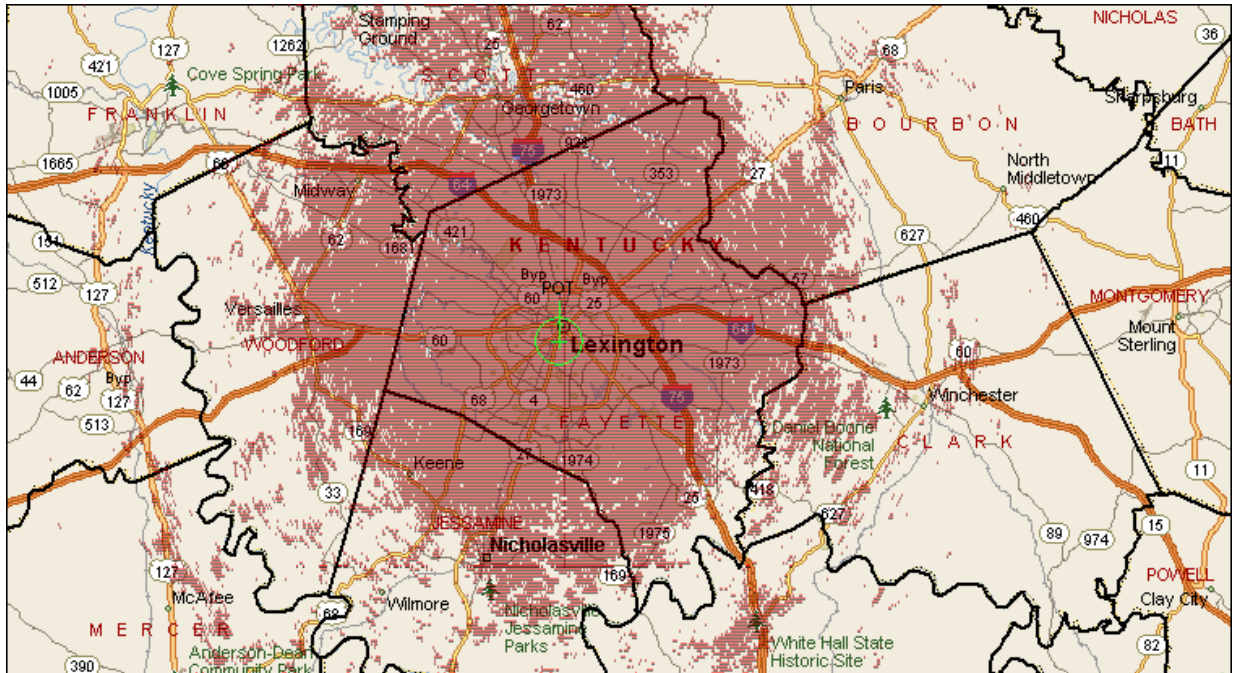
Figure 10 – Talk-in coverage from school buses for the existing POT site only.

The only area of concern in terms of geography is the southernmost tip of the county. It might be necessary to maintain some EDACS channels at the existing WDKY site to address that issue, but no new sites are needed for the entities that are content with EDACS now and intend to remain on the system.

The main concern for the future county-wide system in the context of today's EDACS coverage is performance in buildings as the outdoor portable coverage is generally sufficient.
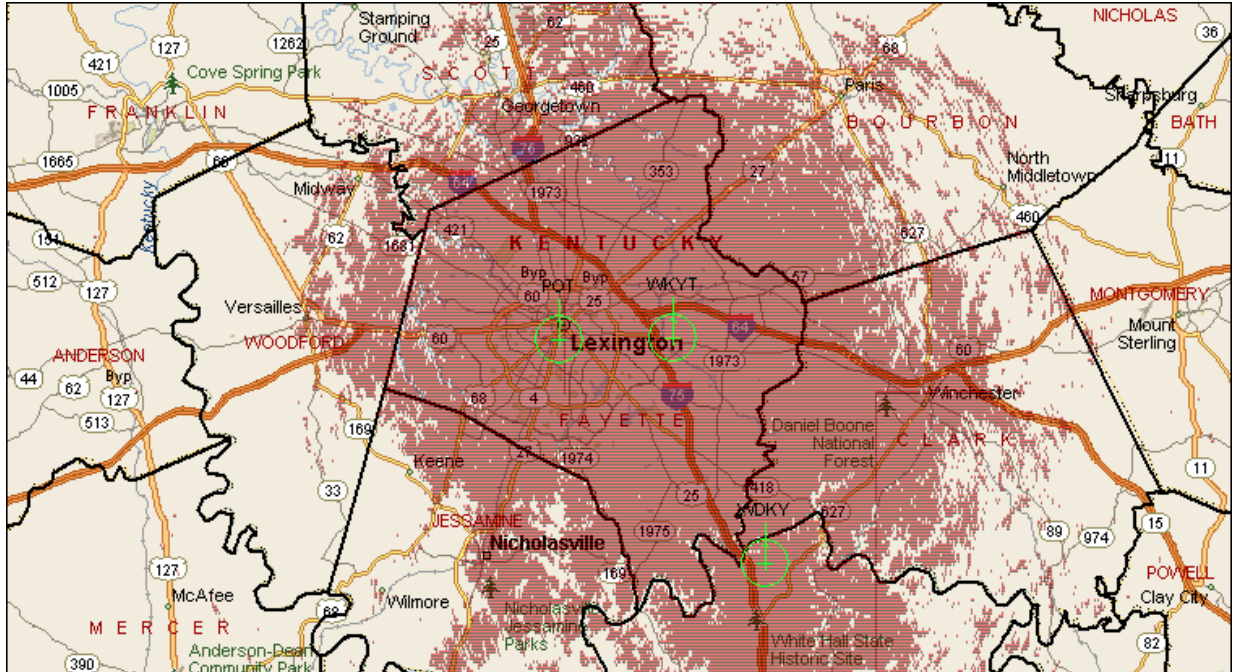
Figure 11 – <u>Talk-out portable</u> outdoor coverage – existing EDACS system.
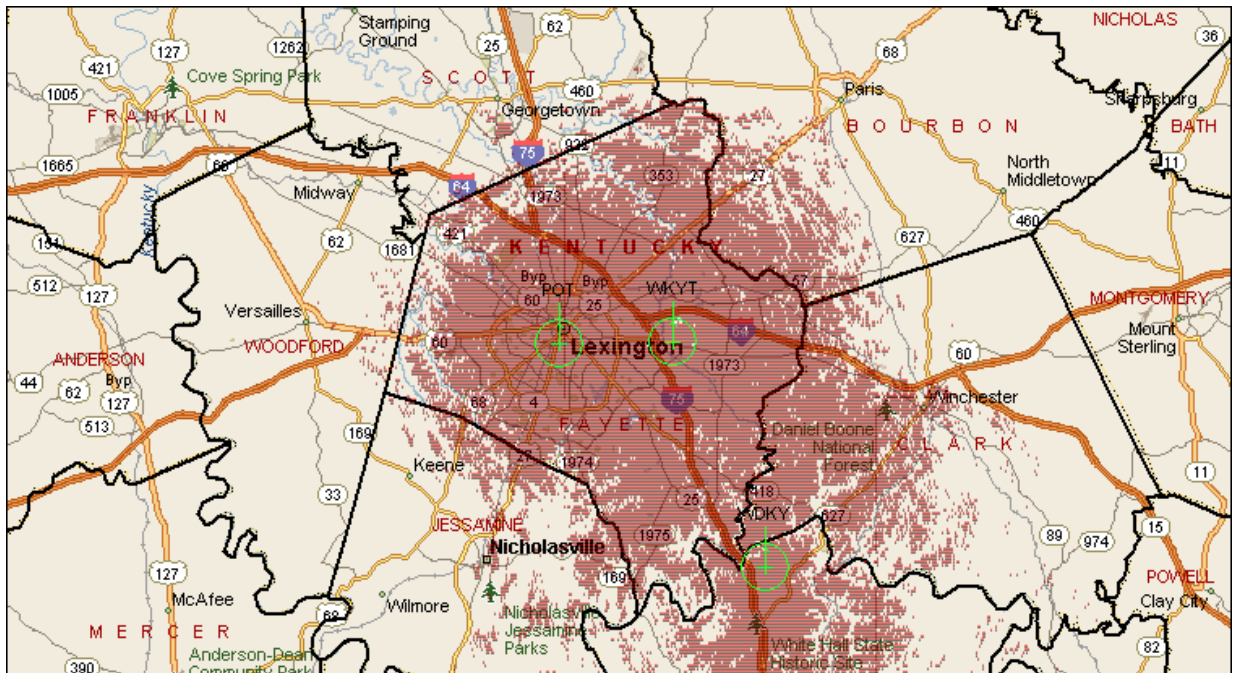
Figure 12 – <u>Talk-in portable</u> outdoor coverage – existing EDACS system.

However, as it was shown in Figures 6 and 7, the existing portable in-building coverage is dissatisfactory. In addition to the Division of Fire, Fayette County Schools Security has a need for improved portable radio coverage inside of schools. Improving the situation will require additional sites near the center of the City where the large and heavy buildings requiring strong penetration are concentrated.

Finding the exact number of additional sites will require setting up specific design parameters such as:

- Area of coverage with specific building loss
- A list of specific buildings to be covered regardless of their actual attenuation, or
- A combination of both approaches
- Desired percentage of the area and reliability of future coverage
- Usage parameters for portable radios (hip height/shoulder height, types of antennas used)
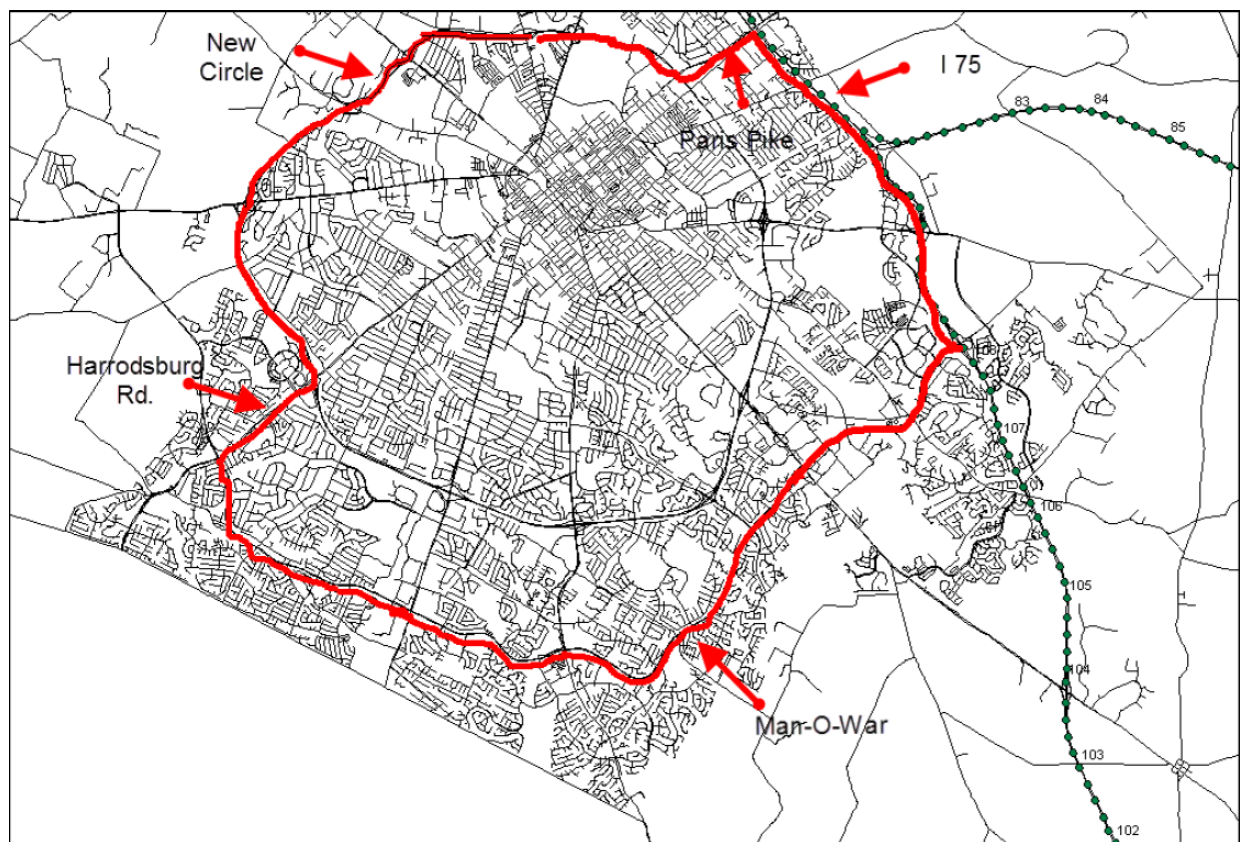
Figure 13: Division of Fire's desired area of coverage with 20 dB in-building penetration.
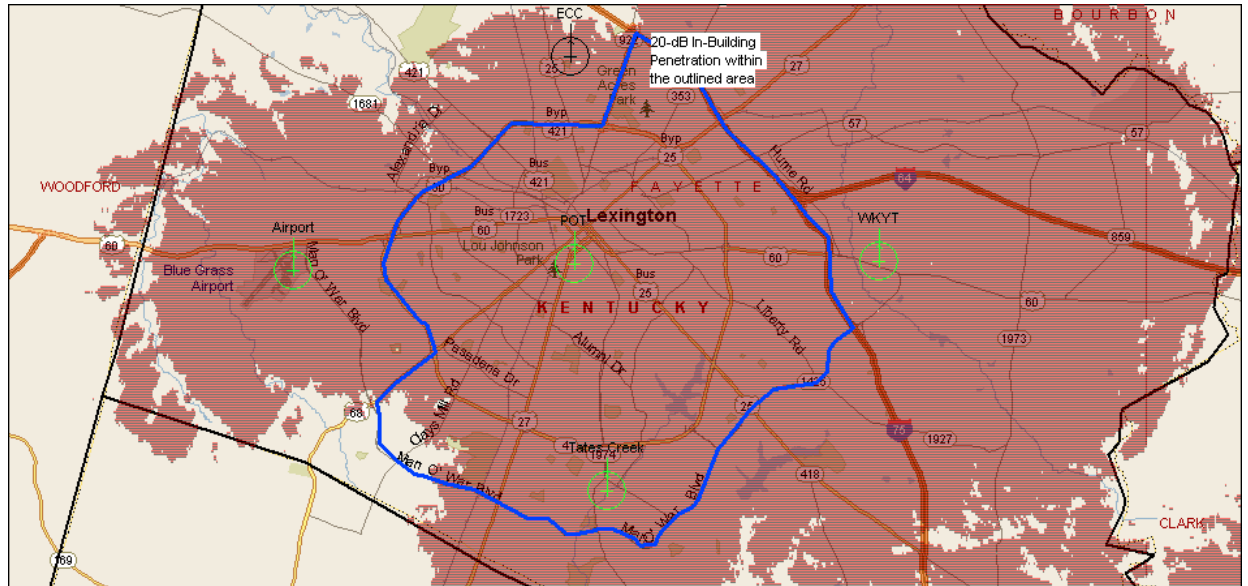
Figure 14 – <u>Talk-out portable</u> coverage for 20 dB buildings – hypothetical P25 system with 2 additional sites.
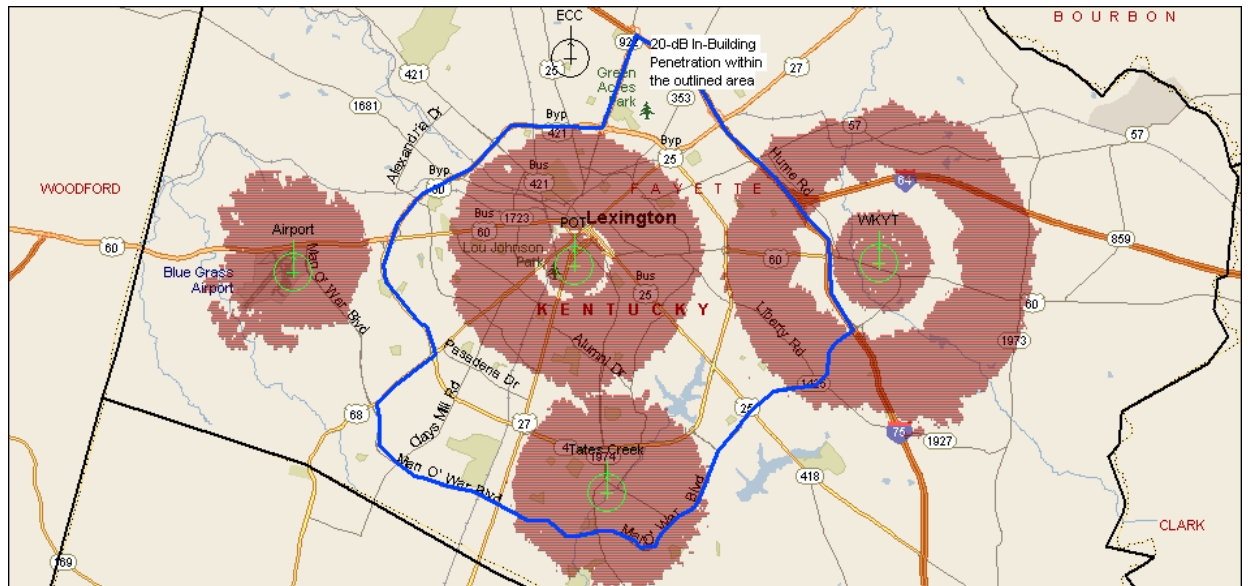
Figure 15 – <u>Talk-in portable</u> coverage for 20 dB buildings – hypothetical P25 system with 2 additional sites.

Because the great majority of buildings in Lexington are of light to medium construction, the optimal system can probably be designed with somewhat relaxed general in-building coverage requirements (12-15 dB) and with the most critical heavy buildings that must have in-building coverage identified individually. This would allow the providers to minimize the number of radio sites (towers) and add special solutions, such as in-building bi-directional amplifiers in the most critical buildings.
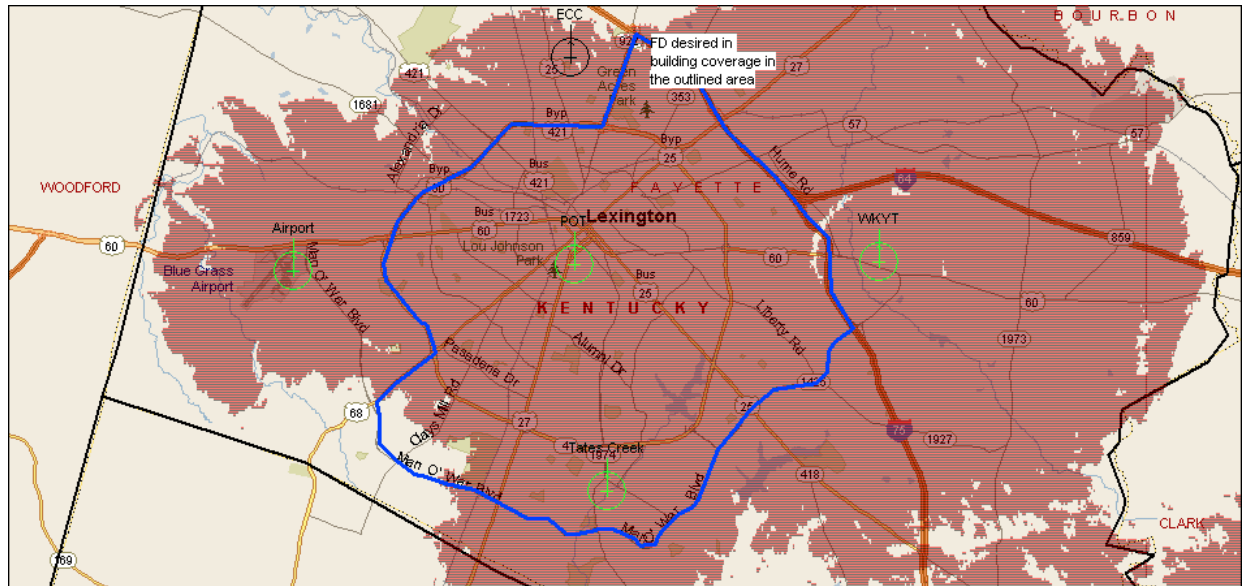
Figure 16 – <u>Talk-in portable</u> coverage for 12 dB buildings – hypothetical P25 system with 2 additional sites.

The recommended solution is to use the infrastructure of the existing trunked system as a basis of the future system:

- Replace/update the existing system to P25 (to allow roaming to Madison County now, Scott and other counties in the future), and
- Add sites as necessary to provide the in-building coverage as needed by the first responders (primarily fire-fighters, typically the most demanding users).

Determining the actual number and location of additional sites should be left to the competing equipment vendors.

11.3 Capacity

Current EDACS users are listed in the following table:

Entities	Approx Units
BERT	5
Fayette Co School Law Enforcement	39
Fayette Co Schools Transportation	310
Hospitals / DES	22
LexTran	126
LFUCG Animal Control	13
LFUCG DEEM	30

LFUCG Lexington Fire Dept	450
LFUCG Lexington Police Dept	13
LFUCG Sanitary Sewers	110
LFUCG Health Dept	14
Madison County (Fire and EMS)	95
Miscellaneous	14
Scott County (Fire and EMS)	62
UK Communications	62
UK Emergency Management	10
UK Equine	7
UK Fire Marshall	2
UK Library	23
UK Med Center Security	85
UK Parking & Transportation	87
UK Police Dept	112
UK Student Affairs	10
	1701

LFUCG Division of Police lists 1,450 radios. As two radios are assigned to each user, the number of users within Police is about 725.

The Blue Grass Airport system has about 100 radios.

The total number of users is ~2525. Using standard industry guidelines, accommodating all of these users would require approximately 24 voice channels. This could be provided with the existing number of physical channels licensed to Fire and UK (22), as the recommended technology, P25, is capable of splitting each of the physical channels into two voice channels with the P25 Phase II specifications.

The move to P25 Phase II, however, is not necessary at this time. The standard guidelines assume average usage of the radio system for each subscriber during the busiest time – the so called "busy hour". The interviews with representatives of the participating agencies showed that several additional factors should be included for calculation of the number of channels:

- The peak times for different groups of users are different. For example, one large group, the school buses, is busy in the mornings and early afternoons while most law enforcement officers are active during late afternoons and evenings
- The total number of users active during the busy hours is in some cases drastically different from the above total inventory numbers. For example, according to the Police, the highest number of radios recorded as active is about 150-200, or about 10-14% of all radios in the inventory

- Some of the users are very happy with their current systems and the plans should have accommodations for allowing them to use their current equipment. For example, the school buses are very content with EDACS and should remain on the existing system together with some other carefully selected groups. Almost 900 users may stay on EDACS, at least for some time, after the new system has been implemented.

Additional important consideration needs to be given to users that roam between jurisdictions should a region-wide system approach be implemented. In that case, some capacity needs to be reserved to accommodate the roamers from neighboring counties. Depending on the desired configuration, the number may be negligible (if the participating counties have good coverage from their own systems and seldom roam to Fayette County) or quite significant (if the participating counties rely partially or completely on coverage from Fayette County).

One of the most important factors in determining capacity of a radio system is the selected technology. Systems with conventional channels (users manually select the channels they want to use) are least efficient, therefore all larger organizations tend to move to trunking, where channels are pooled and assigned automatically according to a variety of algorithms. Among the trunked systems with multiple sites, a method for allocation of channels among the sites is a very important factor determining system's capacity and operations. The current EDACS system operates in multisite configuration, which means that the total 22 channels are split between the three existing sites (8-8-6). This configuration has some significant advantages, for example it minimizes the amount of equipment at each site, but it also has some serious drawbacks. From the point of view of system capacity, it is very inefficient. For example, a group call involving members operating in coverage areas of all three sites will use a channel (a unique set of two frequencies) at each of the sites. The most common configuration alternative to multi-site is called simulcast. In simulcast, all sites have exactly the same channels and when channel 1 is transmitting at any site, it is transmitting at all the sites. This has two effects – first of all, all channels can be installed in all sites. Second, any group call ties up only one unique set of frequencies in the entire system.

RCC recommends that LFUCG procures a system in a simulcast configuration.

Another important technology choice with a major impact on system capacity is whether to move to P25 Phase II. In short, P25 Phase I uses one physical channel (a pair of frequencies) for one voice channel. The leading suppliers of P25 systems are now offering systems compliant with P25 Phase II, which doubles the number of voice channels in a system by using TDMA (Time Division Multiple Access) technology.

RCC recommends that LFUCG gives due consideration to P25 Phase II and, as a minimum, requests all potential vendors to commit to Phase II upgradeability if Phase I technology is chosen now.

In any case, it is unlikely that additional channels would have to be acquired to accommodate all potential users of the proposed integrated system.

11.4 Functionality

In general, the radio users in Lexington-Fayette County are satisfied with the functionality of their radio equipment. This can be attributed to the fact that EDACS is a feature-rich technology, on par with or perhaps even ahead of P25 Phase I offerings.

One crucial exception is LFUCG's Division of Police. A multitude of features taken for granted by users of trunked systems all over the world and including the subscribers of the local EDACS system are not available to Lexington PD. This includes, but is not limited to:

- Emergency Alert with ID display
- Individual calls
- Telephone interconnect
- Voice encryption
- Location tracking
- Remote TX
- Stun and revive
- OTAP/OTAR
- Text messaging

RCC recommends that LFUCG procures a single integrated county-wide digital trunked P25 system that is either P25 standard Phase II compliant or guaranteed to be P25 standard Phase II upgradeable, as this will provide Police's users with access to advance functions and features making them more effective and improving their safety.

Should LexTran move onto the new P25 system, it may require additional provisions to accommodate its special needs. Transit companies in general operate in mode different from public service and public safety organizations. Modern trunked radio systems can typically be configured to accommodate such needs.

11.5 A Region-Wide Network

As mentioned above, there are many good reasons to consider a region-wide approach:

- The vicinity of the chemical stockpile in Madison County requires an exceptionally high level of coordination and interoperability and provides an opportunity for related federal funding.
- Scott and Madison counties' 800 MHz systems combined with Fire/UK's EDACS could be used as a solid base for the future potential region-wide system.

- Lexington-Fayette County is a hub for the adjacent counties. It acts as the local commercial center, providing the population of adjacent counties with entertainment, education and health care among others. Occasionally, the first responders from Fayette County are involved in major planned or unplanned incidents in the adjacent counties. Many live in those counties.
- The Department of Homeland Security (DHS) is openly promoting such region-wide initiatives and providing funding for implementation of systems that serve multiple jurisdictions

The region-wide system could be implemented in an infinite number of approaches and versions. As the minimum, RCC Consultants recommend that LFUCG builds up its own 800 MHz P25 trunked system and enters into roaming agreements with Madison County and Scott County (when upgraded from EDACS to P25). This would allow all authorized users free roaming in these three counties and their adjacent areas. The interoperability would be limited only by the parameters set up by the system administrators as all units would technically be capable of direct (talk-around, via repeaters or via network interface) communications with all other subscribers.

Taking into consideration high level of satisfaction with their current technology, Nexedge, and relative self-containment of operations in Jessamine, Bourbon and Woodford counties, the most pragmatic approach may include a hybrid solution where Scott, Fayette and Madison counties build an integrated 800 MHz P25 network and the other four counties remain using their conventional digital Nexedge systems. Any advanced modern trunked system will have provisions for interfacing external conventional networks. The requirement for such a network must be included in the future potential new system RFP.

In the most ambitious version, the region wide approach would encompass building a single integrated network, expanding from Madison County's existing system, using elements of the existing trunked infrastructure in LFU County and Scott County and providing additional sites as necessary to cover the four remaining counties in the region. Depending on the coverage requirements this may necessitate anywhere from four to ten additional sites.

12. BUDGETARY CONSIDERATIONS

12.1 Cost Estimates

12.1.1 Phase I – Incremental Improvements

The costs can be estimated upon completion of inventory of all equipment that needs to be replaced and reprogrammed in all command vehicles and gateways, but the external costs should not exceed $50K. All LFUCG units that need to communicate with the adjacent counties will need to procure radios compatible with VHF Nexedge systems used in Bourbon, Jessamine and Woodford Counties (one radio for all three), with VHF P25 system being implemented in Clark County and with 800MHz trunked P25 system for Madison County. The Nexedge radios can be purchased for less than $1K each and the P25 units currently range in price from approximately $1K to $5K, depending on brand and configuration.

In addition to the hardware cost there may be additional labor cost for verifying functionality of consoles at PHQ, FHQ, UK and the Airport by appropriate equipment vendors.

The internal costs will include coordination, creating interoperability plan and necessary training.

12.1.2 Phase II – County-Wide System

Based on recent similar projects, RCC estimates that the infrastructure for the LFUC county-wide system will cost between $5M and $15M, with most likely figure in the $10-12M range.

There are several very significant and wide-ranging factors that make more precise estimate impractical at this point:

- limitless variability in configuration and functionality
- technology choice (P25 Phase I or Phase II)
- coverage requirements (will drive the number of tower sites)
- potential development of tower sites on currently vacant locations
- availability of backbone data network connecting all sites
- level of participation of LFUCG personnel in project management
- vendor selection

Similarly, RCC estimates that the subscriber equipment will cost between $3.7M and $8.7M. Even such a wide range of potential costs requires some explanation:
- The numbers were derived from recent proposals by three different subscriber equipment providers; they are not based on list prices and the discounts offered to LFUCG will vary

- The numbers were calculated based on the equipment count and coarse split of different types of radios provided by LFUCG
- The numbers do not include subscriber equipment that is not responsibility of LFUCG (most of the UK users) or the agencies that are initially expected to stay on the current system (LexTran and Fayette Co Schools)
- The vendors use different and dissimilar discounting methods and levels, making simple comparisons very hard
- Price levels are changing from project to project and over time
- There is a wide range of features and options that must be closely defined for actual quotes. Some of the major ones are:
  - technology choice (P25 Phase I or Phase II)
  - encryption
  - remote programming and encryption key change (OTAP and OTAR, Over The Air Programming and Over the Air Rekeying)
  - single band versus multi-band operation
  - compatibility with other radio protocols
  - environmental requirements (submersibility, hazardous atmosphere)
  - choice of accessories (microphones, covert configuration, chargers) and installation options

Based on the above, the total cost to the LFUCG for the new infrastructure and subscriber equipment should fall between $9M and $24M, with the lowest number reflecting severe limitations in functionality and performance and the highest number corresponding to leading vendors offering their top of the line equipment.

It would be reasonable to set the budget to $20M and to structure the bidding process so that a substantially lower cost, such as $15M, could be achieved.

12.1.3 Phase III – Regional Network

Based on recent similar projects, RCC estimates that the incremental infrastructure for the region-wide system will cost between $5M and $25M, with most likely figure also in the $10-12M range.

The same considerations apply for Phase III as for Phase II. In addition to the points listed above, the crucial factor will be which of the counties participate in the project. On the minimum side, should the project be limited to Scott, LFUC and Madison counties, the total cost may be lower than that quoted above as it would include upgrading Scott County's system to P25 and providing the necessary connections between the three systems. On the other end of the range, with full participation of all seven counties and strict coverage requirements, the region-wide system might include a high number of additional sites, several of them likely to be new tower installations, new backbone network and the maximum price might exceed the upper limit quoted above.

For the purpose of this project only the counties adjacent to Lexington-Fayette Urban County have been considered. LFUCG might, however, consider also an even wider approach based on Blue Grass Emergency Response Team (BERT).

The Bluegrass Emergency Response Team is a group of emergency responders who have pooled resources from eleven counties to become a major emergency response asset for the Bluegrass Region in case of a large-scale emergency. The project includes: Bourbon County, City of Berea, City of Lancaster, City of Nicholasville, City of Paris, City of Richmond, City of Stanton, City of Versailles, City of Winchester, Clark County, Estill County, Lexington-Fayette Urban County Government, Garrard County, Harrison County, Jessamine County, Madison County, Nicholas County, Powell County and Woodford County.

12.2   Grant Considerations

By now it is well known and publicized that Federal agencies in charge of public safety communications grants strongly favor multi-agency, multi-jurisdiction projects that enhance interoperability. It is therefore very important to include the necessary provisions and language in all relevant actions already in Phase II of the project, to maximize the grant opportunities and to make the future expansion as easy and affordable as possible.

13. ADDITIONAL COMMENTS

For the purpose of this study, RCC Consultants did not consider proprietary technologies, despite some attractive features available to buyers of such systems. It was assumed that the combination of Federal and State mandates, restrictions on potentially availability of Federal grants and, above all, implementation of the technology in the singular most critical area in the region (chemical stockpiles in the Madison County) all point to P25 as the obvious choice.

Other technologies available in the market place and being used in the region may seem worthy of consideration, but they fail under quick scrutiny. Specifically, EDACS is a technology that can meet all of currently listed requirements, but the fact that the vendor is not investing in its development anymore and the user equipment prices are two factors sufficient to disqualify it from further considerations, despite many of its radios being compatible with P25. It needs, however, be noted that the current EDACS platform is upgradeable to P25.

Nexedge, currently in use in Jessamine and Woodford counties, is a technology receiving some rave reviews from its users. It is, however, also proprietary (Kenwood being the sole provider) and it has limited references among wide area public safety grade systems. It is not compatible/interoperable with P25 at this time. Should the LFUCG decide to pursue a county-wide rather than region-wide approach, Kenwood should, however, be invited to bid provided the company can furnish dual mode, P25 compatible radios.

APPENDIX A

14. FINDINGS FROM INTERVIEWS

The following section contains notes from individual interviews conducted with representatives of the agencies in LFUC and in adjacent counties.

14.1   List of the interviews

Agency	Interviewee(s)	Date of the interview
Division of Police	Commander Alan Martin (Also Jack Wilshire, 859-576-3753 and Dennis Todd)	12/14/2010
Division of Fire	Major Paul See, Lexington Division of Fire and Emergency Services Communications/Information Technology, 219 East Third Street, Lexington, KY 40508, 859-231-5674	11/29/2010
UK	Chief Joe Monroe – UKPD: 859.257.5770 ext. 241	12/14/2010
School District	John Kiser @ 381-4532, Director of Maintenance	12/10/2010
DEM/DoH	Pat Dugger – DEM Director and Steve Jackson: 859.258.3784; Karen Early, Public Health Preparedness Coordinator, 859-619-9832	12/06/2010 (DEM) and 12/07/2010 (DoH)
LexTran	Rocky Burke, General Manager; Carlos Rowland, Maintenance Director; Tracy Sewell, Dir of Operations; Jared Forte, Assistant General Manager (859) 255-7756	01/06/2011
Blue Grass Airport	Chief Scott Lanter – Airport Department of Public Safety: 859.425.3101	12/15/2010
Sheriff's Office	Kathy Witt, Fayette County Sheriff, 150 N Limestone Ste 265	N/A

Madison County	Carlis Richards, EMA Director, 560 South Keeneland Drive, Richmond, KY 40475, 859-624-4787	12/20/2010 (via phone)
Jessamine County	Tammy Durham, Deputy Director, Jessamine Co 911, Jessamine County Public Safety Center 101 S 2nd St, Suite B, Nicholasville, KY, 859/887-2987	12/13/2010
Woodford County	Steve Tracy, Communications Director, STracy@VPD.Versaillesky.com	12/15/2010
Scott County	Robert Swanigan, Administrative Lieutenant, IT Systems Manager, 1 Quality Dr, Ste C, Georgetown, KY 40324; 502-863-7826	12/03/2010
Bourbon County	Shawn Jacobs, E-911 Director, Terry Pollitt, Safety Officer,525 High Street, Ste 007, Paris, KY 40361; 859-987-2105	01/05/2011
Clark County	Rhonda Rogers, Communications Supervisor, Winchester Police Department, P.O. Box 40, Winchester, KY 40391	01/24/2011

14.2 Current system Users in Lexington-Fayette County

14.2.1 LFUCG Division of Police

Lexington's Division of Police conducts all of its business on a conventional VHF system with primary transmitters situated at 5 different locations and satellite receivers at 4 additional sites. Three channels are serving three primary geographical sectors. There are 1450 radios using the system, up to 200 more subscribers may be added over the next 4 years.

Both portable radios and mobiles are assigned to individuals.

The busiest time is Thursday through Saturday, 4pm through 4 am. At any given time, there may be up to 150 active users.

Police are dispatched by the Division of E911 from the PSAP located with the Police Headquarters (PHQ) at East Main Street in Lexington. The PSAP is equipped with 10 Gold Elite Motorola consoles. One dispatch operator is assigned to each of the three basic geographic sectors, the other positions are used as needed. At least one supervisor is always on duty.

In terms of interoperability, Police's everyday needs are very limited; this, however, was attributed by the interviewees to the limited understanding of the capabilities of current technologies. Infrequently, the Division of Police will work with Division of Fire and Emergency Services, typically limited to scene of accident (mostly when Fire personnel are on scene prior to Police).

According to Jack Wilshire, the following channels / radios can be accessed by the police dispatch center:

- Lexington Streets and Roads Dept. (VHF)
- National Weather Service (Monitor only).
- EAS (Emergency Alert System). Generates community alert messages via WUKY (University of Kentucky) radio station. This is connected via dedicated telephone line.
- Fayette County outdoor emergency siren system. (VHF).
- Lexington Fire & Emergency Services. Two (2) 800 MHz radios are located on the roof of Police HQ that have been assigned talk groups on the current EDAC system. One talk group is used to call into or out of the E911 Center. The second is used to patch the 800 MHz system to the Police VHF system via software.
- A two meter amateur radio control station is available, but only activated in times of declared emergency. This capability is utilized by the local ARES (Amateur Radio Emergency Services).
- A tabletop control console is available to connect to Frankfort as part of a statewide emergency system. This console is connected via dedicated telephone line.
- An 800 MHz Harris control station is used to talk to the Madison County CSEPP system.
- The dispatch positions can send 911 call and other CAD data through the Lexington Police / State of KY 800 MHz dedicated MDT system.
- The console system is interfaced to WWVB (National Bureau of Standards in Boulder Colorado) to synchronize accurate time. This connection is via a LF radio receiver located on the roof of Police HQ.
- An 800 MHz telemetry repeater is located on the roof of Police HQ that monitors numerous pumping stations for the Lexington sanitation dept. The pumping telemetry is monitored at a facility located in the Fleet Services area off of Old Frankfort Pike. This repeater is not connected to the E911 dispatch system.

A 300 KW Cummins / Kholer genset is also housed at this location.
The genset feeds a 50 KW Liebert UPS that is dedicated to the E911 Center.

Police is in daily contact with Madison CO and KSP, for testing purposes.

Police cannot talk to Jessamine Co./Nicholasville anymore as they switched to Nexedge.

Police would like to be able to have easy interoperability with all local and adjacent Public Safety agencies including Fayette Co. Sheriff (currently on conventional 800 MHz channel).

Interoperability with adjacent entities is provided, in theory, by the mobile command and control post. Unfortunately, the vehicle is equipped with some obsolete equipment and has no direct communications with Nexedge, P25, or Scott County's EDACS.

All subs are programmed with a couple of interoperability channels – "Intercity" and "KLEEN" (Kentucky Law Enforcement Emergency Network, KSP maintained and dispatched).

Police provides communications training to all new recruits and participates in annual disaster assessment exercises (simulated crash at the airport, etc).

Overall interoperability capabilities were rated poor, with death of Lt. Brenda Cowan cited as tragic evidence.

High level of direct interoperability is needed first at the higher levels of organizational hierarchy.

Patching capability is available but not used by dispatch operators.

Madison Co P25 radio is available at the PSAP for direct communications with that county.

Current project notwithstanding, Police is aware of the narrowbanding requirements and is considering upgrading its base stations to P25 (they are not narrowbandable now).

The channels are congested, especially during major events such as UK football games. The system's capacity is also limited by the number of dispatchers (one per sector).

Channel interference problems have been experienced and some channels have been moved.

Coverage issues: NE section of the county by the river. Handhelds – NW talkout issues; in general, all outlying areas.

Encryption is used only by the Emergency Response ("SWAT") team.

In general, many functions typically not available in conventional analog systems are desired:

- Emergency Alert with ID display
- Individual calls
- Telephone interconnect
- Voice encryption
- Location tracking
- Remote TX
- Stun and revive
- OTAP/OTAR
- Text messaging

Interested in LTE.

Explained the reluctance to participate in earlier efforts with the manner in which Police was involved (too little, too late)

14.2.2 LFUCG Division of Fire and Emergency Services

Lexington's Division of Fire is using an 800 MHz EDACS system, co-licensed with the University of Kentucky. 800 MHz channels are used at the fire scenes and two VHF Mutual Aid channels are used for interoperability.

Small portion of the radios currently in use (32 portables and 12 mobiles) are P25 capable.

Majority of radios are more than 10 years old. Most of the radios are assigned to fire trucks. The Division of Fire is looking at some multiband radios for interoperability needs.

Minimum staffing for a shift is 142; during multiple emergencies up to 200 radios can be expected to be active.

Fire has 5 C3Maestro consoles; the switch has some conventional interface capability (3 800 MHz radios, 1 UHF and 1 VHF unit are connected). In addition, Fire owns an ACU 1000 unit equipped with 4 800 MHZ, 2 UHF and 4 VHF radios that can be patched through consoles. Another ACU1000 is installed in a Mobile Command Post, which is equipped with 15 radios, including 4 800 MHz workstations, driver's radio and 10 additional units: 4 800 MHZ, 2 UHF and 4 VHF. The interoperability radios used by Fire are programmed with neighboring counties' frequencies and regularly maintained.

HazMat and Heavy Rescue trucks have capability to communicate with outside counties that operate on analog VHF channels.

The Division of Fire emphasizes the importance of dedicated and well trained fire dispatchers, as they require different set of skills from law enforcement personnel. The fact that dispatchers for police and fire are not co-located is an issue; a lot of communications between them take place using phone lines.

The agencies contacted by the Division of Fire most often are Police and DEM. In addition, Fire needs to be able to talk to Streets and Roads, Sewers/Water. Building Inspection – all of these use VHF frequencies.

The most important external entity is Madison County, followed by Scott County (Fire Departments in Scott County use VHF rather than EDACS).

Typically the Division's fire trucks travel outside the County to help the neighbors, not the other way round.

There is no regular radio interoperability training provided, but some was conducted for WEG. Fire does not have enough VHF radios, but a grant is pending and will be used to purchase some multi-band units.

Ability to communicate directly with the Police is highly desired. No patching capabilities at the Fire HQ. Police can patch with Fire. Never pursued a common talk (permanent patch) path between Fire and Police.

Individual companies cannot communicate with agencies outside the County, but the Command vehicle, supervisors, ambulances and rescue truck have the capability.

Fire is planning to buy additional 800 MHz portables to replace the aging units. They will be P25 capable. The expected grant will enable a separate purchase of 10-12 multi-band units for command vehicles.

No system-wide changes are currently planned. The desired changes include additional sites to improve coverage, upgrade to P25, network switch to provide better interoperability, adding Blue Grass Airport to the network.

The desired coverage includes all counties members of BERT (Blue Grass Emergency Response Team). It is currently solved by carrying VHF radios. Portable coverage is essential in buildings.

Current coverage is not satisfactory, especially in buildings. The areas of concern are Beaumont Center, Russell Cave Road, Newton Pike, NE corner of the county, Avon Bluegrass Station and all areas alongside the river.

Desired functions/improvements include mobile repeaters, voice encryption for some personnel, in-building coverage.

Congestion is in-frequent and there are no complaints, but it does happen on some school days. Persistence interference has been blamed on Nextel.

No dispatch back-up. Sites are connected by microwave and fiber, but there is no automatic switchover should Fire HQ fail.

Concerned about the age of equipment and its maintenance.

Fire has some concerns about the digital mode of operations and is conducting some testing in P25 conventional mode.

In building coverage will be required inside the New Circle Road, alongside Man o War Blvd and Harrodsburg Rd.

Among the desired functionality/other concerns:

- Switching from trunked to conventional mode (must be simple, preferably just with turning a knob)
- Maintaining dedicated fire dispatch personnel
- Problems with durability of lapelle microphones

14.2.3 UK

UK's EDACS system, initially a single site, was implemented in 1997, then joined by Fire and expanded/upgraded with additional sites and channels.

Physical Plant and Athletics use separate radio systems (details unknown).

Current system fully meets the functional needs of all of the UK's users. However, UK has facilities in counties adjacent to Fayette County and radio coverage extending to these facilities would be desirable.

No significant increase in the number of users is planned, but there is potential growth of up to 100 additional radios.

The busiest times are 7:00 through 8:30 am and 8:30 pm through 2:00 am, Monday mornings and Thu-Sat nights.

The UK dispatch is equipped with two C3 Maestro consoles. Additionally, two desktop stations are installed at the headquarters at 305 Euclid Avenue; one 800 MHz unit for communications with Fayette Sheriff, the other one, VHF, for communications with Lexington Police. The UK PD can thus communicate with Lexington Police, Airport, Fayette Co Sheriff, KSP and, of course, all users of the EDACS system. Most interoperable activities take place during UK football games and all interoperability through the current EDACS switch.

There is no interoperability with the adjacent counties. The most important would be Woodford, Scott and Jessamine.

Channel congestion is an unusual occurrence. Channel interference – Nextel is blamed for some occurrences.

Approximately 25% of the radios are more than 7 years old.

Given good coverage from the WKYT site, the system has strong backup capabilities.

UK plans to purchase a number of vehicular chargers.

Encryption or data communications are not in use.

Chief Monroe would like to see everyone on the same system in case of any major emergency. Virginia Tech shooting was cited.

14.2.4 Fayette County Public School District

Using Fire/UK's EDACS system for a $50 per radio per year fee.

Two dispatch terminals.

Happy with coverage. Switching to talk-around when multiple buses travel outside the County.

Very satisfied with the system. Not happy with the latest mobile – wants one self-contained box (speaker, radio, control unit), "very simple radio needed".

The busy times are 6-9 am and 2-5 pm.

Radios are equipped with a "disaster channel" for interoperability in emergency; never need to talk directly to the Division of Police (via dispatch or Schools' own Law Enforcement only). No need for additional interoperability, in or out of the County.

1/3 of the units are more than 10 years old, but all are still working well.

Interested in new technologies for student tracking.

No plans to increase the number of radios, although have two divisions relying entirely on cell phones (Operations – 40 units, Maintenance – 60 units).

In good financial shape, just put cameras on the buses.

14.2.5 DEM and DoH

DOH owns 60 VHF portables on one of Police frequencies (the coordinator believes Police are using DoH's channel); simplex only, no repeater. The radios are used 5 days a year and for exercise purposes only. DOH relies on cell phones on daily basis. No interoperability is perceived as needed, the agency is using liaisons instead of technology. One of the main problems is "people do not know how to use the radios". It would be desirable to have direct radio contact with Fire, Police, DEM, Hospitals, Red Cross. Would like to see smaller radios.

DEM is using both Police and Fire systems, have their own small radio dispatch facility. Use Police's frequency for siren activation (27 units). Have about 30 Fire radios which are deployed to shelters, etc., in case of emergency. Also about 12 Police radios. The agency is a part of the chemical stockpile program and has some additional radios – including KSP, Madison County, National Guard. Relying on cell phones day to day.

Seriously concerned about poor coverage of existing systems inside the schools.

Interoperability – direct with Police and Fire. Through Fire with utilities, Red Cross, Schools, UK, LexTran. Also using amateur radio and Civil Air Patrol. Talking to other counties through KY National Guard.

Unhappy about having to carry multiple radios, scanning, having to understand multiple channels and groups.

The primary channel – Police – is often congested. Concerned about congestion and interference on the Police channels used for siren activation.

No back-up. None for sirens, no way to activate sirens if the Police channel fails.

Would like to see a consolidated system with a simplified multiple alert activation methodology.

14.2.6 LexTran

LexTran operates on Lexington's 800 MHz EDACS system.

The RF coverage is fully satisfactory today, there are no known dead spots. It needs to be noted that LexTran currently operates primarily within the City and may venture in the future to extend the operations, possibly even outside the LFUC, to Frankfort, Georgetown, Winchester, Versailles and other locations within the region.

There are 78 buses equipped with radios; in addition there are 18 non-revenue vehicles and 17 portables.

No significant growth is planned – the internal plans assume 4% per annum increase.

The busy time for LexTran is 6:00-9:00 am and 3:00-6:00 pm, weekdays only. Large events, such as UK games do not have significant impact on the radio traffic generated by LexTran users.

The agency is self-dispatched, using three desktop stations at its headquarters. There is no back-up other than portable radios.

LexTran is self-contained. There is no perceived need to talk to anyone else on the radio system as off-duty metro police hired as security already use LexTran radios. Normal mode of asking for assistance is driver-dispatch via radio then dispatch-fire or dispatch-police via phone.

The drivers are expected to limit any conversations and be focused on driving. It might be useful to enable supervisors to talk directly to other agencies.

LexTran is using Police scanners to gather information about traffic disruptions.

LexTran's management complained about congestion and interference on the system; with some additional questions it was apparent that these terms are used in different sense than usually and that LexTran's problems are caused by how the system is set-up and utilized rather than by any inherent limitations of the technology. Specifically, LexTran, like most other transit companies, likes to have dedicated "channels", meaning that the drivers should not be able to interrupt any conversations, which is the opposite of the premise of public safety group call. While detailed analysis of LexTran's internal needs is outside the scope of this project, LexTran's needs, such as ability to prioritize its own calls and use individual rather than group calls can very likely be met with proper programming of the EDACS radios used by the company.

LexTran is in the process of replacing some old radios. The new radios M7300 will be capable of P25 operation.

LexTran received $5M from the Stimulus Package and is in the process of implementing suggestions provided by Avail Technologies. This will include some new radios and other facilities that are expected to remedy most of the current concerns.

14.2.7 Blue Grass Airport

The Airport operates on four conventional analog UHF channels with the repeaters on premises. In addition, TSA operates its own system (details unknown) and the airlines are using services of Orange Business Services.

The UHF system has been provided by and is maintained by RCS Communications.

For interoperability purposes, the Airport is keen on joining the Fire/UK system. The 2006 crash was cited.

While the coverage at the airport is generally good (with the exception of the end of the runway – Parkers Mill Road), duties of the officers and employees take them to Lexington and other areas and therefore the airport-only coverage is not satisfactory.

The overall quantity of the radios is expected to remain unchanged, although the mix will tilt towards the portables.

The traffic load remains steady all days between 9 am and 8 pm. There are typically 25-30 users on active duty at that time.

The airport is self-dispatch, with its own, single position MIPS5000 dispatch console. Patching is available, but the delays make patching unusable (must be resolved with the supplier!). Patching is thus in theory available with PHQ, FHQ,, UK Police, Versailles and Woodford County Police and Fire, and with KSP.

The two most important agencies for interoperability are Lexington Fire and Police, but it is desirable for the airport to be able to contact all of the Lexington-Fayette County's agencies.

Channel congestion is not experienced at the airport. Some interference was occasionally heard from Ohio, but the problem has been fixed now.

The facilities do not have adequate back-up now – all repeaters are at a single location and all of dispatch capabilities are at a single location.

The airport has no plans to upgrade its own system; switching to the Fire's system is top priority and coverage testing is being performed with one of Fire's portables, so far with very promising results (as good as the UHF system at the Airport).

In terms of desired functionality, the radios need to be tough and geared towards typical Division of Fire's needs (for example, compatible with fire apparatus). While there is no need for data communications or digital communications, tracking of personnel's location is desired.

Cost is not a top consideration. Planning to buy Fire-compatible radios in the next couple of months.

14.3   Adjacent Counties

14.3.1 Madison County

Madison County operates on a new Harris P25 Phase I digital trunked 800 MHz system. While some of the agencies may still maintain and occasionally use their own conventional VHF or UHF systems, all day to day communications takes place on the new network.

The system has been designed to provide maximum coverage within the County. It provides good coverage in the south part of Fayette County and some fragments of other neighboring counties. Some of the outlaying areas are of concern, for example Red Lick and Paint Lick.

The system has capacity to accommodate 30% growth in the number of users, but there are no current plans to increase the number of subscribers.

The busiest time for Madison County is weekday mornings, when EMS is transferring patients.

The County utilizes one centralized PSAP for all participating agencies, although EKU, with its 16,000 students uses its own limited 911 call center.

By the nature of its P25 system, all agencies within the County are inherently interoperable.

In terms of interoperability with Lexington-Fayette County:

- Madison County's mobiles are programmed to operate on Lexington's EDACS system
- Lexington's agencies (Police, Fire, DEM) have Madison County's radios
- A VHF unit programmed with Lexington Police's frequencies will be connected to Madison County's dispatch

Madison County's EMS is making daily runs to Fayette County's Hospitals. Communications via EDACS system in Fayette County.

Madison County would like to be able to have easy access to Fayette County's Fire, Police, EMS, DEM and hospitals. Other agencies less important.

The recently installed Harris switch has the capability to connect to a variety of conventional devices to provide interoperability with other counties.

The biggest challenge for in-county interoperability is training and proper group set-up.

Description	Quantity
Mobiles	600
Portables	900

14.3.2 Jessamine County

Most of Jessamine County's public safety VHF and UHF radio systems have transferred or will transfer to Nexedge in the next 3-4 months; this includes Nicholasville and Wilmore.

A single PSAP ties all of the channels together using CML's Comstar system.

There are coverage problems in the SE, alongside the river. Also, some problems persist in the SW corner. Rugged terrain. Positive comments about coverage improving after moving to Nexedge.

No significant changes planned in the overall quantity of subscriber units.

The most busy time is Thursdays and Saturdays 4-9 pm.

Interoperability is achieved through consoles, but suffering from poor quality of audio and feedback.

Occasionally, LF users get on Jessamine County's frequencies and talk directly to the local agencies. The reverse does not really happen. Interoperability is important with Woodford County as the counties are each other's back-up on 911.

In general, there is no need for interoperability with Lexington-Fayette County, although the interviewees volunteered that that opinion might not be shared by the Fire Chiefs.

Congestion is not a problem, although the Nicholasville Police channel gets busy sometimes.

Channel interference is an infrequent occurrence; it happens sometimes in cold weather.

The EOC can serve as a back-up for the main dispatch as it is capable of operating RF equipment, albeit a bit outdated.

The County is planning to replace the radio controller in a year or two.

Police Departments have access to mobile data using the State's system.

Despite investing in Nexedge, the County would be interested in moving to P25 for interoperability sake if funding was to be made available. The County is only 173 sq miles and legible for funding through the CSEP program.

Description	Quantity
Total	~250

14.3.3 Woodford County

Woodford County is using 12.5KHz Nexedge now on a number of VHF channels used by the local Police and Fire Departments. A variety of locations and towers are in use.

Some agencies are still using analog VHF channels, with Police using one (for interoperability purposes) that has already been narrowbanded.

Public works use a mix of UHF and VHF channels.

Coverage of the systems is generally good, although Police complains about portable coverage in particular locations on particular channels. This will be addressed by upgrading the Nexedge system to "Wide Area Network" with some automatic roaming and channel scanning. Moving to Nexedge brought significant improvement in coverage.

There are no plans to significantly change the total number of subscribers on the systems.

The busy time for Woodford County systems starts at 4:00 pm on weekdays.

The PSAP is equipped with VHF and UHF radios that are used to communicate with all neighboring counties. The County has received grants to equip the PSAP with three new Telex consoles.

Woodford County public safety users do not communicate with Lexington-Fayette County frequently. When they do, it is typically with the Lexington Police or Airport. Most of the communications with the Police occurs via phone.

Woodford County would like to be able to talk to the Lexington Division of Fire as well (may be possible with the new consoles). In the past Mutual Aid channels were used to talk to Lexington Fire.

All radios in Woodford County are programmed for interoperability in accordance with the statewide interoperability plan.

The County may have a grant for a gateway for Emergency Management. This was spurred by failure to communicate in 2009 when a federal fugitive was hiding in the Woodford County for several days and an external equipment had to be brought in to help in interoperability, especially with Federal Marshalls and Lexington Police.

There are no issues with in-county interoperability. Nexedge radios are backward compatible with analog modulation. Most interoperable calls made via dispatch.

Woodford public safety does not experience channel congestion, as the County is licensed on sufficient number of VHF frequencies (more than Lexington!).

Channel interference is an issue, attributed primarily to poor frequency coordination. Problems with Elizabethtown (Versailles had to quit using the affected channel), problems with another system during the ice storm a couple of years ago.

The system has sufficient resilience – using multiple TX towers and with well equipped EOC.

The systems seems to be continuously updated – new consoles, new furniture at the PSAP, moving current PSAP consoles to EOC to replace the 21 years old Centracom.

In the long run, the County would like to move to P25 for interoperability's sake if grant money is available. Kenwood claims that current Nexedge radios (portables and mobiles) can be flash-upgraded to P25.

Description	Quantity
Mobiles	~80
Portables	~80

14.3.4 Scott County

Scott County's 800 MHz EDACS system started as Georgetown's project with single site. Sadieville and Stomping Ground sites were added later – 3 x 5 channels. Fire – both City and County – not happy with in-building coverage, stayed on VHF and bought Nexedge.

The desired coverage is county limits. Actual coverage exceeds County limits. Mobiles usable past Frankfort and all the way to the south edge of Fayette County, Paris, portables operational in downtown Lexington. There are some areas of concern – northern and western edges of the County, some spots at the east edge of Georgetown.

There are no plans to increase the number of users.

Peak usage time is 2:00 pm through 10:00 pm, about 30 active users.

The agencies are self-dispatched from single location, 550 Bourbon Street.

Interoperability within the County is good; it is achieved via 800 MHz to VHF patch. Supervisors have Lexington radio frequencies in their cars.

There is also a common group with Toyota plant which maintains its own EDACS system.

Scott County users interoperate rarely with other entities; most often with Lexington Police or Fayette Co Sheriff. Would like to be able to talk to Lexington officers, many of whom live in Scott County.

No channel congestion problems.

The system is 14 years old and many subscriber units are past their prime.

The three sites are connected with 4.9GHz microwave ring. All sites and the dispatch center have back-up generators.

Plans and wishes:

- Upgrading to P25 (getting quotes from Harris and Motorola, eager to get additional quotes)
- Open to working with Lexington-Fayette on a regional system
- After rebanding, the system is using new MastrV base stations and brand new switch capable of P25 operation

Description	Quantity
Mobiles	195
Portables	265
Note: the above numbers include 130	

units owned, but not used by FD's	

14.3.5 Bourbon County

Law enforcement agencies in Bourbon County operate on Kenwood's Nexedge digital repeater. The license includes 4 channels. The main repeater is on the water tower in Paris, with back-up repeater on water tower in North Middletown.

Fire services/EMS operate on Motorola's analog repeaters, with one repeater in Paris and another on water tower in Middletown.

Nexedge's coverage is considered to be very good, Fire Department reports no coverage problems in the County.

Public Works uses its own repeater.

The busy time is weekdays 4:00-8:00 pm. There is one E911 dispatch center at 525 High Street in Paris.

There are two options for interoperability with adjacent entities – using State of KY interoperability frequencies or using ACU-1000 with Mobile Command Vehicles.

There is no perceived need to interoperate with Lexington-Fayette County. Lexington does not want anyone else using its frequencies. When necessary, Lexington officers use Bourbon County's frequencies – hot pursuits, K-9 units, etc. The County is self-contained and lack of closer interoperability with Lexington is not perceived as a problem.

In terms of intra-county interoperability, the Nexedge radios are capable of operating in analog mode. The PSAP console has patching capability but it is never used (considered impractical as it ties up two channels).

Very few incidents of channel congestion have been recalled - the ice storm of 2009 or some large accidents.

There are no complaints of any interference since law enforcement changed to digital mode of operations.

The most serious concern is age of equipment on the Fire side; the County is scrambling to replace it. Narrowbanding brings hope for a grant that will enable the Fire Department to move to Nexedge as well.

Law enforcement channel is considered to have adequate back-up with the site in North Middletown providing similar coverage print. Fire Department lack proper back-up. In terms of back up for dispatch, it is provided by Mobile Command Post.

Description	Quantity
Law Enforcement	151
Fire Department	190

14.3.6 Clark County

Clark County uses VHF frequencies, conventional channels with some satellite receivers connected via a microwave system. The repeaters are spread geographically. The area of desired coverage is the County. There are some problem areas towards the borders of the County (except the West).

No significant growth is expected in the number of units.

The busy time is workdays 1:00 pm through midnight.

All first responder agencies are dispatched by Police at 16 S. Maple.

There are multiple means of interoperating with Lexington-Fayette:

- CSEP radio
- Direct – the officers have the necessary frequencies programmed in their radios
- There is also a desktop station at the PSAP, not connected to the existing consoles

The most commonly contacted agency is Lexington Police, 1-2 times per day via phone.

The County does not own any gateway equipment. Current interoperability capabilities are considered adequate.

Channel congestion is experienced seldom. No interference.

Some old radios in SO need to be replaced.

Back –up facilities are also considered adequate – backup power, at the main PSAP, ability to dispatch from Station 1 and ability to dispatch using portable equipment. Clark County is in the process of upgrading its system to conventional VHF P25 Phase I.

Description	Quantity
Total	200

14.4 Summary of Needs and Requirements

TABLE 2.2-1 - ISSUS AND CONCERNS	
Agency	**EXISTING CONCERNS**
LFUCG Division of Police	Insufficient capacity Lacks any advanced public safety functionality Obsolescence and compliance with narrowbanding mandate: approximately 50% of the radios currently in use will not be allowed after 12/31/2012 Interoperability with adjacent counties moving to Nexedge Interoperability with Madison County (800 MHz P25) Some coverage issues (outlaying areas) Process used to upgrade the radio communications
LFUCG Division of Fire & Emergency Services	Insufficient coverage, especially in-building Obsolescence Proprietary technology Interoperability, especially with the PD Lack of automatic switchover between backbone networks (microwave and fiber)
UK	Lack of coverage in adjacent counties and lack of interoperability with them Poor interoperability – concerned about potential major emergency

TABLE 2.2-1 - ISSUS AND CONCERNS	
Agency	**EXISTING CONCERNS**
DEM/DoH	Poor radio coverage in local schools

Sharing siren control channel with Police's operations

Interference and lack of back-up on the channel used for siren activation

DoH personnel not comfortable with the radios (size, weight, ease of use)

Interoperability with adjacent counties

Interoperability - having to carry multiple radios

Congestion on PD channels

No power back-up at the DEM facility |
| School District | Lack of appropriate mobile radio |
| LEXTRAN | |
| Blue Grass Airport | No interoperability (neither with Lexington Police or Fire)

Coverage limited to the Airport and near vicinity

Limited functionality

Insufficient back-up facilities |
| Fayette County Sheriff Office | SO did not provide information for the project |

APPENDIX B

15. COVERAGE FROM THE MADISON COUNTY AND SCOTT COUNTY SYSTEMS

The following two plots illustrate just one potential advantage of close cooperation with Scott and Madison Counties. The sites closest to LFUC were selected to show mobile coverage in LFUC. The maps show that, in case of a total failure of the LFUC system, the adjacent networks could provide back-up coverage in most of the County.
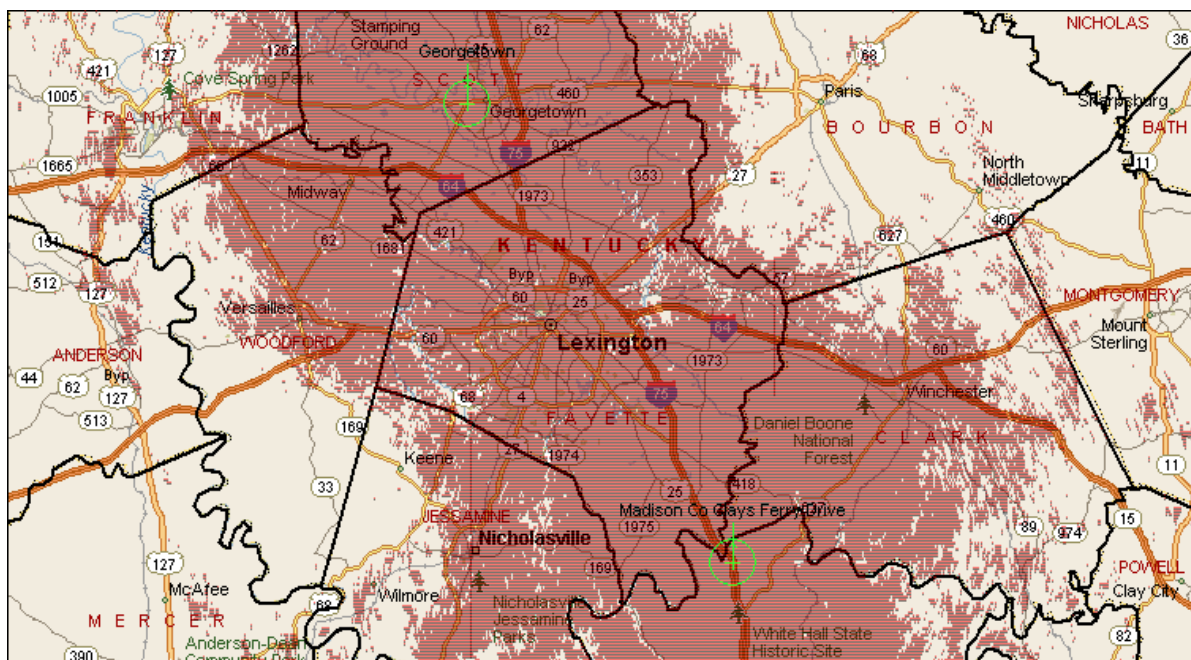

Figure 17: Mobile talk-out coverage from Scott and Madison county systems (only the sites closest to Fayette County)
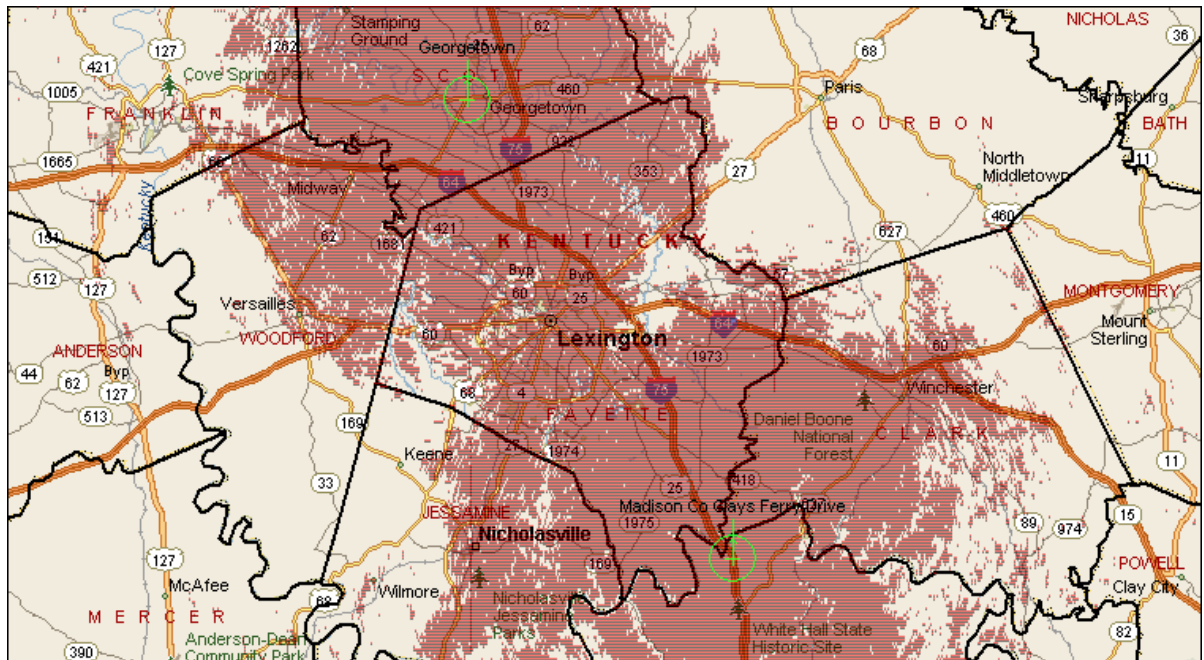
Figure 18: <u>Mobile talk-in</u> coverage from Scott and Madison county systems (only the sites closest to Fayette County)

APPENDIX C

16. HIGH LEVEL TIMELINE FOR THE THREE PROPOSED PHASES

The following chart is an estimate of the timing required to implement the three phases of the project. Please note, <u>the most important date is 12/31/2012</u> as the FCC will **not** grant extensions for narrow-banding. The new system must be implemented by then – or the Police must replace at least 700 of its existing radios to meet the Federal compliance requirements.

Task Name	Duration	Start	Finish
Phase I - Incremental Improvements	75 days	Fri 4/1/11	Thu 7/14/11
Inventory of current interoperating equipment	10 days	Fri 4/1/11	Thu 4/14/11
Inventory of all involved frequencies	10 days	Fri 4/1/11	Thu 4/14/11
Procurement of all missing radios	20 days	Fri 4/15/11	Thu 5/12/11
Cross-programming (new radios and updates)	20 days	Fri 5/13/11	Thu 6/9/11
Regional interoperability plan	30 days	Fri 5/13/11	Thu 6/23/11
Installation	10 days	Fri 6/10/11	Thu 6/23/11
Functional tests	10 days	Fri 6/24/11	Thu 7/7/11
Interoperability training (radio subscribers and PSAP personnel)	5 days	Fri 7/8/11	Thu 7/14/11
Phase II - LFUC County-wide system	420 days	Fri 4/1/11	Thu 11/8/12
Concept design	15 days	Fri 4/1/11	Thu 4/21/11
Technical specifications (Infrastructure and Radios)	15 days	Fri 4/22/11	Thu 5/12/11
RFP/-s issued	10 days	Fri 5/13/11	Thu 5/26/11
Bid evaluation	40 days	Fri 5/27/11	Thu 7/21/11
Contract/-s negotiations	20 days	Fri 7/22/11	Thu 8/18/11
Implementation	260 days	Fri 8/19/11	Thu 8/16/12
Acceptance testing	20 days	Fri 8/17/12	Thu 9/13/12
User training	20 days	Fri 9/14/12	Thu 10/11/12
Switchover (including PD)	20 days	Fri 10/12/12	Thu 11/8/12
Phase III - Regional Network	815 days	Wed 6/1/11	Tue 7/15/14
Needs analysis	40 days	Wed 6/1/11	Tue 7/26/11
Concept design	45 days	Wed 7/27/11	Tue 9/27/11
Buy-in from participating adjacent counties	60 days	Wed 9/28/11	Tue 12/20/11
Create regional governance structure	40 days	Wed 12/21/11	Tue 2/14/12
Research and apply for funding	40 days	Wed 12/21/11	Tue 2/14/12
Technical specifications	40 days	Wed 2/15/12	Tue 4/10/12
RFP/-s issued	20 days	Wed 4/11/12	Tue 5/8/12
Bid evaluation	60 days	Wed 5/9/12	Tue 7/31/12
Contract/-s negotiations	30 days	Wed 8/1/12	Tue 9/11/12
Implementation	390 days	Wed 9/12/12	Tue 3/11/14
Acceptance testing	30 days	Wed 3/12/14	Tue 4/22/14
User training	30 days	Wed 4/23/14	Tue 6/3/14
Switchover	30 days	Wed 6/4/14	Tue 7/15/14