Communications Systems Review Analysis and Recommendations

Knox/East TN Healthcare Coalition

Final Report

June 30, 2017

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1 Overview

Knox/East Tennessee Healthcare Coalition (KETHC) contracted Blue Wing Services to perform a Feasibility Study to review Incident Command Communications for its Regional Hospitals and Ambulance Services. The purpose of the study was to review Incident Command Communications for the Regional Hospitals and Ambulance Services. The Feasibility Study identifies the levels of future communications functionality, operational improvements, including potential for leveraging interoperability and intra-operability. Considerations are given to the long-term options and potential partnerships with TACN/TVRCS System and/or Knox County's new P25 radio system.

Blue Wing Services is presenting the final observations and recommendations to the Knox/East TN Healthcare Coalition stakeholders.

The Blue Wing Team understands and appreciates the importance of modernizing KETHC's / Incident Command Communications mission critical voice communications systems by commissioning the process of evaluating its existing and future communications system needs. Communications among users require enhancements, redundancy, potential subscriber equipment upgrades and infrastructure buildout (repeaters, sites, etc.) and increased coverage through BDA's (Bi- Directional Amplifiers) and other viable technologies.

Blue Wing understands Knox County/East Tennessee Regional Hospitals and EMS agencies have been in discussions regarding the next steps to enhance communications among users (hospital-to-hospital, security personnel, incident command among 21 hospital command centers, etc.), redundancy, infrastructure build-out options, upgrade subscriber units, increased coverage and cost efficiencies. KETHC committee members would like to understand the positive and negative impacts of joining the TACN/TVRCS system, as well as the impact of the new P25 radio system upgrade Knox County is currently implementing; along with any potential advantages and/or disadvantages of these type partnerships.

KETHC covers a large geographic area, and includes the following counties:

- Anderson

- Blount

- Campbell

- Clairborne

- Cooke

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- Grainger

- Hamblen

- Jefferson

- Knox

- Loudon

- Monroe

- Morgan

- Roane

- Scott

- Sevier

- Union

Additionally, the following KETHC partners were provided an access link or pdf of the radio user survey by the "Regional Hospital Coordinator of Tennessee East Tennessee Regional Health Office" and "Regional Hospital Coordinator of the Knox County Health Department" to participate in the collection of valuable data. (collectively referred to as "RHC's"):

- Knox County Hospitals
  - East Tennessee Children's Hospital
  - North Knoxville Medical Center (TH)
  - Parkwest Medical Center (CH)
  - Physicians Regional Medical Center (TH)
  - University of Tennessee Medical Center
  - Turkey Creek Medical Center (TH)
  - Fort Sanders Regional Medical Center

- Regional Hospitals
  - Methodist Medical Center of Oak Ridge (CH)
  - Blount Memorial Hospital
  - LaFollette Medical Center (TH)

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- o Jellico Community Hospital

- o Claiborne County Medical Center (CH)

- o Newport Medical Center (TH)

- o Morristown Hamblen Healthcare System (CH)

- o Jefferson Memorial Hospital (TH)

- o Fort Loudon Medical Center (CH)

- o Sweetwater Hospital Association

- o LeConte Medical Center (CH)

- o Roane Medical Center (CH)

- o Lakeway Regional Hospital

- o Big South Fork Hospital (Previously known as Pioneer Community Hospital of Scott County)

- Other Organizations:

  - o UT LIFESTAR

  - o Oak Ridge Fire Department

  - o Oak Ridge National Lab Fire Department

  - o Priority Ambulance

  - o Union County EMS

  - o Claiborne EMS

  - o Morgan County EMS

  - o Anderson County EMS

  - o Gatlinburg Fire Department

  - o Morristown Hamblen EMS

  - o Campbell County EMS

  - o Roane County Ambulance

  - o Jefferson County EMS

  - o Sevier County Ambulance

- American Medical Response (KNOX) EMS

- UT Medical Center Security

- Scott County Ambulance

- First Call Ambulance Service

- Monroe County Ambulance Service

- Roane County Ambulance

- Lifeguard Ambulance Service

- Region 2 Regional Medical Communications Center (RMCC)

- Grainger County EMS

- Rural Metro of East TN Fire

- Knox County Regional Forensic Center (Medical Examiner's Office)

- Jefferson County Emergency Medical Agency (EMS)

2   Existing Communications Systems Review

This phase focused on research and documentation of the existing operational and technical radio communications functionality as well as the requirements to maintain the current and future desired levels of radio system functionality among, hospitals and ambulances located in the Knox County and the Eastern Tennessee Region.

It was vitally important to KETHC that all aspects of existing radio communications be collected and documented for analysis. Close consideration was given to ownership, operation, and maintenance of radio communications. KETHC stakeholders submitted relevant information to Blue Wing for compilation, as it related to the following topics:

- Operational performance
- Radio coverage
- Day to day and event-driven capacity
- Technical features and functions
- Control point and dispatch operations
- Operating budgets
- Governance
- System life cycle and obsolescence

Blue Wing also considered additional stakeholder feedback received during various meetings, including the most recent technical meeting on August 7, 2017.

2.1   Data Collection Process

During this phase, Blue Wing focused on the collection of relevant, critical data with respect to current and desired future communications. This data was valuable to ensure knowledgeable observations and recommendations.

Data was collected in the following formats:

- Meetings
    - o Stakeholders Meetings (on-site and teleconference)
    - o Kick-off meeting held on-site February 7, 2017
    - o Project Status call held via teleconference March 7, 2017

- o Technical Group meeting held on site August 7, 2017
- o Operational Guidelines Working Sessions with Coordinators
  - o Discussion held via teleconference April 26, 2017
  - o Discussion held via teleconference May 2, 2017
  - o Discussion held via teleconference May 11, 2017
  - o Discussion held via teleconference May 15, 2017
  - o Discussion held via teleconference May 22, 2017
  - o Discussion held via teleconference June 1, 2017
- o System Analysis Report Review Meeting held via teleconference July 13, 2017
- o System Analysis Report Stakeholder Feedback Discussion October 20, 2017
- o Final Report Review held November 20, 2017
- Radio User On-line Survey
  - o Blue Wing developed survey utilizing on-line survey tool
  - o KETHC and select stakeholders reviewed and provided feedback on draft survey prior to deployment to all stakeholders
  - o Solicited survey responses from all stakeholders of the coalition
  - o Blue Wing compiled data and provided a draft report to all on-line survey respondent agencies for review of data and feedback
  - o Blue Wing provided final survey summary report to KETHC for distribution to stakeholders
- On-Site Audits. Blue Wing along with KETHC and the RHC's conducted on-site audits at five (5) locations that are representative of a cross section of facilities within KETHC.
  - o Regional Medical Communications Center (RMCC)
  - o Blount Memorial Hospital
  - o Turkey Creek Medical Center
  - o Parkwest Medical Center
  - o UT LIFESTAR

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2.1.1 Meetings

Blue Wing, along with RHC, facilitated the kick-off meeting on February 7, 2017. During the meeting, KETHC stakeholders were provided an overview of the Blue Wing project team and methodology along with a PowerPoint Presentation outlining the proposal, objectives, project approach, and project schedule. In addition, Blue Wing discussed the pending radio user survey and data collection process.

Throughout the project Blue Wing facilitated additional on-site meetings, operational discussions, teleconferences, facility on-site audits and data collections, accompanied by research to collect the following types of information:

- List of currently active hospitals

- Operational Requirements

- Current Governance

- User Survey Feedback

- Supporting documentation (Communication plans, inventories, MOU's, licensing, disaster plans, bylaws, etc.)

- Review of local and cross-jurisdictional interoperability (City, County, and State).

- Review of current training, emergency exercises and state-led initiatives that may impact radio system transitioning.

2.1.2 On-Line Survey

Blue Wing, along with KETHC, prepared and implemented an on-line survey targeted at collecting existing radio communication data designed to solicit feedback regarding radio communications, individual agency operations, system reliability, current radio equipment, perception of the current system communications, observation of coverage issues and additional pertinent details.

The survey was developed and administered using an on-line tool powered by Survey Monkey. The invitation link to participate in the survey was distributed to designated personnel via email. Alternatively, the survey was provided via email in PDF format.

The survey was developed to target essential components of the radio communications infrastructure and subscriber features and functionality, including coverage, dispatch, channel usage, short comings, future needs, etc. The current radio communications architecture has been on line since 1984 and was upgraded approximately four (4) years ago. The system was designed to accommodate thirty-three (33) ambulance services, three hundred (300) ambulances and twenty-one (21) hospitals in the region. During the

analysis period, Pioneer Community Hospital of Scott County was reported as closed and has since re-opened as Big South Fork Hospital.

The responses and comments identified significant attributes of the current system (negative and/or positive), users' future needs, assessments of the current system, users level of experience of the system, current and future features and functionality, and current use of technologies, all of which would provide better communications and safety for the staff.

Survey data responses were collected during the period of March 9, 2017 through March 15, 2017. Results of the survey were utilized, in part, to formulate the users' needs and final recommendations.

Blue Wing provided the KETHC stakeholders with a *Radio User Survey Summary Report (Appendix A) that provides* a high-level overview of observations provided by survey participants as well as the study methodology.

2.1.3 On Site Audits

After the initial on-line survey and summary report, Blue Wing along with KETHC and RHC's conducted on-site audits at five (5) locations.   The on-site audits provided a more in-depth understanding and obtained additional insight into the operations, functionality, interoperability and requirements along with the desires of the stakeholders.

During the on-site audits, Blue Wing reviewed equipment/site ownership, communication operations and priorities moving forward, radio equipment inventory, maintenance process/agreements, future communications desires and solicited valuable knowledge as offered by the site escort.

The on-site audits were selected at random based on their diversity of geographic location and terrain, size, operations and equipment.   The data collected during the on-site audits was complimentary to the data collected via the on-line surveys.

2.2   Communication System Information Gathered

Blue Wing facilitated on-site meetings, operational discussions, teleconferences, facility on-site audits and data survey collections along with industry standards research.

2.2.1 Meetings – Information Gathered

During the series of conference calls, meetings and surveys, the following type of information was submitted by system users for review and consideration:

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- The initial Kick-off meeting generated standard KETHC documents such as current by-laws, contact lists, licensing data, schedule review, and general expectations from its stakeholders.

- Subsequent operational discussions with the RHC's and Blue Wing focused on the documentation of current operations among the KETHC stakeholders, prioritization of the desired future communications, clarification of inventory and infrastructure, channel plans, coordination of future meetings, and site visits.

- In-depth technical stakeholder meetings offered Blue Wing the opportunity to engage in detailed discussions with stakeholders to clarify any gaps in the draft report. Additionally, KETHC members assisted in refining the prioritization of desired communications, governance management, importance of MOU's, impact of the recently approved revised bylaws, etc.

Blue Wing reviewed and analyzed the foregoing information into the overall feasibility study.

2.2.2 On-Line Survey – Information Gathered

Designated personnel within all agencies and groups that utilize, or have a desire to utilize, the KETHC radio network were surveyed. The users surveyed provided indicators throughout their responses along with general comments relevant to the radio system. Blue Wing utilized all survey data provided by radio system users in conjunction with meetings and other forms of correspondences to formulate the observations and recommendations.

Additional files, spreadsheets and documentation was provided from survey respondents via email. The additional information that was provided is listed below:

- Anderson County Emergency Service - Coverage and MOU

- Anderson County Emergency Services 2011 FCC License

- Anderson County Emergency Services Disaster Plan

- Anderson County Emergency Services Dispatch

- Anderson County Emergency Services EMS RESOURCE ACTIVATION

- Anderson County Emergency Services Radio Inventory 2017

- Anderson County Emergency Services 790-890 channel list 2017

- Anderson County Emergency Services MMC Affidavit

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- Claiborne KETHC Feasibility Study Claiborne

- East TN Children's Hospital 2017 Radio Survey

- Fort Loudoun Medical Center Radio Inventory

- Fort Loudoun Medical Center KET HC MOU 2017

- Fort Loudoun Medical Center FCC

- Grange County EMS Coverage Notes

- Grange County EMS FCC License

- Grange County EMS Radio Communication Procedures

- Grange County EMS Radio Inventory

- Knox County Regional Forensic Center All Hazards Mass Fatality Plan 2015

- Knox County Regional Forensic Center Back-Up Generator

- Knox County Regional Forensic Center Counties Served by the Forensic Center

- Knox County Regional Forensic Center Forensic Center Facility Assessment Summary

- Knox County Regional Forensic Center Radio Inventory

- Knox County Regional Forensic Center Use of Med-10

- Methodist Medical Center Oak Ridge Incident Commander startup

- Methodist Medical Center Oak Ridge license reference copy 3_4_2022

- Methodist Medical Center Oak Ridge Hand-held Radio Inventory to Blue Wing 3-2017

- Parkwest Medical Center 155.340-155.280-WQUV747

- Parkwest Medical Center Peninsula-WQPJ645

- Parkwest Medical Center Public Safety Repeater -WQFE278

- Parkwest Medical Center Trunked -WQBR673

- Parkwest Medical Center

- Parkwest Radio Talk Groups 3-16-17

- TN EMS Telecommunications Plan August15 Revised

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- TN EMS Telecommunications Plan August15

- Turkey Creek Medical Center EM.02.01.01.2 - Emergency Operations Plan Policy.1643

- Turkey Creek Medical Center SKM_

- University of TN Medical Center Security Management Plan Annual Review 2017

- UT LIFESTAR and the RMCC radio Equipment list

- RESPONSES\UT LifeStar EMS RESOURCE ACTIVATION

- RESPONSES\UT LifeStar FCC License

- UT LifeStar Region 2 MED CHANNELS

- UT LifeStar RMCC Policy and Bylaws

- UT Medical Center Kenwood Radios 4-27-2010 backup

- UT Medical Center Radio System FCC

A complete list of Common Channel Naming information, frequency assignments and regional coverage maps can be found in the Tennessee Emergency Medical Services Telecommunications Plan.

Blue Wing compiled the survey data responses collected during the survey period of March 9, 2017 through March 15, 2017. Results of the survey were utilized in part to formulate the users' needs and final recommendations.

Blue Wing provided the stakeholders with a *Radio User Survey Summary Report (Appendix A).* This deliverable provided the stakeholders with a high-level overview of system observations as viewed by representatives from all stakeholders' entities and Blue Wing information that was utilized during this process.

2.2.3 On Site Audit – Information Collected

Close consideration was given to aspects of ownership, operation, and maintenance of the existing radio communications during on-site audits to understand of the existing radio systems, operational communications, interoperability and intra-operability communications. The primarily focus of the feasibility study report is on the interoperability communications component.

Sections 2.2.3.1 through 2.2.3.5 below provide a comprehensive compilation of the data collected during the on-site audits from the five (5) sites visited.

The five (5) locations selected as a sampling for on-site audits are:

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- RMCC

- Blount Memorial

- Turkey Creek Medical Center

- Parkwest Medical

- UT LIFESTAR

2.2.3.1 Regional Medical Communications Center (RMCC)

Radio System Operations/Observations: Is the official Regional Medical Communications Center (RMCC) designated by the State of Tennessee Department of Public Health and Emergency Medical Services for Western Tennessee, providing ground and air ambulance to hospital medical communications, located at Regional Medical Center Region 2's Medical Communications Center.

The following points highlight the data collected during the RMCC on-site audit:

- RMCC assist EMS with communications to the area hospitals (Knoxville area), and assist EMS / Hospitals during MCIs.

- Knox Med Channels MED 3 through MED 8 Knox Hospital and 155.340 are used for EMS to hospital communications

- When out of the area MED 72 Knox MCI and 155.295 and any reasonable frequency that is common to the affected area/county/agency and the RMCC are used for emergency personnel communications during a major event.

- The statewide talk group 155.340 as well as TACN, TAC, DOH, RMCC (800 MHz trunking) is used for RMCC to RMCC communications.

- For direct communications via the radio system EMS requests a MED channel for Knox Area Hospital MED 10 MedLink II. MED 10 MedLink assigns a MED channel or 155.340, opening the channel for the designated hospital.

2.2.3.2 Blount Memorial Hospital

Radio System Operations/Observations: Blount Memorial Hospital provides internal and EMS communications serving East Tennessee.

The following points highlight the data collected during the Blount Memorial Hospital on-site audit:

- Hospital has a dedicated ER repeater and channel

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- Repeater utilizes Baofeng HT (handheld transceiver)

- Security and engineering have a repeater that utilizes Kenwood HT

- There are three (3) channels for ER, maintenance and security

- TCC also has five (5) non-repeated channels for COMM

- MED 42 channel is utilized. MED 42 channel is known to go down on a regular basis.

- The facility utilizes the statewide channel 155.340 for EMS to hospital communications, as well as out of area communications.

- There is a dedicated Knox Med Channel - MED 4 Knox Hospital, repeater located at Top of the World. This site is approximately 30 miles away from Blount Memorial Hospital.

- Direct communications are EMS encoders, ER and direct hailing

- Text from TEMA is utilized for hospitals to receive information from incident command

- Lack of communications with outside agencies

- Motorola/Kenwood Inventory

  o Portable - ER /62 units, Maintenance /30 units, Security 15 units, Misc. 15 units

  o Mobile – 7 units

  o Base Stations/Desk Top Units

2.2.3.3   Turkey Creek Medical Center

Radio System Operations/Observations: Turkey Creek Medical Center is a full-service hospital located off Route 40 on Parkside Dr. Located in East Tennessee, Tennova Healthcare encompasses ten (10) hospitals and numerous health care service facilities which includes Turkey Creek Medical Center.

- The following points highlight the data collected during the Turkey Creek Medical Center on-site audit: Staffed 24/7
- Hospital uses radios for the following departments: Surgery, Security, Plant Engineering, ED (Emergency Department), EVS and HICS
- System is a single channel trunked radio system utilizing DMR (Digital Mobile Radio) NXDN
- Seventeen (17) talk groups programmed into the radios

- Primary channels are inter-departmental

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- Channel 155.340 is utilized for EMS to Hospital communications

- RMCC is utilized for out of area communications

- Knox Hosp MED 5 is utilized for direct communication with EMS

- EMS contacts ED direct for pre-arrival notifications

- RMCC can contact TCMC and they can communicate, but TCMC (Tennova Healthcare) cannot initiate a call with RMCC

- No outside "PA style" speakers

- Police, Fire, EMS use 800 MHz. No radio communications inside the hospital

- Some "dead spots" in the hospital for the LTR (Logic Trunked Radio) system

- Plaza 2 cannot communicate via radio with the main hospital

- Inventory

  o Portable Inventory - 50 units

  o Mobile Inventory – No radios

2.2.3.4   Parkwest Medical Center

Radio System Operations/Observations: Parkwest Medical Center is in Knox County. Peninsula Hospital is in Blount County. Peninsula is an operating cost center of Parkwest.

The following points highlight the data collected during the Parkwest Medical Center on-site audit:

- Parkwest has one channel of MotoTRBO in use

- Other local channels are LTR

- Single UHF conventional public safety channel is used for inbound chopper, since Parkwest Blvd closes during a chopper arrival

- Telex is being used to cross patch LTR and DMR. Hospital Aid is a cross patch from the Parkwest system to the UT system

- Two (2) Channel MotoTRBO (digital) for main campus

- Three (3) Channel Kenwood LTR (analog with Trident controller and TX/RX combiner)

- One (1) Conventional Repeated Channel – Parkwest; One (1) Conventional repeated Channel – Peninsula; Five (5) Primary Talks Groups for Emergency Department, Security, Engineering, Hospital Disaster, Shuttle Transportation.

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- Parkwest / Peninsula talk group is maintained for use as needed. Parkwest conventional channel used as needed should the trunk system fail. Peninsula conventional channel used as needed for daily operation

- Future desire for hospital command center to receive the same radio communications from RMCC that is being communicated to ED, Coalition Command Talk Group and Coalition Security Talk Group

- Inventory

  o Portable Inventory - 100 units (25 MotoTRBO)

  o Base Stations/Desk Top Units

2.2.3.5   UT LIFESTAR

Radio System Operations/Observations: UT Lifestar is the East Tennessee Region's provider of air medical critical care transport.

The following points highlight the data collected during the UT Lifestar on-site audit:

- UT Lifestar utilizes two (2) American Eurcopter EC-135 helicopters

- Fleet also includes two (2) Bell 407 helicopters

- Staffed with 24/7 and have two (2) staff members manning the console positions

- Staff's operation communication functions include, but are not limited to; track all aircraft, 9-1-1 EMS calls, NCI, tracking of "sister" aircraft using "skytrac" mapping, monitoring weather, monitoring Park Services, listen to aviation radios (UHF) and MED channels of all Knox Hospitals.

- Center utilizes ZETRON telephone system which is aging and has significant limitations. The telephone system desksets are at full capacity for preprogramming of vital telephone numbers. Therefore, the staff must refer to a drop-down list for manual dial.

- Dispatch of program aircraft, mission information, safety monitoring, aircraft flight following, monitoring of other programs aircraft visiting our service are for safety and courtesy

- Three (3) console base station with VHF/UHF/Aviation radios with limited 700/800 trunking as utilized by the RMCC

- Statewide talk group for hospital/EMS communications is 155.340

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- Primary channel are 3 UHF channels with repeaters and a local VHF channel

- Channel used for hospital to hospital communications is a selection of UHF MED channels

- Channels used for EMS to Hospital are Knox Hospital MED channels 3 through 8 and 155.340

- Channel used for out of area communications is Knox Med Channel MED 72- Knox MCI MED (also known as MedTalk) with linked repeater) / 155.295 or frequency assigned by RMCC

- Cannot reach Knox Med Channel MED 10 MEDLink II using Sharps Ridge. It is difficult to communicate on Med 10 and has limited coverage

- Knox Hospital Med Channels 3 through 8 are utilized

- Non-linked systems

- Patch issues; such as, repeater in one area and channel assignment in another area using different repeaters

- Coverage of repeaters is an issue, no remote access to repeaters, Repeaters are stand-alone

- No multicast /No simulcast

- Intermodulation issues (Sharps Ridge is crowded)

- Equipment at end of life

- Failures every 6-8 months

- No alarms when equipment is down

- Need call from field users to let them know there is an issue or no radio field communications

- Equipment/communication issues since narrowbanding

- Radios vs Site settings may be issue

- Staff needs to know geography extensively since there is no one point of reference easily assessable. No mapping integration at all positions. Only one position has mapping software. Others rely on Google earth, etc. Two (2) positions have street atlas software, but is no longer supported/updated.

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- Limited software version standardization and upgrades

- Currently no method to send or link EKG's directly to Hospitals/Centers/doctors

- Three (3) maximum number of channels (This is not a system design issue)

- Cannot hit Scott County site. Repeater was never replaced at site

- Ambulance calls MED 10. Need to patch to hospital

- Repeater channel sometimes requires a second attempt to key up. This may be due to aging repeater or need for synchronization. Shadow areas for repeaters.

- Desire for extended range, for transport to Nashville TN, Lexington KY, Ashville NC, etc.

2.3   Governance

Maintenance and governance of a communications network and equipment is a large undertaking. The Coalition supports the enforcement of the bylaws, sharing of information, training of the hospitals and ambulance/EMS entities along with fostering cohesive communications among the members to maintain and governance of a communications network and equipment.

As identified during the process, the Coalition bylaws and memorandums of understanding (MOU's) require significant administrative support and oversight.

Over the course of time and change in equipment procurement, loan programs, maintenance and the need for upgrades/replacements, the Coalition bylaws were updated and approved as of June 13, 2017. The revised bylaws provide clarification on Coalition owed equipment maintenance, loaning of equipment, modifications/changes and support. However, Blue Wing wants to note that it is mutually agreed that any recommendations for proposed changes or modifications to Coalition-provided equipment be brought to the attention of the Coalition prior to implementation of such changes. Coalition owned equipment, assigned equipment or loaned equipment often resides at the facility in which it is installed and/or utilized daily. Therefore, the facility maintains the health of the equipment, including regular preventive maintenance (PM). However, the Coalition reviews any request for replacement of equipment or modifications, as stated in the bylaws.

In accordance with the revised bylaws, the Coalition currently owns assets. Coalition owned equipment is maintained by individual agencies.   If the equipment is installed at a facility, the facility manages the PM and associated costs.

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Blue Wing believes that governance and maintenance is an important aspect required to maintain the integrity, security and safety of the equipment's intent and system users.

3   Review of Collected Data

During the feasibility study, Blue Wing formulated various questions to ensure that Blue Wing observations and recommendations meet expectations of the KETHC stakeholders.

3.1   Regional Scope of Communications

Scope of communications includes guidelines related to who can/should talk to whom.

The following guidelines were captured:

- During the first phase, at a base level of the enhanced radio communication plan implementation the following are primary consideration:

  - 21 hospitals plus RMCC should communicate

  - RMCC needs to communicate with all hospitals at any given time and simultaneously

  - RMCC, RHC's and hospitals able to communicate

  - RMCC and RHC's require voice communications. Data is desired but not required

  - Hospitals, RMCC and RHC's need to be able to communicate at a command level with ED (Emergency Department) emergency room command communications.

  - EMS needs to be able to communicate with hospitals from incident site and when in route. EMS routinely communicates with hospitals on MED channels, VHF channel and/or telephone.

  - ED and Security require communications

  - ED should be able to broadcast to RMCC. RMCC coordinates and patch all ED's when needed to communicate with one another. Currently using telephone to communicate. Technically viable but must be coordinated and managed. Note: RMCC on command can pull all talk groups together

  - EMS needs to be able to communicate with hospital (pre-arrival) During the subsequent phases the following need to be considered:

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- o Hospital Security has a desire to communicate with other hospital security for real time information sharing on a separate talk group

- o EMS to EMS and to RMCC Communications required as a future need

Note the following additional information was obtained during the process:

- RHC's do not need to have direct communications with EMS/Ambulance

- Not all hospital's ED have portables. ED's communications are internal only and cannot be reached by outside agencies for radio communications.

- Most facilities have some type of control stations

- The communication requirements can be outlined using a Communications Priority Matrix. The Matrix references four (4) touch points where communications are required. (ED-RMCC-RHC's). The Matrix will show tiers of communications and classify, as "Required" and "Desired", "Restricted" or "Prohibited".

- Obstacles to consider while obtaining maximum communications and interoperability (i.e. funding, time, staffing, etc.)

- Since the original report analysis period, Pioneer Community Hospital of Scott County has reopened under the name Big South Fork Hospital

3.2 Exchange of Communication

Coalition stakeholders defined the type of communication to be exchanged with one another, and to other entities during various meetings.

The following guidelines were collected:

- 21 facilities, plus RMCC exchange information/data what are the requirements, data capacity, and accessibility 24/7

- Voice communications is required

- Data is desired

- Need to consider "prioritization" of the agencies to access and exchange information

- Priority matrix designates communication levels and combinations, along with "desired", "required", "restricted" or "prohibited"

- RHC also track via HRTS (Healthcare Resource Tracking System) and currently communicate with command centers and hospitals by telephone

- There is currently no complete list of ED locations

- Potential opportunity to leverage intra communications with inter communications

- Some hospitals migrating to DMR systems

- Consideration of utilizing the telex box for internal communications

3.3   Use of Communication

The Coalition determined and established when communications should be used, and under what circumstances during various meetings.

The following guidelines were collected:

- Daily, critical, 24/7, occasional?

  o Priority Matrix to address the requirements

  o Determine what priorities are system driven and which will override lesser priority transmissions

3.4   Levels of Communication

Levels of communication should be established for Coalition communications.

The following guidelines were collected:

- Do stakeholders need in building communications or a point of presence? Example: Is there only one-control stations or is there a need for a portable that provides communication from any area in the hospital. Solution would be cost impacting.

- Proposed solution may support intra communications. Therefore, a control station may be required at each facility. Coalition may have funding to support this solution. However, support of this equipment would be the responsibility of the facility.

- In-building coverage would require BDA's. Currently, City of Knoxville code requires in-building amplification. Implementation of a BDA code requirement is not a widespread practice at this point.

- Consideration of DAS vs BDA

- Currently, hospitals use portables for internal communications. Hospitals cannot communicate via portable with outside entities

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3.5 Necessary Features and Functions

Features and functions for radio communications determination:

- Define stakeholder requirements for radio communications; voice, data, and encryption for current and/or future use.

- Voice is required

- Data desired

- No encryption in the current environment. Need to consider the future needs in the next 5 years. (Subscriber and Infrastructure equipment).

3.6 Communications Equipment

The following information was collected regarding communications equipment:

- Coalition owned equipment governance defined in bylaws

- Define future cost and funding responsibility and opportunities

- Inventory Coalition assets

- Define how any newly acquired equipment will be maintained and by whom

- Typically, the entity that is housing the equipment will maintain the equipment. Any change in programming or use would need to be approved by the Coalition.

- Maintenance and Governance through Coalition are addressed in the revised bylaws that were presented on June 13, 2017 and approved

- Ensure the proper policy and protocols are implemented to cover the overall equipment that impacts the radio system and communications of all users. (I.e. equipment functionality changes to Coalition owned equipment, adding channels/programming changes, relocation of equipment, support of equipment available for loan to agencies, etc.)

- Coalition assets can be borrowed. PM (Preventative Maintenance) and support of the borrowed equipment is the responsibility of the individual entities.

- The hospital / region that houses the repeater fund the MED channel

- Currently the general rule is that the hospital that houses the repeater funds the PM

- The revised bylaws address equipment PM costs

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- Memorandum of Understandings (MOU) need be revised to align with the bylaws

- PM's performed on interval and is based on manufacture specifications

- Minimum PM Standards need to be defined and the aligned with in-field PM practices

- PM standards should be defined in a user's agreement

3.7   Governance

A governance model should be established for Coalition communications. The following guidelines were collected:

- Understand who utilizes the system and what the fleet map would reflect

- Governance/maintenance section included in report

- Mechanism for decisions for the entities, structure to handle request from entities regarding equipment (repairs, replacement, loan process, maintenance, funding).

- Entities agree that any recommendations for proposed changes/modifications, to Coalition provided equipment should be brought to the Coalition for consideration prior to being implemented

- Entities housing Coalition owned equipment with be responsible for funding PM's

- Request for equipment replacement should be brought to the attention of the Coalition

- Bylaws address the Coalition owned equipment

- MOU's to be aligned with bylaws

3.8   Command Center Communications

Each stakeholder agency has a variety of internal groups that communicate, including Security and Command Centers. Protocols should be established to determine what groups can communicate to other groups, and when. The following guidelines were collected:

- The team confirmed that the 21 hospitals command centers, RHC's must have radio communications with each other as part of the solution

- Objective is that hospital security groups can have real time communications via radio

- ED and Security require communications

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- Numerous talk groups could be considered as a solution

- Additional considerations for communications is to ensure who can talk to whom. Communication objectives to be viewed from an operational plan level

- Priority levels and protocols would be defined in a written operational plan

3.9   Priority Levels of Communications

Coalition stakeholders should determine and establish levels and priorities of communication. The following guidelines were collected:

- Levels of communications are viewed as desired, required, restricted or prohibited

- Examples:

  o   RMCC to Hospital is required

  o   Hospital ED to Hospital ED is restricted. This is managed by internal protocols

  o   Hospital security to another hospital security is desired

  o   Functional groups within hospital to other hospital is desired

  o   RHC's to all hospital command is required

  o   Security of one Hospital to ED at another hospital to RMCC. Not desired nor required. This is managed by internal protocols

  o   RMCC, and RH take priority over anything else being communicated at any given time and is required

  o   Encryption for other type distress situation at the facilities is desired. AES is part of P25 Standard

- Priority levels would be defined in a written operational plan. Plan would outline priority levels. Blue Wing and KETHC need to understand when priorities are forced vs assigned system demand levels settings. There should be the ability to prioritize the level of communications.

- This type of operational view will help guide the system solutions

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3.10 Asset Management

Assets purchased by the Coalition must be managed and maintained. Guidelines for this requirement are noted:

- Coalition purchased equipment is maintained by individual agencies. If the equipment is installed at a facility, the facility manages the PM and associated costs

- Revised bylaws and MOU address Coalition owned equipment, maintenance, replacements, decision making authority and funding

- Define the request and approval process for handling Coalition owner equipment so all members have the same understanding

- It is agreed that any recommendations for proposed changes/modifications to Coalition provided equipment should be brought to the Coalition for consideration prior to being implemented

3.11 Future Funding and Cost

The primary focus of stakeholders is to develop a modern, reliable radio system that supports portable and mobile communications designed to address the needs for interoperability, increased coverage and redundancy.

Radio users' provided feedback regarding cost of dispatch services, aging equipment replacement, maintenance and support. While not applicable to all agencies, those which responded, had a wide range of cost indicators.

These agencies are dependent on outside funding such as grants, while others have fiscal budget resources. It is understood that some agencies were not permitted to disclose financial budget information.

There is a potential of funding opportunities through Knox County/East Tennessee Health Care Coalition. This option would need to be vetted with the Coalition membership for consideration and approval.

The recommended funding solutions for the enhancement of communications systems would be cost impacting and often present funding obstacles. Cost efficiencies can be realized through various solutions and design alternatives to ensure stakeholders communication requirements are meet.

During the technical meeting, the Coalition noted they would provide funding as available to support the communications equipment upgrade, along with the continued shared costs to maintain the facility located equipment.

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4 Observations and Recommendations

This segment includes comments, observations and recommendations with respect to KETHC's radio communications. This will be a key document when evaluating the effectiveness of various solutions, implementation of guidelines and future planning.

The observations and recommendations are primarily focused on Interoperability not Intra-operability. Therefore, there has been no expectation that hospitals are required to change their internal communications.

Blue Wing has formulated the additional following observations and recommendations:

4.1 General Observations and Recommendations

Observation: Currently the technical experts from each agency/facility do not have standard meetings or a committee structured to share radio knowledge.

Recommendation (Technical Committee Meeting Coordination): Blue Wing recommends that KETHC schedule quarterly technical meetings consisting of the IT and/or radio personnel from each agency/facility. The technical experts would serve at an advisory level.

Observation: During discussions, Blue Wing was made aware of agencies/facilities who do not have a full understanding of channels and available resources. Since some resources are used on a very limited basis, it is not uncommon for personnel to lose the ability to quickly recall equipment functionality/operations.

Recommendation (On-line Radio/Equipment Refresher Training and Operation Cards): Blue Wing recommends that KETHC implement on-line refresher training, radio/equipment operation cards and other similar strategies for quick and easy reference by agency/facility personnel. It is important for users to be familiar and comfortable with the functionality of any equipment.

Observation: The Coalition provides support for the agencies. It has been noted that there have been catastrophic instances where event radios where placed into service and found to need maintenance (i.e. New batteries, antennas, PM, etc.). RHC's along with some stakeholders have expressed specific concern for XTL/XTS battery availability and end of life equipment maintenance.

Recommendation (Radio Equipment Inventory Management): Blue Wing recommends KETHC conduct an inventory of the current emergency event radios that consist of determination of equipment functionality, evaluation of end of life of the

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equipment and documented radio functionality in the event of activation of the equipment. Radio/equipment operation cards should be affixed to each unit to outline channels, etc.

Observation: During the feasibility study, it was identified that loaned generator and other equipment that was acquired through grant funding is currently made available to agencies/facilities in the event of an emergency. However, the maintenance and repair support cost has not been considered.

Recommendation (Equipment Quote): Blue Wing recommends KETHC obtain a quote for a support maintenance contract and research funding source opportunities. In addition, cost of this nature could be defined in the user agreement that RHC's are currently developing.

Observation: In-building coverage has been consistently referenced as a concern from the stakeholders. Stakeholders noted that some jurisdictions are requiring in building amplification by use of BDA's. The requirements would require minimum standards to ensure a reasonable degree of radio coverage and reliability for public safety personnel. Blue Wing understands that KETHC members want to enhance coverage during Phase 1 of the upgrade process.

Recommendation (In-Building Coverage Solution): Blue Wing recommends a joint effort by the user community and jurisdictional authorities to coordinate the implementation and adoption of the same level of in building amplification standards to unify the requirements and mandate standardization.   In building coverage is a concern. The technical solution selected will potentially drive the in-building coverage solution.

Observation: Blue Wing noted that a comprehensive list of all Emergency Department (ED) does not exist.

Recommendation (Comprehensive ED Listing): Blue Wing recommends a compilation of a comprehensive list that includes, but is not limited to, facility address and location of ED within the building, 24/7 contact information, alternate contact, telephone numbers (including landline, cellular and fax, as applicable).

Observation: Alignment of Coalition bylaws and Memorandum of Understanding (MOU).

Recommendation (Alignment of MOU's and Bylaws): Blue Wing recommends that the stakeholders coordinate the language of the bylaws and MOU's to reflect consistent content, processes and intent to eliminate any future confusion or misunderstandings of responsibilities. Contradiction in these documents can cause unnecessary confusion straining overall operations and budgets. During the transition period of implementing the MOU's, user agreements are a viable option.

Observation: During the data review and operational discussions it was noted that some stakeholders' entities have reported potential repeater issues. Infrastructure equipment issues are identified during the PM (Preventative Maintenance) process. The issues

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noted during the study suggest the repeaters are either aging, failed, never replaced or not synchronized. During the technical meeting, stakeholders identified two specific repeaters locations (Scott and Jellico) where there are repeaters on site that are not installed. It is possible these repeaters can be relocated.

Recommendation (Repeater Functionality, Installation and/or Relocation Verification): Blue Wing recommends review of the PM records associated with infrastructure equipment and implementation of monthly equipment and system test procedures. In addition, further research to identify the options to install the equipment at the existing site locations or relocation to a new site that can utilize the excess equipment. Funding options would need to be identified and secured for the installation and/or relocation of the repeater equipment.

Observation: During the data review and operational discussions it was noted that some software and firmware versions are outdated or not fully functional.

Recommendation (Software and Hardware Contact Review): Blue Wing recommends a review of all supporting software and firmware, along with the review of support contracts to ensure vendors have provided all applicable contractual updates. In the event the support has expired, Blue Wing recommends that KETHC obtain a quote for a refresh, upgrade or replacement.

Observation: During the technical discussions, stakeholders addressed the requirements of some entities to record radio traffic.

Recommendation (Recording Requirements and Responsibilities): Blue Wing understands that RMCC does not mandate recording of radio traffic. Inter-facility and EMS to hospital recording is the sole responsibility, and at the discretion, of each individual entity. Blue Wing recommends that each entity review any applicable legislations, mandates or guidelines that govern their agencies to ensure their requirements to record radio traffic are met.

Observation: Minimum PM Standards need to be defined and aligned with in-field PM practices.

Recommendation (PM Tracking): Blue Wing recommends that Preventative Maintenance (PM) standards should be defined in a user agreement and PM results submitted to designated personnel for tracking.

Observation: KETHC does not currently have an Operational Plan which supports and documents the approved procedures that align with the current practices.

Recommendation (SOP Development): Blue Wing recommends the documentation and development of the standard operating procedures (SOP).

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4.2   Technical Operations Observations and Recommendations

Blue Wing has engaged the KETHC stakeholders in numerous meetings (on-site and via teleconference) to identify existing operations and overall objectives.   During the feasibility study, stakeholders most noted concerns were interoperability, coverage (in-building and field), failing/lack of repeaters, equipment capability/limitations (subscriber and infrastructure), and end of life equipment.

Additionally, Blue Wing reviewed the level of radio communications, combinations of communications and system talk path priorities required. To track the priority of the communications assessment Blue Wing created a Communication Priority Matrix. Subsequent discussions lead to the following priority consensus elements that carry the most weight amongst the stakeholders.   The following Matrix designates the level of communications with any system upgrade:

- Required
- Desired
- Restricted
- Prohibited

Type of Communications	Required	Desired	Restricted	Prohibited
21 hospitals, plus RMCC Communications in initial Phase	X			
RMCC to Hospital Communications simultaneously at any given time	X			
Hospital Security to Other Hospital Security		X		
RHC's to all hospital command	X			
RMC and RHC's take priority over any other communications, at any given time	X			
EMS to EMS and to RMCC	X			
EMS to Hospital Pre-arrival notifications and patient updates	X			
ED to broadcast to RMCC		X		
Hospitals, RMCC and RHC's communicate at a command level with ED	X			

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Voice Communications	X			
Hospital ED to Hospital ED, as applicable.			X	
Functional groups within hospital to other hospital			X	
Encryption for other type distress situation at facilities (Does not include patient information protected by HIPAA)		X		
System driven prioritization	X			
Data transmission		X		
24/7 Communications	X			
Mobile/Portable in-building communications	X			

Table 4-1: Communications Priority Matrix

Blue Wing recommends the following "required" communication improvements, as outlined in the Matrix, based on the discussions with a core group of stakeholders. The Matrix provides the latest insight into industry-standard systems and subscriber capabilities that allows KETHC to take advantage of the current technologies in the industry such as P25 and DMR.

We believe the Knox County and TVRCS radio system provides the best conceptional solution for interoperability operations among the Coalition stakeholders. We recommended the Coalition engage with KCECD (Knox County Emergency Communications District) to discuss detailed design and costs related to the adoption of this approach.

Large networks such as Knox County's upcoming P25 system and TVRCS offer:

• Single point of administration

• System oversight

• Provide operational and administrative guidelines for all system operations and users.

The benefits of joining Knox County/TVRCS are:

• System support maintenance costs are maintained through a set "subscriber fee"

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- Regional talk groups

- Increased coverage, interoperability with neighboring systems

- Sharing of encryption keys (as applicable)

- Day-to-day system features that would otherwise be too costly to implement

- P25 radio system architecture various subscriber vendor equipment would be compatible

- Versatility that would assist with budgeting for equipment replacement and/or upgrades

- Encryption capability. (NOTE: If stakeholders desire encryption in the next 5 years, it should be considered during a solution for subscriber and infrastructure equipment procurement.)

However, a potential disadvantage of joining a County or Regional P25 radio system is that all subscriber and infrastructure equipment must be TDMA and/or FDMA P25 compliant depending on the system parameters and console updates to accommodate multi-band. Therefore, extremely old subscriber equipment would require replacement to migrate to the P25 architecture platform. In addition, through good engineering practices, additional research and information relating to coverage capabilities through TVRCS and TACN for all stakeholders/entities would need to be further defined.

Stakeholders identified the desire for a digital system. Some entities have implemented a Digital MotoTRBO radio system solution. While this is a viable solution it does present some limitations, as the system is not P25 standard compliant and would not meet any state or local mandates to upgrade new radio systems to P25. Unfortunately, MotoTRBO cannot be interfaced with P25 systems at this time.

In addition, it is recommended that the Coalition explore the use of the MED channels and the option to license tactical frequencies to increase coverage. Blue Wing understands that there is a MED channel plan with channel designations referenced through the survey responses and on-site visit documentation. During the technical discussion, the consensus was to evaluate the MED channel plan and further define and correct any license corrections or modifications, as applicable.

Blue Wing believes that there is merit for the utilization of hospital intra communication systems to cross connect.

Using control stations/desk sets as a fixed point of communications at ED command locations along with BDA's would increase the portable communications hospital coverage.

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Appendix A – Radio User Survey

The Radio User Survey report is provided as a separate document.

Appendix B - Glossary of Terms

700 Megahertz - Public safety frequency band for voice and data including wideband data channels. Channel between 764-806 Megahertz.

800 Megahertz -The frequency band where public safety trunked systems operate. The channels between 806 and 869 Megahertz.

Bandwidth -The range within a band of frequencies. A measure of the amount of information that can flow through a given point at any given time.

BDA – Bi-Directional Amplifier

Channel - A band of frequencies of sufficient width to allow a single communication.

Console - Equipment in dispatch center tailored to dispatcher needs. Single and multi-talk groups/channel configurations available.

Coverage - The amount or percentage of area reached by a communications medium.

Encryption - Digitalization and scrambling of the voice signal to prevent unauthorized monitoring of the message over the airwaves. There are variations of encryption: "Advanced Digital Privacy" (ADP) or a hardware-based option such as "Data Encryption Standard" (DES), "Advanced Encryption Standard" (AES) or other variations.

FDMA – (Frequency Division Multiple Access) A channel access method used in multiple-access protocols as a channelization protocol. Giving users an individual allocation of one or several frequency bands, or channels.

Hertz -Hz. Abbreviation for cycles per second.

HRTS – Healthcare Resource Tracing System

Infrastructure -The underlying permanent installations required for radio communications.

KCECD – Knox County Emergency Communications District

LTR- Logic Trunking Radio

MOU – Memorandum of Understanding

P25 - Project 25 **(**P25 or APCO-25) is a suite of standards for digital radio communications for use by federal, state/province and local public safety agencies in North America to

enable them to communicate with other agencies and mutual aid response teams in emergencies

Patch -This is a form of group regrouping which the joined groups are allowed to carry on normal message trunking operations between and among all the separate member groups of the call, upon a single channel resource.

PM- Preventative Maintenance

Repeater - A transmitter and a receiver operating on different frequencies and often connected to a common antenna. Mobile Relay

Subscriber Unit - Individual serialized devices.   Commonly referred to as radio, portable, mobile, etc.

Talk-Around - Talk-around by-passes the repeater and talks directly to another unit. Units in the talk-around mode are operating in a conventional mode.

Talk groups - A talk groups is the primary level of organization of users on a trunked radio system. Talk groups activity is not heard by other talk groups. A talk groups is often referred to as channel.

TDMA(Time Division Multiple Access) A channel access method for shared medium networks. It allows several users to share the same frequency channel by dividing the signal into different time slots. The users transmit in rapid succession, one after the other, each using its own time slot.

Trunking - The sharing of several talk paths among many users. A method by which multiple channels are accessed for user needs. Channel assignments are more efficient than systems where channel access is limited to a single channel or require manual user channel switching. Creates spectrum efficiency

TACN – Tennessee Advanced Communications Network

TNHAN – Tennessee Health Alert Network

TVRCS – The Tennessee Valley Regional Communications System is an APCO P25 trunking system covering the majority of East Tennessee and North West Georgia with additional coverage area in Middle and West Tennessee having master sites in Nashville, TN (Zone 1) and Chattanooga, TN (Zone 2).   The system is collaboration between State and Local governments that multi-discipline and crosses state lines.

UHF - (Ultra High Frequency) The frequencies between 450 and 470 Megahertz.

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VHF - (Very High Frequency) The frequencies between 150 and 174 Megahertz.