UTAH COMMUNICATIONS AUTHORITY

Land Mobile Radio System Strategic Plan

FINAL

March 8, 2024

UTAH COMMUNICATIONS AUTHORITY

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Executive Summary

The Utah Communications Authority (UCA) is an independent state agency charged with providing and maintaining a radio communications network on a statewide basis for the benefit and use of local, state, and federal agencies.

Since 2000, the UCA 800MHz system, which uses Motorola's SmartZone OmniLink trunked radio technology, has taken on an increasing portion of the state's public safety communications and today supports more than 44,000 user radios. While the system has proven reliable over the years, Motorola has discontinued support for much of the existing 800 MHz trunked radio equipment and no longer manufactures some of the replacement parts needed for the system. UCA signed a contract with L3Harris Communications (L3H) in late June 2021 to provide a new Project 25 system. The goal of the project is to replace the existing system with:

- A digital radio system including infrastructure equipment, and software that complies with the latest applicable APCO Project 25 (P25) suite of standards, with at least the same levels of functionality as the existing system
- Radio system coverage within the geographical boundaries of the service area with portable on-street coverage matching the coverage provided by the current system
- Replacement of equipment at the 119 radio frequency (RF) sites on a site-by-site basis, and four (4) IP-based Voice, Interoperability, Data and Access (VIDA) Core Pairs
- 25 new RF sites to support the planned coverage expansion
- A stable, reliable infrastructure radio environment for the next 10-15 years

Development of an LMR strategic plan is recognized and required by the "Utah Communications Authority Act", to facilitate planning for and administering LMR radio communications for the next several years. The plan should address the critical coverage and redundancy needs when evaluating new technology and staffing constraints in the near term.

The current Radio Strategic Plan was initially prepared in March 2017 and revised in May 2021. This strategic plan will update and replace the previous versions. The methodology employed to develop the strategic plan is illustrated in Figure ES-1.

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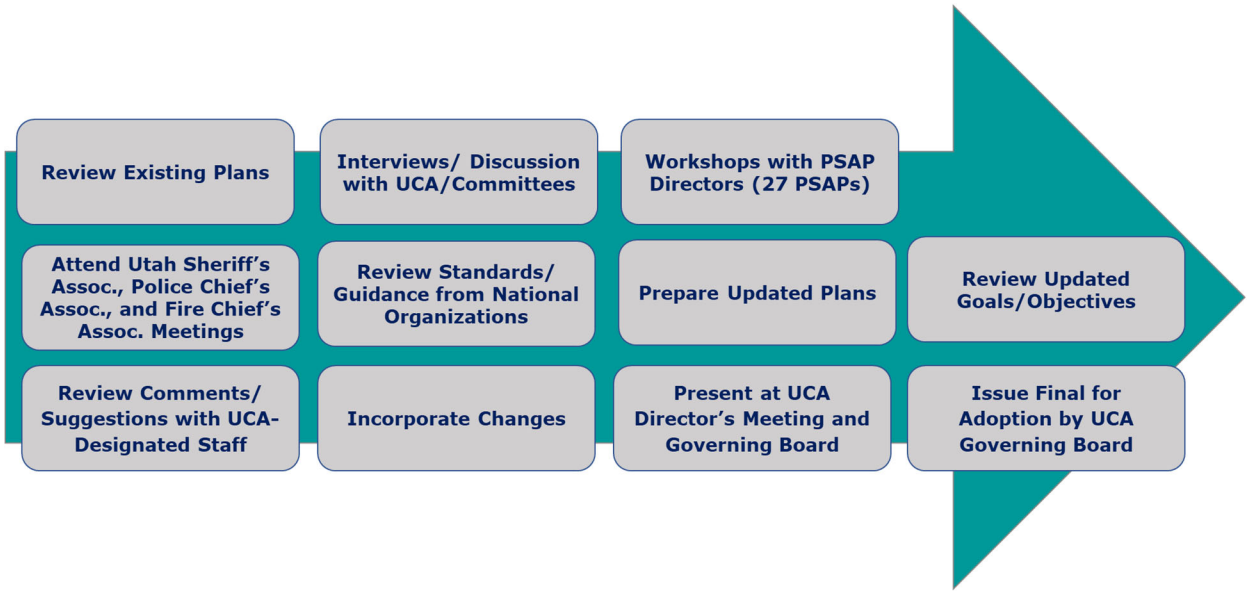

Figure ES-1: Project Methodology

A series of interviews was conducted to gather additional information from UCA stakeholders regarding their public safety communications operational and technical needs. Feedback gathered through these interviews helps to identify the ability of the current systems to meet stakeholders' needs, identify any unmet needs, and gather ideas for meeting those unmet needs.

Feedback from the interviews was captured and delivered in October 2023 in the *Initial Findings Memorandum* summarizing the analysis and recommendations focusing on UCA LMR staffing, organizational structure, funding, interoperability requirements, and governance.

The findings from those initial reports were used as the foundation upon which to build this Land Mobile Radio System Strategic Plan (Plan), and the development of the following recommendations:

1. Land Mobile Radio System

    - As the new P25 system being deployed was a site-for-site replacement for the current radio system, new areas will be identified where coverage is lacking. UCA should address these as quickly as possible to keep the users satisfied with the performance of the new system.

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- Consider options to improve mobile and portable radio by adding additional sites at existing structures, site-on-wheels, and/or micro-sites to fill in gaps in the coverage.

- The P25 Inter-RF Subsystem Interface (ISSI) interconnects different P25 core networks, regardless of frequency band or manufacturer, to allow roaming of user radios between networks. UCA has tested the functionality with various partners and should consider whether the ISSI capability needs to be expanded to connect to neighboring systems.

- UCA should recommend and set standards for BDA usage as part of the management of its approved frequency spectrum provided by the FCC. While UCA does not guarantee in-building coverage, UCA should encourage stakeholder use of distributed antenna systems (DAS) and/or bi-directional amplifiers (BDA) to improve the in-building portable coverage, as required.

2. Radio Subscribers

   - Continue to replace the end-of-life radios with new L3H or UCA approved P25 CAP certified subscriber units.

   - Continue evaluating new subscriber handsets and update the approved radio list as new models come to market as this would provide a greater range of approved P25 choices to participant agencies.

3. Cybersecurity

   - UCA already utilizes the DHS SAFECOM recommended Interoperability Continuum during periodic self-evaluation. This should dovetail with the State of Utah's plan to fund existing and future interoperable and emergency communications priorities as outlined in Section 5.7 of Utah's Statewide Communication Interoperability Plan (SCIP).

   - Continued use of the commonly recognized four pillars of an effective cybersecurity strategy are risk assessment and management, security control implementation, security awareness and training, and incident response and recovery.

   - Building a routine corporate structure that encourages due daily diligence combined with network security at the forefront where everyone who touches the UCA network is aware and conscious of ongoing threats and how to counter them.

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This plan identifies and prioritizes the strategic initiatives that UCA should pursue to achieve improvements in providing radio communications services that meet the needs of UCA first responders and other public safety users.

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1. Overview

This *Land Mobile Radio* (LMR) *System Strategic Plan* (Plan) provides the Utah Communications Authority (UCA) with actionable activities as part of a comprehensive strategic plan for their mission critical Land Mobile Radio (LMR) system. The Plan also outlines initiatives for UCA to improve communications capabilities throughout the State of Utah during the near-term and beyond, and develop budget requirements to address these initiatives, for future budget cycles.

1.1 Background

The Utah Communications Authority (UCA) was created by the "Utah Communications Authority Act" to provide administrative and financial support for statewide 911 emergency services. This Act established the method for creating a statewide public safety communications network for all state, city, county, and local governmental entities in Utah. This "Utah Communications Authority Act" also continues to maintain the Utah statewide public safety communications network.

Within the UCA operational structure are the Radio Network, 911, P25 and Interoperability Divisions, each providing administrative management, technical oversight, and field support of the UCA statewide system. State and local Public Safety agencies depend on UCA to operate and maintain the UCA LMR systems, microwave backhaul, and data networks.

Communications is a vital tool to both public safety field and command personnel during routine, local incidents and even more so during major incidents covering a larger area. The State of Utah, in accordance with Utah Code Annotated (U.C.A.) Section 53-2a entitled Emergency Management Act, is required to prepare for, respond to, and recover from emergencies or disasters with the primary objectives to save lives, health, safety, property and the environment[1].

With these State charters in place, the UCA LMR system is supported and capable of providing Public Safety agencies safe and reliable communications throughout the State of Utah. These UCA communications systems enhance and enable Utah's emergency management capabilities to mitigate, prepare for, respond to, and recover from natural, man-made, and technological emergencies. The UCA system supports over 44,000 mobile and portable radios, 285 radio dispatch consoles across four regions, network connectivity to four redundant data centers and over 175 communications sites statewide.

[1] State-of-Utah-EOP-Basic-Plan-Final-2016-2020.pdf

As with the other divisions, UCA Radio Network Division works with partners throughout the State, including local and federal agencies.

In accordance with Utah Code Ann. §63H-7a-206[2] UCA acknowledges the need to develop an updated Land Mobile Radio strategic plan to facilitate planning for and administering unified public safety communications for the next several years while addressing the critical coverage, redundancy, innovative technologies, and staffing constraints in the near term. In response to this determination, UCA issued a request for proposal (RFP) to retain ***FE*** as the consultant to develop a comprehensive multi-year strategic plan process for the UCA LMR systems.

The process of strategic planning contributes to UCA by laying the foundation for success by identifying key topics for making important tactical decisions. With UCA, the key partnerships are in place, key strategic activities are already underway, and key resources are readily available. This Strategic Plan helps to build upon the solid culture already in place at UCA and strives to provide recommended areas of focus over the near term and into the future.

Mission-critical communications are composed of a varied range of solutions that includes a mix of devices, equipment, systems, and infrastructure all designed to enable first responders and others to communicate quickly, efficiently, and effectively in the field. The National Institute of Standards and Technology's (NIST) Public Safety Communications Research (PSCR) Usability Team has investigated the varied settings that first responders work in, their related experiences with incident response, the requirements for communication technology and their problems encountered while collaborating over the communications systems in place. These findings and recommendations contribute to the foundation from which this Strategic Plan is constructed.

The importance of LMR system operability and interoperability, as related to the public safety community UCA serves, makes it vital that administrators and public safety agencies comprehensively consider best practices in all aspects of project planning, including creation of partnerships and authority, identifying stakeholders, assessing technology, crafting and updating policies, and establishing operations and maintenance (O&M) requirements that may arise in a shared resources environment[3].

As identified by the approved SAFECOM Statewide Communications Interoperability Planning (SCIP) Methodology this communications interoperability provides, "The ability of public safety agencies to talk across disciplines and jurisdictions via radio

[2] Utah Code Section 63H-7a-206
[3] Best Practices for Planning and Implementation of P25 Inter-RF Subsystem Interface (ISSI) and Console Subsystem Interface (CSSI) (project25.org)

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communications systems, exchanging voice and/or data with one another on demand, in real time, when needed, and as authorized." At present through its Interoperability Division, UCA works diligently to promote a statewide voice and data network that delivers effective critical interoperable communications that are fiscally sustainable. This effort to enhance and promote interoperable emergency communications involves stakeholders at the State, Local, Federal, and Tribal levels.

The Project 25 Technology Interest Group (PTIG) defines "Public Safety" as "the collection of Federal, State, Local and Tribal agencies tasked with keeping the public safe." The communication needs of these individual agencies are diverse and unique when compared to the communication needs of the general public. In fact, depending on the respective missions, roles and operating environments, the communication needs of one Public Safety agency can even be quite different than the needs of another Public Safety agency. UCA handles these tasks well in providing service for 138 unique customer agencies.

1.2 Methodology

A diverse group of multi-disciplined subject matter experts were engaged to collect and analyze available information. This approach utilized the data previously gathered by the UCA team to obtain baseline information necessary for assessing UCA's operations, performance goals, technology needs, and staffing requirements to determine proactive strategic goals. By assigning a team of experts who are familiar with UCA's strategic initiatives, they could provide the required analysis through proven methods.

The P25 Radio team members are uniquely qualified, working for the past six years to assist UCA in procurement and implementation of the new statewide P25 radio system, making them already familiar with UCA and the State of Utah.

Based on interviews and discussions with stakeholders across the State, the team evaluated the current status of the strategic goals and objectives outlined in the 2021-2022 Strategic Plans, identified objectives that have been achieved and gaps that still remain to determine requirements for new strategic goals and objectives. Following extensive input and multiple review cycles, the outcome is the release of this 2023 Land Mobile Radio Strategic Plan.

The methodology used to develop this Plan comprised several steps to support the analysis and provide information to guide its recommendations, including the following tasks:

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1. Conducted a Project Initiation Meeting with UCA's Project Manager and key stakeholders identified by UCA to establish a mutual understanding of the project's background, goals, objectives, concerns, and vision.
2. Delivered the Request for Information (RFI) to gather pertinent technical information about UCA's existing systems and processes, categorized into the following areas:
    - Previous Communications System Studies
    - Organizational Structure, Agency Agreements, and Stakeholders
    - Funding
    - Processes and Procedures
    - Current System Technology
    - Coverage Improvements Information
    - System Performance
    - Backhaul / Transport System Information
    - Public Safety Answering Point (PSAP) / Dispatch System Information
    - Subscriber Equipment Inventory Information
3. Conducted onsite stakeholder interviews with representatives from each of the eight UCA districts, Communications, Technicians, and Management
4. Conducted remote interviews with manufacturer representatives, AT&T FirstNet, Cybersecurity, and Infrastructure Security Agency (CISA) and the UCA Radio Network Division.
5. Supplied the initial Findings Memorandum summarizing the' analysis and recommendations focusing on the UCA LMR staffing, organizational structure, funding, interoperability requirements, and governance.
6. Researched various other sources of information to capture suitable info
7. Interviewed various manufacturers to get an insight into future trends and products on the roadmap

1.3 LMR Strategic Plan Structure

This LMR Strategic Plan incorporates the analysis and findings to support near-term strategies for the UCA LMR systems. This Plan structures the content in each of the following categories:

- Key Stakeholders
    - First Responders
    - Dispatchers

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  - Operational UCA Divisions
  - Partner Agencies
  - Interoperability Stakeholders
  - Stakeholders Interviews
- Assessment of Existing Systems
  - LMR System Overview
  - Radio Dispatch Consoles
  - Radio Subscriber Devices
  - Statewide P25 Trunked System
  - Interoperability
- Organizational Assessment
- Action Plan

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2. Key Stakeholders

2.1 First Responders

First Responders are responsible for traversing the estimated 3,658 miles (5,887 km) of state routes and interstate highways in Utah. They do so in responding to emergencies, providing escorts and support for major events with authority throughout the State. First Responders are the primary users of the system. They depend on the UCA LMR systems to communicate and coordinate efforts during routine and emergency operations. First Responders use these vital systems as the backbone of their public safety operations. Having the UCA LMR system is crucial to mission success and a key factor in saving lives.

2.2 Dispatchers

UCA's 911 Division supports Utah's PSAPs that provide emergency 9-1-1 and dispatch services for First Responders in the field who respond to the needs of the public 24 hours-per-day. These dispatch services also extend to Public Safety agencies throughout the State, including federal, local, and tribal agencies. Communications Officers, also known as "dispatchers," serve as a vital link to First Responders in the field.

2.3 Operational UCA Divisions

Also, within the UCA operational structure are the Radio Network Division, P25 Division, and Interoperability Division, providing administrative management, technical oversight, and field support of the UCA statewide system. State and local Public Safety agencies depend on UCA to operate and maintain the UCA LMR systems, microwave backhaul, and data networks. Communications is a vital tool to both public safety field and command personnel during routine, local incidents and even more so during major incidents covering a larger area. UCA supports over 44,000 mobile and portable radios, 285 radio dispatch consoles across four regions, network connectivity to four redundant data centers and over 175 communications sites statewide. As with the other chartered agencies, UCA works with partners throughout the State, including local and federal agencies.

2.4 Partner Agencies

At the time of the development of this plan, 318 independent public safety agencies were partner agencies with UCA. These UCA LMR systems provide a critical link for partner

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agencies to communicate over LMR with dispatchers and other uniformed personnel supporting the public safety needs of residents on state routes, interstates, and county roads.

2.5 Interoperability Stakeholders

Interoperability is the ability of emergency response providers and relevant government officials to communicate across broad areas, disciplines, and levels of government as needed and as authorized.[4] Reliable, timely communications among public safety responders and between public safety agencies and citizens are critical to carrying out public safety missions effectively and, in many cases, saving lives. This extends to other governmental agencies UCA partners with for mutual aid when responding to planned and unplanned events. These other government agencies represent additional stakeholders that depend on the UCA LMR systems.

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[4] National Emergency Communications Plan, September 2019

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3. UCA LMR Systems Assessment

3.1 LMR Systems Overview

The Utah Communications Authority LMR systems combine a mixed technology of VHF and 800MHz Motorola Smartnet/SmartZone trunked radio systems that provide the 84,899 square miles of vast landscape with reliable interoperable mission-critical communications. The UCA P25 Division is diligently completing an upgrade to a new P25 Phase 2 Trunked system. This Radio System Upgrade to a new L3Harris P25 Phase 2 IP Trunked System Radio Communications System will contain four (4) IP based VIDA Core pairs, and consist of 144 radio sites, delivering a single, unified, and resilient platform supporting P25 voice, data, and applications across LMR and LTE networks. As an advanced solution, built with P25 standards and redundancy, this engineered platform reliably integrates critical services over a secure network. When completed this L3Harris P25 Phase 2 trunked radio system will replace the legacy 800MHz Motorola Smartnet/SmartZone trunked radio system and serve as a complement to the recently upgraded UCA VHF system.

3.2 Radio Dispatch Consoles

At present UCA supports 220 radio dispatch consoles across four regions statewide. As with the other divisions, UCA works with partners throughout the State, including local and federal agencies. The UCA radio system infrastructure enables live coordination with first responders during the real-time response of each incoming 9-1-1 call received. Therefore, the long-term plan will need to include continued support and enhancement to the capabilities of these UCA consoles and the 911 centers that the UCA LMR systems connect with.

3.3 Radio Subscriber Devices

UCA provided inventory data shows UCA has 44,000 subscriber units consisting of the following types of radios:

- EFJ5300 Series, EFJ5477 and VM900 Mobile radios from EF Johnson Technologies
- EFJ5170 Portable radios from EF Johnson Technologies
- VM5930, VM6390, VM6930 and VM7000 Mobile radios from JVCKENWOOD Corporation

- VP5430/6430 and VP600/900 Series Portable radios from JVCKENWOOD Corporation
- APX® 7500/8500 Consolette radios from Motorola Solutions
- APX® 8500 HP, AST-CON, ASTRO SPECTRA, AST-SPEC, MCS2000, XTL1500/2500/5000, XTL5000-CON, XTS3000-1 and Other Legacy Mobile radios from Motorola Solutions
- APX® NEXT, APX® 4000/6000/7000/8000, APX® 8000H, APX® 900, MT1500/MTS2000, MTS2000-2, MTX838, SABERS, V600, XTS1500/2500/2500-2/2500-3/2500-M2/2500-M3/3000/3000-3/5000 and Other Legacy Portable radios from Motorola Solutions
- Other Legacy Mobile and Portable radios were not accounted for on this list
- New L3Harris P25 Mobile and Portable radios were not accounted for on this list

Some radios, such as the Motorola XTL® 5000 mobile radios have reached the end of their manufacturer-supported lifecycle with limited support and parts available. This analysis assumes the replacement of existing radios with new P25 radios comparable to the Motorola APX® 8500 mobile radio and the L3Harris XL-200 radios within the upcoming budget cycles. Analysis also assumes the continued use of all other existing mobile and portable radios for the VHF expansion. There will need to be re-programming of existing radios to the new L3Harris P25 Phase 2 trunked radio system.

In addition to this UCA owned VHF network (Statewide and Statewide Radio System (SRS)), there are numerous independent county owned VHF networks. These autonomous operators have caused some confusion for users related to system maintenance. As a matter of statutory responsibility, UCA maintains its Statewide VHF network but does not maintain these local independent county owned VHF systems.

A commitment is made by UCA to maintain this important system that provides radio coverage for multiple vendor mobile and portable radios and continues to provide radio communications in a significant portion of Utah. The majority of all Federal land management agencies also utilize the VHF public safety band giving this system multiple uses.

Utilizing the Project 25 standard delivers a capability that may not be available on this Statewide VHF network system at this time. Additionally, the US Department of Agriculture, Forest Service (USFS) has also mandated the purchase of P25 compliant

radio equipment[5]. The transition to P25 could enhance UCA interoperability with Federal agencies that fight wilderness wildfires.

In a February 2023 Report to the President the topic was Modernizing Wildland Firefighting to Protect Our Firefighters and Closing Persistent Technology Gaps for Wildland Firefighters. An upgrade to P25 on the Statewide VHF network system could keep UCA users on the forefront of technology by providing the mandated location services called for in the Natural Resource Management Act (the Dingell Act 2019) [6] enabled by the LBS [Location-Based System] Program that combines current Global Positioning System (GPS) technologies with BLM fire and aviation preparedness for situational awareness.[7]

3.4 The Statewide P25 Trunked System

The Statewide P25 system scheduled to be completed by end of 2024 will equip over 144 radio towers with a suite of digital radio features. The new L3Harris Voice, Interoperability, Data and Access (VIDA) services platform integrates critical services, converged communications, and integrated applications into a scalable, feature-rich communications solution to meet diverse Public Safety challenges. The P25 Phase 2 trunked solution utilizes a suite of standards that specify P25 requirements and standards for the wireless digital Common Air Interface (CAI) designed for first responders. This new UCA selected P25 Phase 2 solution offers added system capacity in a pure P25 Phase 2 mode. The Project 25 Standard provides for hardware and software systems that exhaustively tested, rugged, dependable, and resilient platforms First Responders can rely upon for their mission critical communication needs.

This new P25 system delivers clear digital audio using the AMBE+2 vocoder, advanced Emergency call options, strong encryption options, increased traffic carrying capability, and spectrum efficiency. As stated above the UCA P25 system has added features, functionality, and more tower site locations to enhance the available RF coverage footprint and to provide additional capacity. As a service to public safety operators Utah stays current with this P25 radio system that utilizes a suite of standards to make certain digital two-way radio products from various vendors can interoperate with each other. The Utah Communications Authority has tested radios, developed, and published an approved radio list. This valuable service to the UCA System users authorizes specific

[5] P25 Digital Radios (nifc.gov)
[6] PCAST_Wildfires-Report_Feb2023.pdf (whitehouse.gov)
[7] Renewed call for the 'Holy Grail' of firefighter tracking - Wildfire Today

approved radio manufacturer models confirmed capable of operating upon this UCA provided P25 radio system.

UCA should continue evaluating P25 radio system performance indicators to understand where adjustments can be made to support and improve the jobs of first responders.

3.5 Interoperability

Interoperability is defined as the ability for UCA departments and outside agencies to communicate during incidents that require the response of multiple departments or agencies. Figure 1 illustrates the "five lanes" of the SAFECOM *Interoperability Continuum* as a tool to assist emergency response agencies and policy makers to plan and implement interoperability solutions.

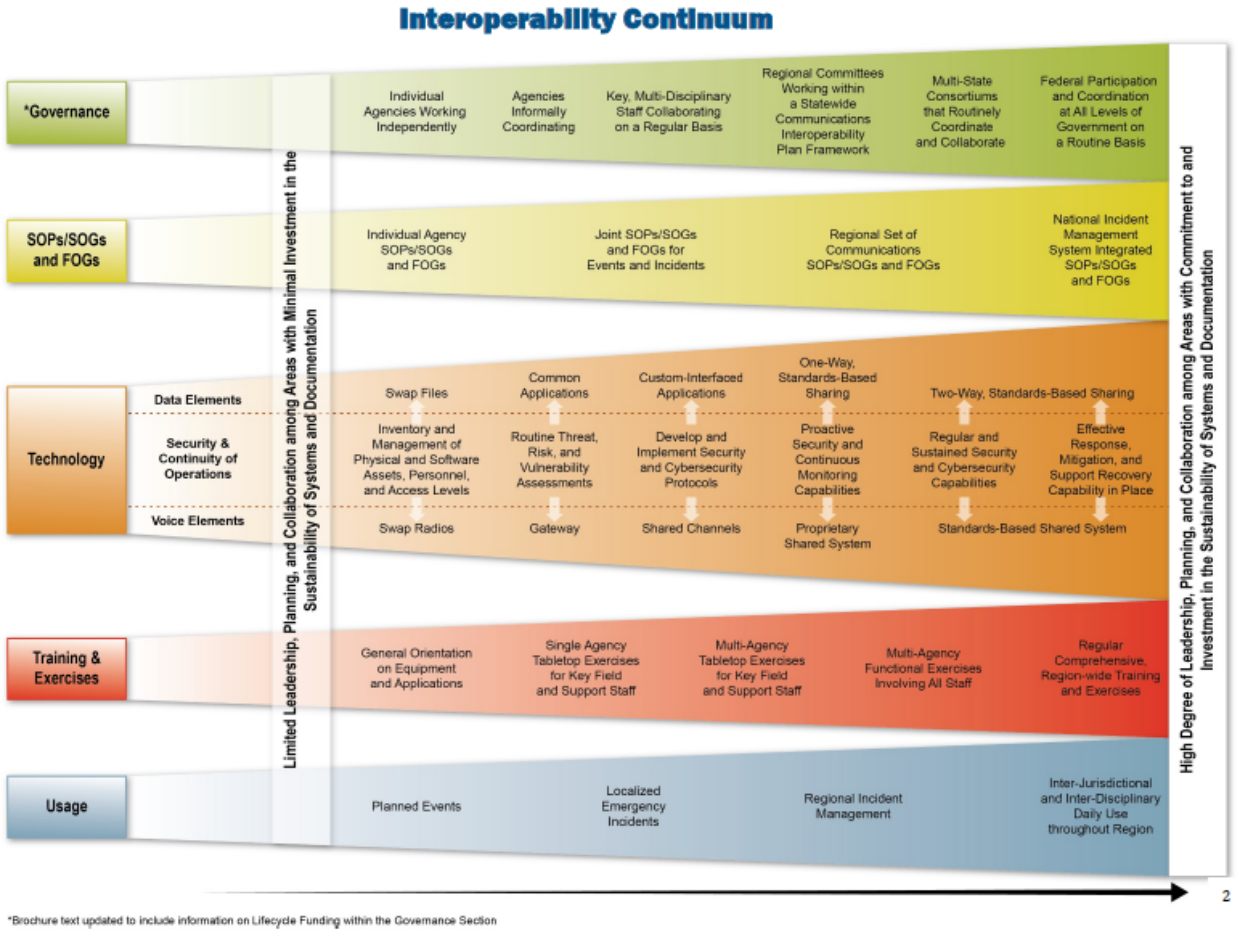

Figure 1 – DHS-OEC Interoperability Continuum

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For the purposes of this Plan, the Voice Elements section of the Technology Lane is pertinent. Moving from left to right, the methods become more advanced and effective in their ability to address interoperability requirements, and rely more on technology to increase the ease of interoperability, as described in SAFECOM's June 2021 brochure[8]:

- **Swap Radios**. While expensive and human-resource intensive, swapping radios or maintaining a cache of standby radios is a reliable but least sophisticated solution to achieve interoperability.

- **Gateway**. Gateways retransmit across multiple frequencies and talk groups, and also allow access to phone and cellular systems. Gateways provide an interim interoperability solution as agencies move toward shared systems. However, gateways encumber spectrum because each participating agency must use at least one channel in each band per common talk path and because they are tailored for communications within the geographic coverage area common to all participating systems. A gateway may also create latency and other technical obstacles between push-to-talk and traffic reception which can be adjusted to decrease impact on operations.

- **Shared Channels**. Interoperability is enhanced when agencies share a common frequency, talk group, or air interface (analog or digital) and are able to agree on common channels. A clear understanding of the nature and availability of interoperable communications channels in each area is essential to prevent congestion, and to assure that shared channels and/or talk groups can be assigned quickly and to appropriate end users when needed.

- **Proprietary Shared Systems and Standards-Based Shared Systems**. LTE Broadband combined with Regional shared systems are the optimal solution for interoperability. While proprietary systems limit the user's choice of product with regard to manufacturer and competitive procurement, standards-based shared systems promote competitive procurement and a wide selection of products to meet specific user needs. An optimal technology solution can be provided with proper talk group architecture and capacity planning, and both operability and interoperability addressed by system design.

Project 25 (P25) remains the predominant standard for public safety in North America. Most U.S. Federal Government and state grants require use of P25 based equipment.

[8] https://www.cisa.gov/sites/default/files/publications/21_0615_cisa_safecom_interoperability_continuum_brochure_final.pdf

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The P25 standard supports both conventional and trunked operations, with over 1,800 conventional systems and over 1,100 trunked systems in operation throughout the United States.

At the time of this Plan, there are twelve (12) P25 Conventional[9] systems and (9) P25 Trunked[10] systems in the State of Utah, as reported by the P25 Technology Interest Group (PTIG). There are also many other P25 systems that could be connected for interoperability in adjacent states. Therefore, the use of P25 systems and subscribers provides the highest likelihood of achieving interoperability with other public safety users. P25 is a mature and robust standard, providing detailed specifications with a well-defined interface path for connecting with other P25 radio systems, even with potentially disparate manufacturers.

Operating on a P25 system increases interoperability opportunities with other P25 users in the region. It is important to note that interoperability with other P25 systems may require additional system hardware and/or software, agreements, planning, and programming on the foreign system and subscriber units, but the potential for increased interoperability is there. With multi-band radios (VHF, UHF, and 7/800 MHz), UCA can retain existing interoperability with agencies on VHF but also program other UHF and 7/800 MHz channels for mutual aid purposes.

Interface Requirements

The P25 ISSI and Console Subsystem Interface (CSSI) provide the ability to interconnect radio and console subsystems, even when their manufacturers and software versions differ. This provides public safety agencies the opportunity to link their networks together to create a “system of systems” architecture. The ISSI could allow for interconnection of the UCA system to other P25 systems with necessary hardware, software, and programming on both ends. In addition to the existing IWN ISSI connection, interoperability with UCA and other P25 systems would require backhaul connectivity and ISSI hardware, software, and licenses on both systems, with ISSI talkgroups programmed on the radio systems and subscriber units.

It is important to note that ISSI provides a subset of P25 features. The following features can be supported between UCA and other ISSI interconnected system(s):

1. Automatic (hands-free) roaming to both systems
2. Confirmed group call

[9] https://www.project25.org/images/stories/ptig/P25_Conventional_Systems_List_Final_REV02_March_2020_200324.pdf
[10] https://www.project25.org/images/stories/ptig/P25_Trunking_Systems_Update_November_2021_REV_16_X.pdf

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3. Unconfirmed group call
4. Announcement group call
5. Emergency group call
6. Priority call (with and without preemption)
7. Advanced Encryption Standard (AES) encryption
8. Call alert
9. Emergency alarm
10. Emergency clear
11. Unit ID

Although not listed in the Interoperability Continuum, a dispatcher can create a "patch" between the channels used by different agencies so that transmissions on either channel are heard on both channels. Dispatchers typically create console patches for short durations and for specific events, but it can lead to operational confusion because of infrequent use. Console patching is also inefficient in that it uses the channels of all involved agencies involved. Nevertheless, the design includes interoperability gateways at each communications center, allowing interfaces to 700 MHz P25 trunking, VHF P25 Conventional, and VHF analog conventional channels.

3.6 System Assessment

3.6.1 LMR Systems

The L3H P25 system is a software based feature rich product so features, functionality, performance tracking and reporting, and other similar enhancements, should be reviewed and considered. L3H publishes a roadmap so UCA should monitor the updates to identify any suitable features.

3.6.2 Dispatch Consoles

Dispatch provides the ability of emergency response providers and relevant government officials to communicate across jurisdictions, disciplines, and levels of government as needed and as authorized[11]. Reliable, timely communications among public safety responders and between public safety agencies and citizens are critical to carrying out public safety missions effectively and, in many cases, saving lives. This extends to other

[11] National Emergency Communications Plan (cisa.gov)

governmental agencies UCA partners with for mutual aid when responding to planned and unplanned events. These other government agencies represent additional stakeholders that depend on UCA and its complimentary LMR systems.

During calendar year 2022, for all of Utah's PSAPs combined, Utah experienced the following telephone call volumes:

- **1,057,015** incoming 9-1-1 Calls received, including abandoned calls
- **2,259,670** 10-digit calls received (undifferentiated between 10-digit emergency and 10-digit administrative calls), including abandoned calls
- **936,654** Outbound telephone calls were made by dispatchers in support of these 9-1-1 Calls received

The UCA radio system infrastructure enabled live coordination with first responders during the real-time response of each of these calls.

3.6.3 Radio Subscribers

UCA should:

- Continue to support the existing Motorola APX® series and the new L3Harris XL185 and XL200 and Motorola APX NEXT™ subscriber units as there are no manufacturer-published end-of-life notifications, and the manufacturer still provides support and parts for these products.

- Utilize subscriber units with multi-band and multi-mode capabilities as these features increase interoperability.

- Suggest the replacement of any radios that have reached the end of their manufacturer-supported lifecycle with limited support and parts available.

3.6.4 Coverage Enhancements

There are several measures that UCA could implement to improve coverage along roadways, as well as coverage inside buildings, such as key UCA facilities. The following subsections describe opportunities for LMR coverage enhancement.

3.6.4.1 DAS / BDAs

During an emergency first responders must be able to maintain communications at the location. Their mission critical communication devices must transmit and receive in hard-

to-reach areas, such as stairwells, elevators, basements, and thick-walled or shielded areas. Newly built LEED-certified buildings with low-E glass[12] often suffer from poor public-safety signal coverage due to signal attenuation caused by the low-E glass[13] used during construction. This mission critical level of in-building coverage for first responders is not an amenity but a requirement.

UCA should encourage the use of distributed antenna systems (DAS) and/or bi-directional amplifiers (BDA) to improve the portable coverage inside specific buildings. These types of solutions can vary in cost and complexity, depending on the size of the building under consideration, the construction materials used in the building, and frequency band(s). In addition to 700/800MHz P25, considerations for VHF, and other 700/800MHz and FirstNet's® 4G/5G LTE frequency bands should be considered. In many cities, any new construction has ordinance for in-building systems. However, for many existing buildings, owners are not obligated to install them[14].

3.6.4.2 Emerging Technologies

P25 systems have the capability for smartphone/broadband device integration (SPBBI) to integrate voice and data communications between P25 700 MHz trunked radio users and other field users with broadband devices and/or smartphone applications. The SPBBI system can provide PTT communications operating over private and public Wi-Fi networks, 4G/5G commercial carrier networks, and FirstNet's® 4G/5G LTE network. The system can support both carrier-integrated Push-to-Talk over Cellular (PTToC) operations and over the top PTToC operation on carrier networks as well as private and public Wi-Fi networks. The system can support management of features and functions such as Quality of Service (QoS), PTT Call Priority, and Preemption.

This SPBBI solution must enable Push-to-Talk (PTT) communications operating over private and public Wi-Fi networks, 3G/4G/5G carrier networks, including but not limited to FirstNet's LTE network. The SPBBI Subsystem must stipulate that UCA will not be held responsible for performance over private/public Wi-Fi networks or cellular networks utilized and that the network utilized support the following:

1. Carrier integrated PTT over cellular (PTToC)

[12] Why Low-E Glass Blocks Cell Signal and How a DAS Can Help - Waveform
[13] Public Safety DAS: NFPA/IFC Codes & ERRCS Testing [2023] - Waveform
[14] Utah Code Section 15A-1-403

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2. Over-the-top PTToC operation on carrier networks

3. PTT communications on private and public Wi-Fi and other broadband networks (PTToBB)

The SPBBI system server hardware must use high-reliability internally redundant processor platforms. The system can support reporting and display of location information for broadband and smartphone user devices. The system can supply an interface to an audio recording and retention (logging recorder) system, meeting the legal and operational requirements of the State. SPBBIs can also be compliant with open standards for encryption and authentication, subject to applicable UCA policy.

The SPBBI system includes the necessary hardware, software, and licensing to provide TIA-102.BACA (P25 ISSI) network-level communications and the following P25 supplemental services:

- Group calls
- Emergency calls
- Call alert
- Radio check
- Radio detach
- Radio inhibit/uninhibit
- Emergency call monitor
- Short message
- Status query

3.6.4.3 Coverage Enhancement

UCA has considerable options available additional sites, micro-sites, and mobile site on wheel solutions to improve mobile and portable radio coverage, and/or evaluating emerging technologies third-party 4G/5G LTE networks for augmentation of the UCA LMR Systems in place.

To provide greater customer service UCA will closely monitor the new P25 700 MHz trunked radio system once it is in place. P25 radio system performance indicators can show where adjustments can be made.

3.7 Backhaul Network

The current hybrid UCA data transport solution is unique and as such it requires a prudent monitoring methodology. Consider strengthening the network with modifications and upgrades designed to provide a secure, reliable, and redundant system-wide digital backhaul transport throughout the State for the UCA LMR systems and the PSAPs.

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Modern data transport represents a substantial investment as it is a major component within any mission-critical communication system environment. The backhaul network that interconnects tower sites and control centers requires practical consideration, especially when a hybrid approach is in place. UCA needs to work to secure the vital link between all UCA tower sites and PSAP locations.

The goal is to provide reliable and redundant backhaul access throughout the State. To guarantee high system availability, transport protection measures should include built-in monitoring to trigger alarms/switchovers when transmission parameters are compromised. System design including multi-path routing, ring structures, and duplicate bearers can contribute to this objective. UCA also needs to make certain that the performance parameters are clearly identified, particularly with third-party providers, for each data transportation link.

The tower structures that support the backhaul network require constant monitoring as well as periodic maintenance, remediation when necessary, and replacement. A plan should be in place that includes tower inspections every three years. In addition, depending upon climate, any tower over 30 years old should be periodically evaluated for refurbishment or replacement. A comprehensive Operations and Maintenance (O&M) plan for UCA infrastructure and support components provides visibility to future costs, plans for overall system reliability, and can be used to reduce energy consumption and other costs.

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4. UCA Action Plan

A summary of key findings for infrastructure system management, radio programming, infrastructure maintenance and repair, inventory management (including Spares), and operational procedures follows.

4.1 Current Staffing and Organizational Structure

Current staffing at UCA shows diversity in the workplace. This inclusion facilitates an understanding of the cross-functional backgrounds and facilitates the cross-cultural impact UCA systems have a responsibility to serve. This stakeholder mapping incorporates a comprehensive approach by exploring how each of the users that benefit from this project are connected to the system. This applies as designated by the Utah Communications Authority Act as it establishes the Public Safety Advisory Committee (Utah Code Ann. 63H-7a-207) and the PSAP Advisory Committee (Utah Code Ann. 63H-7a-208)[7]

UCA should work to improve hiring campaigns, offer a defined career path, and develop a formal training plan to help with successfully recruiting, training, and retaining qualified technicians.

UCA should evaluate staffing level needs as new systems are brought online, with a reassessment of roles and responsibilities with appropriate promotions and compensation levels designed to improve retention.

4.2 UCA LMR Systems

The process containing three levels of subscriber programming helps UCA to modernize and continue to bring value to this important VHF radio resource.

UCA should continue to monitor and evaluate the service this system provides as well as developing ways this system can augment coverage by connecting to Federal agency VHF and non-UCA member VHF systems.

UCA should continue evaluating new subscriber handsets and update the approved radio list to provide a greater range of approved P25 choices to participant agencies.

As this P25 implementation nears completion, new areas of need, such as RF coverage fill-in needs, will become apparent. UCA will address each with due diligence so that the needs and requirements of the public safety personnel are maintained.

UCA is deploying a P25 standards-based shared system which includes compliance with the P25 Common Air Interface (CAI). The P25 CAI enables over-the-air interoperability between P25 radios regardless of manufacturer. If another agency has a P25 radio system within the state or in a surrounding state, UCA can program their P25 mobile and portable radios with talk groups on the other P25 system, and vice-versa. The P25 Inter-RF Subsystem Interface (ISSI) interconnects different P25 core networks, regardless of frequency band or manufacturer, to allow roaming of user radios between networks. ISSI supports many common P25 features, including Caller ID, group calls, encryption, and emergency calls. A user roaming into a foreign system must have radios which are on the same frequency or multi-band compatible with the foreign host.

4.3 Cybersecurity

By necessity, cybersecurity has risen to the forefront of organizational concerns with the abundant use of prolifically connected digital technologies. Regardless of whether these communications are over a wired or wireless medium, the same rules related to third-party risks must apply. To equip The State of Utah with the information and guidance required to combat ongoing threats, the Department of Homeland Security created a communications program called SAFECOM. SAFECOM is an integral component of the Department of Homeland Security's (DHS) efforts to enhance the Nation's interoperable emergency communications. Managed by the Cybersecurity and Infrastructure Security Agency (CISA) they and SAFECOM provide a wealth of public safety grade "mission critical" field-tested solutions, use cases, related guidelines, and associated information.

"SAFECOM works with existing federal communications programs and key emergency response stakeholders to address the need to develop better technologies and processes for the coordination of existing communications systems and future networks"[15]. "Through these partnerships, SAFECOM has created key documents such as the Interoperability Continuum, the Statement of Requirements (SoR) for baseline communications and interoperability standards, the Statewide Communication Interoperability Plan (SCIP) Methodology, and the National Emergency Communications Plan (NECP) to assist

[15] SAFECOM | CISA (SAFECOM Blog)

emergency responders nationwide with improving communications and interoperability"[16].

The SAFECOM Interoperability Continuum, at present already an important part of the UCA system, has served as a pillar for emergency communications and critical infrastructure communities for decades. It explains ways to improve the operability and interoperability of public safety communications[17]. As stated previously, these valuable tools from CISA are already in use by UCA administrators.

Stakeholders benefit when UCA continues to utilize this proven governance structure. Doing so means UCA is prepared to take proactive measures to manage and mitigate cybersecurity risks, expand field training opportunities to reinforce policy and procedure, and content to improve operational readiness policies and procedures through design continuity. Additional emphasis on resiliency measures, including backup power, overlapping coverage, and route diversity will enhance UCA's ability to build a better statewide public safety communications network for its customers.

Recommendations based on the analysis are as follows:

1. UCA should integrate the cybersecurity analysis as outlined in Utah's Statewide Communication Interoperability Plan (SCIP) Section 5.7 along with the DHS SAFECOM recommended Interoperability Continuum.

2. Continued use of the commonly recognized four pillars of an effective cybersecurity strategy are risk assessment and management, security control implementation, security awareness and training, and incident response and recovery.

3. Building closed networks to assist in any cybersecurity approach. Where this approach is impractical perimeter firewalls should be employed. Remember that each individual component connected to the network plays a significant role, while it works in harmony within the integrated system. In this integrated approach, it is more important to review and understand how all the various parts work together to make certain that the UCA cybersecurity strategy is successful.

[16] SAFECOM | CISA (SAFECOM Blog)
[17] SAFECOM Publishes Updated SAFECOM Interoperability Continuum and Frequently Asked Questions | CISA

4. A program built with periodic checks and balances as UCA strives to build a resilient communications network that is unreachable from the outside world, where many of the threats exist. Other threats exist within UCA amongst members, employees, and third-party resources that may periodically help to maintain the system.

5. Building a routine corporate structure that encourages due daily diligence combined with network security at the forefront where everyone that touches the UCA network is aware and conscious of ongoing threats and how to counter them.

4.4 FirstNet/LTE Evaluation and Implementation

On Tuesday, November 6th, 2017, then Governor Herbert announced that Utah had opted in to using FirstNet for its First Responders, making Utah the 31st state and territory to opt into this wireless broadband network[18]. As mentioned above in the Key Initiatives introduction, no single communications network approach will suit every public safety use case. It is important to remember that each individual component plays an important role, but also works in harmony within the wholly integrated UCA system. UCA administrators should view the issue from multiple perspectives and understand how each of the various components work together as well as how each module operates independently. The FirstNet Authority was designed and built as a nationwide wireless broadband network specifically for first responders.

UCA should be aware that all Broadband LTE solutions are not created equally. While all of these strive to offer ubiquitous coverage across the country and across carriers, prudent examination should be employed as some carrier plans do not provide first responder priority and that do not have sites that are hardened, redundant, or sustainable in the event of a natural or man-made disaster. Broadband LTE solutions such as The FirstNet First Responder Network[19] built by an independent agency within the federal government with AT&T in a public-private partnership with the First Responder Network Authority (FirstNet Authority) provide these fundamental characteristics.

UCA should explore the many ways that this technology can augment their operations. In connecting disparate radio networks multi-network interoperability can be achieved with existing LMR systems. Where concerns exist related to sharing encryption keys

[18] Utah opts into FirstNet | Division of Technology Services
[19] FirstNet Brings First Responders Innovative Tools (att.com)

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Broadband LTE could provide a conduit through which this multi-network interoperability is possible.

UCA should consider employing the following recommendations:

- A single secure LTE-enabled talk group can also provide a method for the local PSAPs to also join the conversation. As an example, consider the case where Agency A needs to interact with Agency B. To complete the connection, a Broadband LTE talk group can be utilized to bridge these often geographically separated LMR systems. Pulled together through a single secure LTE-enabled talk group, each Agency continues to maintain its own priority encryption scheme while this mutual aid talk group securely bridges the two different systems together.

- Evaluation of a Broadband LTE talk group that could be utilized as a metropolitan street-level, parking deck and in-building coverage enhancement for users that frequent these areas. Existing LTE can help with in-building coverage and the urban canyon effect that exists within city centers where high skyscrapers, tower buildings and other closely confined structures give any city center its own unique geometry. This urban canyon effect creates areas characterized with narrow streets and tall buildings on both the sides of the street, creating a three-dimensional barrier which has an ability to impede wireless communication signals much like a canyon environment could.

- Continued evaluation into using FirstNet for its First Responders. Even though the State of Utah has publicly announced a partnership with The FirstNet Authority, little evidence exists that this network is being used to enhance public safety network communications. FirstNet can provide an augmentation to the UCA LMR systems.

- UCA should also evaluate a vehicular communication platform utilizing products like Motorola's APX NEXT™ and SmartConnect capabilities and the L3Harris BeOn® Mobile Application. The goal with exploiting these technologies is to leverage the coverage provided by FirstNet's® 4G/5G Long-Term Evolution (LTE) network to supply supplemental communication paths to UCA mobile and portable radios. This provides an increased communication resiliency with multiple paths available supporting PTT voice traffic, and to reduce operational complexity for First Responders in conventional-only areas.

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4.5 Special Radio System Challenges

Last mile links in remote areas require a varied approach to providing mission-critical connectivity for first responders working in these places. Unique communications challenges require creative solutions. By necessity, these first responder agency organizations must utilize UCA LMR systems everywhere.

UCA should:

- Evaluate smart connectivity-anywhere practices created to provide secure and reliable dual or tri-band gateway capabilities for first responders and seasonal caretakers. One such option for covering these last mile areas could include custom designed solutions that leverage a combination of broadband LTE, satellite communications (SatCom) and other secure wireless mesh networks to securely support in-area P25 radio subscribers. In one approach a traditional LMR conventional repeater could suffice, provided a method of radio transport hop back to the existing LMR is available. Other more creative avenues exist such as repurposing a vehicular or man worn Wi-Fi solution to cover a small space or incorporating a real-time, secure IP mobile satellite communication solution that could provide a small footprint connectivity into these recreational places. Suitable solutions can be found through vendors such as Hypha, L3Harris Technologies, and Motorola Solutions.

- Evaluate enhancing and bridging satellite communications (SatCom) for Mission-critical communications. One vendor's approach is provided by a portable P25 IP relay that could be semi-permanently mounted to provide a small form factor device that could be utilized via solar power to provide fill-in coverage in remote areas. Many commercial enhancements have been made recently with SatCom by vendors such as Hypha, Skymira and Simoco Wireless Solutions.

- Strive to build a portable P25 Network that is highly secure, FIPS 140-2 level 1 validated and manufacturer agnostic, supporting all manufacturers P25 radios. To assist administrators and dispatch this portable P25 Network should transfer all required P25 metadata with the audio, including Unit ID, GPS location & emergency call. To be effective this last mile link should also be designed as one that is network agnostic with automatic roaming to the greatest extent possible.

- Identify a solution capable of exploiting satellite connectivity along with other bearer networks that use standardized communication protocols such as LTE, FirstNet, fixed site ISPs, and/or available fiber optic networks and one that transmits all P25 audio, subscriber ID, GPS location & emergency call.

- Monitor FCC and other regulatory guidelines as mobile satellite communications continue to evolve SatCom solutions for PSAP connectivity[20].

4.6 Infrastructure System Management

UCA is committed to system maintenance. This effort requires a long-term organizational commitment, consistent monitoring of system parameters, routine software/firmware upgrades, assessment of repair-replacement tradeoffs, and a constant awareness of the regulatory environment. Industry trade publications and manufacturers often recommend that inspections and preventative maintenance take place on a regular, recurring basis to provide proper system functionality and to confirm that the system is operating within manufacturer's specifications and FCC regulations.

UCA should:

1. Monitor and comply with their existing maintenance procedures in place, including the following routine maintenance tasks:
    - Remote sites – Site inspections at six-month intervals for Uninterruptible Power Supply (UPS) testing, battery charger/battery load testing, ground testing, alarm system testing, fuel system inspection, and overall visual inspection of the following:
        - Primary power systems
        - Backup power systems
        - Antenna systems
        - Grounding systems
        - Shelter condition
        - Tower condition
        - Site condition

[20] FCC Proposes Framework to Facilitate Supplemental Coverage From Space | Federal Communications Commission

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- Radio infrastructure – Annual inspections and where applicable, frequency calibration, power output, deviation, Voltage standing wave ratio (VSWR), and line sweep testing, software/firmware upgrades for the following equipment (as applicable):
  - Site controllers
  - Simulcast controllers
  - Base stations
  - Global Positioning System (GPS) time-base systems
  - Voting systems
  - Backhaul systems
- Subscriber Radios – Annual inspection and software/firmware upgrades for the following units:
  - Mobile radios
  - Portable radios
  - Control stations
  - Wireless headsets
- System Radio Core – Inspections and testing at annual intervals to include:
  - Vendor prescribed test procedures related to all network and radio system segments and components.
  - Primary power systems
  - Backup power systems
  - Grounding systems
  - Backhaul systems
  - Readiness functional tests of disaster recovery plans
- Dispatch console sites – Inspections and testing at annual intervals to include:
  - Vendor prescribed test procedures related to all console system and network segments and components.
  - Primary power systems
  - Backup power systems
  - Grounding systems

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- Backhaul systems

UCA should create a document explaining the level of radio services that the UCA LMR systems provides, including but not limited to, system management, infrastructure maintenance, redundancy and security, disaster recovery plan, performance standards and monitoring, and upgrades and enhancements.

By continuing to provide support 24 hours per day, 7 days per-week, 365 days per-year (24/7/365) UCA supports the mission to minimize time to recover during an emergency condition. An emergency schedule with a contact list of technical personnel, site entry security procedures, site phone numbers, site owner contact information, and utility contact information for each site location should be available to all personnel who, when called upon, can respond to any emergency outage. The following is a list of suggested components and equipment to support a response to an emergency:

- All-weather vehicles for transportation to critical remote sites
- Appropriate test equipment and tools
- Spare radio system infrastructure (site controllers, base stations, etc.)
- Spare antennas, transmission lines, and associated hardware
- Spare mobile, portable, control station equipment
- Backup components for communications centers
- Backup components for core and voting site systems

The following is a list of steps to extend system life and avoid service degradation:

- Establish and perform regular preventative maintenance on all systems
- Establish and maintain a spares inventory of components for all systems
- Develop a response plan for emergency outages
- Maintain relationships and information exchange with other system operators that utilize the same type of systems
- Join online technical groups that provide technical information exchange

While there are many approaches to system maintenance, the decision rests with UCA technical staff and radio and backhaul vendors to develop a maintenance program that allows UCA to provide the level of service that their stakeholders expect.

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4.7 Infrastructure Maintenance and Repair

At present, UCA has an online customer service portal where a user of UCA's Radio System and are experiencing an emergency radio outage or problem can Page an On-Call Technician, Request Support, Report an Interoperability or Radio Programming Issue[21].

It is recommended to combine this customer service portal with an organized work order structure for tracking system issues, trouble calls, repairs, or maintenance activities. UCA should evaluate the use of a single asset management tool that can be implemented, such as the MCMtech Commshop solution, to track and manage every aspect of radio support operations. Being able to issue a trouble ticket and follow the process through to the conclusion is vital to continuing the sharp level of customer service that UCA maintains.

This Commshop solution is designed for organizations who need to track and manage radio communications issues and the complex assets that are associated with maintaining a statewide radio system. With these tools UCA can manage every aspect of mission-critical operations with one powerful, user-friendly solution. This solution is purpose-built for the communications industry. The solution provides:

- Control related to assignment of radio system IDs.
- An ability to create work orders that track labor and material costs, linking all activity to all relevant records.
- Storage of key information in a detailed profile for each site. Record infrastructure assets to specific site locations, images of grounding, mounted equipment at the site, and keeping track of vendors for the site are examples of the valuable information stored.
- A dashboard that visually displays and monitors the metrics that matter to you most by providing a 10,000 ft. view of the assets, work orders and inventory being managed in the solution.

This tool simplifies the process when an agency/user needs radio repair or replacement. This also simplifies the inventory management (including spares) for UCA.

[21] Page on Call Tech (uca911.org)

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UCA Glossary of Acronyms

3GPP	Third Generation Partnership Project group
ANSI	American National Standard Institute
APCO	Association of Public-Safety Communications Officials
AVL	Automatic Vehicle Location
Broadband	Broadband is a term used to describe wireless high-speed internet access, as defined by the FCC
CAD	Computer Aided Dispatch
CAI	Common Air Interface (P25)
CISA	Cybersecurity and Infrastructure Security Agency
COMLs	Communications Unit Leaders
COMTs	Communications Technicians
COMU	Communications Unit
Core	a **Core is a networking term** that refers to a distributed architecture computing design composed of multiple servers each acting as a central conduit to reliably connect and transfer network traffic at high speeds
DEM	(Utah) Division of Emergency Management
DHS	Department of Homeland Security

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DTS	Department of Technology Services
ECD	Emergency Communications Division
EMS	Emergency Medical Services
EOC	Emergency Operations Center
ESInet	Emergency Services IP network
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FirstNet	First Responder Network Authority
GIS	Geographical Information System
ICS	Incident Command System
INCM	Incident Communications Center Manager
Interop Continuum	Developed by the Department of Homeland Security's SAFECOM program, the **Interoperability Continuum** is a tool that helps emergency response agencies and policy makers plan and implement solutions for data and voice communications that can work across different disciplines and jurisdictions.
IT	Information Technology
ITIL	IT Infrastructure Library
ITSM	IT Service Management

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ITU	International Telecommunication Union
KPI's	Key Performance Indicators
LMR	Land Mobile Radio, a wireless communication system that uses push-to-talk radios and repeaters to create real-time, one-to-one or one-to-many communications
LTE	Long-Term Evolution, a standard for wireless broadband communication, based on the GSM/EDGE and UMTS/HSPA standards
MOU	Memorandum of Understanding
MSAG	Master Street Address Guide
NCSWIC	National Council of Statewide Interoperability Coordinators
NECP	National Emergency Communications Plan
NENA	National Emergency Number Association
NFPA	National Fire Protection Association
NG911	Next Generation 911
NIMS	National Incident Management System
NIST	National Institute of Standards and Technology
NPSBN	Nationwide Public Safety Broadband Network
NPSPAC	National Public Safety Planning Advisory Committee

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NPSTC	National Public Safety Telecommunications Council
O&M	Operations and Maintenance
OEC	Office of Emergency Communications
P25	Project 25 Suite of standards, published by ANSI.
PRC	Peer Review Committee
PSAC	Public Safety Advisory Committee
PSAP	Public Safety Answering Point
PSCR	Public Safety Communications Research (a part of NIST)
PTIG	Project 25 Technology Interest Group
RCC	Regional Communication Center
SAFECOM	**S**afety **A**nd **F**light **E**valuation **COM**munication, a program of the Department of Homeland Security (DHS) that aims to improve public safety communications across different levels of government and emergency response agencies.
SatCom	Satellite Communications
SCIP	Statewide Communication Interoperability Plan
SERT	State Emergency Response Team

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SmartConnect	A product from Motorola Solutions that automatically switches PTT voice communications between P25 and broadband and provides interconnectivity to 3rd party cores
SOP	Standard Operating Procedure
SoR	Statement of Requirements
SWIC	Statewide Interoperability Coordinator
THSP	Technical Specialist
TICP	Tactical Interoperable Communications Plan
TTX	Table-Top Exercise
UCA 911	UCA 911 Division
UCA Interop	UCA Interop Division
UCA P25	UCA P25 Division
UCA Radio	UCA Radio Division
UCA	Utah Communications Authority
UDOT	Utah Department of Transportation
UHF	Ultra High Frequency, one of the first designated public safety bands, typically 450-470 MHz
UHP	Utah Highway Patrol

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Vesta	VESTA Call Handling Software, a product from Motorola Solutions
VHF	Very High Frequency, one of the first designated public safety bands, typically 150-174 MHz
VIDA	**V**oice, **I**nteroperability, **D**ata and **A**ccess (VIDA) a product from L3Harris that automatically switches PTT voice communications between P25 and broadband and provides interconnectivity to 3rd party cores