E911 Dispatch Migration

Stakeholder's Meeting

2/21/2017

E911 Dispatch Migration Stakeholder's Meeting Agenda

- Introductions
- Review Project Items
  - Overview
  - Objectives
  - Organization
  - Scope
  - Milestones
  - Budget
  - Status
- Public Comment

Project Overview

- Successful implementation of an E911 Dispatch Services Contract with the City of Wasilla.
- Dispatch services will be migrated to COW's MatCom dispatch center.
- Dispatch services for MSB will be consolidated into a single location.
- End-to-end PSAP systems will be implemented for resilience and redundancy.

Business Objectives

- A seamless transition of emergency services dispatch to the COW's MatCom dispatch center.
- Streamline resources within the Borough.

Project Objectives

- Extend dispatch services contract with PPD to provide for transition of dispatch duties to WPD.
- Finalize contract between the MSB and the COW.
- Complete the seamless migration of E911 dispatch services from PPD to WPD.
- Ensure the continuation of operations for the Records Management System (RMS).

Project Organization

- Project Sponsor
  - John Moosey, MatSu Borough Manager
- Steering Committee
  - Otto Feather, George Hays, Cheyenne Heindel, Eric Wyatt, Steve Colligan
  - Role: Executive Management stakeholders that advise the sponsor/owner on their area of influence in major business decisions
- Single Point Of Contact (SPOC) – Mark Baker, MSB Telecommunications Technology Manager
- Stakeholders
  - City of Wasilla, MSB Emergency Services, MSB Animal Care and Regulation, MSB Information Technology, AST, PPD, WPD, SOA, City of Palmer, MSB Residents
- Support Team Project Members

Project Scope

- Completion of a contract to cover the services provided by City of Wasilla. This contract will include all related SLA's.
- Development of a budget schedule for FY18 E911 funds.
- Distribution of funds based on contract requirements.
- Completion of written dispatch protocols for dispatching all fire, EMS, rescue and animal care officers.
- RMS software integrations with CAD system.
- Transfer of existing CAD equipment from MSB to PPD.
- Project management for the MatSu Borough deliverables and responsibilities for this project.
- Ensuring proper fulfillment of the negotiated contract by City of Wasilla.

Project Milestones

- 12/13/2016 – Palmer City Council Approval of PPD Dispatch Contract Extension
- 12/20/2016 – E911 Dispatch Contract Award to City of Wasilla
- 12/20/2016 – Assembly Approval of PPD Contract Extension
- 1/31/2017 – Signed Contract with City of Wasilla for E911 Dispatch Services
- 3/1/2017 – Select Records Management System Replacement
- 4/1/2017 – Dispatch Services Overlap and Transition Period Begins
- 7/1/2017 – Cutover E911 Dispatch Services to City of Wasilla
- 7/28/2017 – Conduct Lessons Learned

Project Budget

- Transition Period Cost: $1,095,576
- E911 Dispatch Contract Total Cost (5 years): $8,312,183
  - Capital Expense: $1,800,668 (lifetime)
  - Operating Expense: $1,302,303 (annual)
- Potential Overrun Cost: $506,000

E911 Dispatch Migration Project Budget Summary

Description	Type	FY	Amount	Budgeted
Capital Portion of New Dispatch Contract	CAPEX	18-22	$1,800,668.00	No
E911 Upgrade	CAPEX	17	$225,000.00	Yes
Reverse 911	CAPEX	17	$300,000.00	Yes
CAD-CAD	CAPEX	17	$48,000.00	Yes
RedAlert RMS Replacement	CAPEX	17	$250,000.00	Yes
PPD Dispatch Support (1/1/17 - 6/30/17)	OPEX	17	$450,000.00	Yes
Overlap Dispatch Support For COW (4/1/17 - 6/30/17)	OPEX	17	$325,576.00	Yes
CAD/RMS Extension	OPEX	18	$56,000.00	No
Operating Portion of New Dispatch Contract	OPEX	18-22	$6,511,515.00	No
Project Management	OPEX	17	$70,000.00	Yes

Project Status

E911 DISPATCH MIGRATION PROJECT

WEEK ENDING: FEBRUARY 15TH, 2017

PROJECT STATUS SUMMARY Percent Complete: 27%

Scope	Schedule	Cost	Risks	Quality

Green	On Track
Yellow	Off track, recoverable within the defined project plan. +/- 5% variance to plan.
Red	Off track. NOT recoverable within the defined project plan. +/- 10% variance to plan.

Risks

- RedAlert RMS is not replaced before dispatch services are migrated.
- MSB is unable to provide operating procedures to COW in a timely manner.

Open Issues

Feb 21-24 2017 →

- Distribution of funds must begin so COW can continue work.
- Ability to staff dispatch support by COP.

PUBLIC SAFETY COMMUNICATION SYSTEM

Detailed Presentation

2016

Prepared by
MSB IT
Dept. of Emergency Services
Resource Data, Inc.

This presentation will explain the many issues our emergency responders face today with the current public safety communications system while exploring the options on how we can meet the needs and provide the public with a system that will work for years to come.

Public Safety Communications System Detailed Presentation

How we have outgrown our current public safety communications system

Slide 1 – Agenda

Today, we are here to talk about public safety, how we have outgrown our current public safety communications system, and how we can solve the problems facing us today. We will be discussing the following:

- Public Safety Communication System – how it works and what our emergency responders need.
- What we have today and the challenges we face.
- Researched solutions and how each of these meets our needs.
- Projected Costs for each of the viable solutions.
- Recommendation based on the research.
- Proposed implementation plan.
- Summary.

Slide 2 – Introduction

The borough public safety communications emergency responders include fire, water rescue, and emergency medical response.

So, how does it work? It begins with a 911 phone call. The dispatcher then sends out a signal that emergency personnel respond to. Communication is provided through tower signals that sends critical information to the responder. Depending on the need, there may be several responders that communicate through radios. Radios used are both vehicle installed and hand held. The most important piece in any response is communication.

Emergency responders need

- 24/7 reliability wherever they are.
- Secure, clear, uninterrupted communication.
- A system that is able to track and record an incident.

There are many different communication systems. Today, we will compare what we have to what is available and viable for our needs.

Slide 3 – Current Public Safety Communication System

Current Communication System:

- Conventional VHF analog system.
    - A conventional system uses one channel. The responder uses a dial or button on the vehicle radio to pick up the appropriate channel. As the vehicle moves from one site (radio tower) to another, the responder must physically change the channel.
    - The VHF range is 30-300 MHz's. Currently, our public safety radios are in the 150 range.

Radio frequencies for public safety are available up through the 800 MHz range.
    - Analog radios use frequency modulation waves to send communications. Think of this frequency as a one street town.
- Using ALMR (Alaska Land Mobile Radio) as a secondary system.
    - Our responders mainly use ALMR to communicate with the State, the city of Wasilla, and any other entity that likewise, uses ALMR. This enables us to communicate with other responders in times of disasters such as last year's Sockeye fire.
    - ALMR uses a Motorola™ ASTRO 25™ Digital Trunking WAN SmartZone solution. Basically, this means that the responder doesn't have to change the channel when driving through a different site.
- 5 sites – Baldy, Grubstake, Pt. Mackenzie, Willow Creek, and Sutton.
- Current Costs
    - Our current Operating and Maintenance (O&M) costs run approximately $150,000 per year.
    - Personnel costs run approximately $320,000 per year.
    - Total approximate costs: $470,000.

Slide information: The red dotted line represents the Borough's boundaries. The circles represent the repeaters. Bright green represents good coverage. Pale green represents compromised coverage. Wolf Lake is in the pale green.

Slide 4 – The Growing Borough

The Matanuska Susitna Borough has grown tremendously in the last 30 years.

- 30+ year old system which was designed when we were a smaller borough with a smaller population.
- Increased population means an increase in responses.
- More schools and commercial buildings mean communication challenges within the structure.
- More roads mean greater distances between towers and a greater challenge for signal strength.
- Increase in capacity needs means responders today sometimes fight for a channel to communicate on. This makes it difficult to hear and can cause confusion and delay.

In the last 5 years, about 20,000 new people have made the Mat-Su Borough their home.

Population Growth			
Year	**2000**	**2012**	**2015**
Census	59,322	95,160	100,178
Source: Wikipedia & UAA			

Population growth means increased response need.

EMS Responses			
Year	**2007**	**2010**	**2014**
EMS Response	6,314	7,639	9,884
Source: MSB EMS			

With the increase in population and EMS responses, we have found ourselves in situations where our current conventional analog portable (hand held) and mobile (vehicle mounted) VHF radios have fallen

short in responding to an emergency.

Slide 5 – Single Channel Issues

Today's challenges

- Paging and radio communication are on the same single channel.
  - Everyone hears everything. Everyone can talk on the same single channel; however, there are times when the responders cannot hear each other.
  - Tactical channels are used to relieve congestion from primary channels but the dispatcher is not able to monitor the tactical channels. Tactical channels do not get recorded.
- Dispatch continues to relay channel communication while also trying to answer other 911 calls.
  - The dispatcher must relay conversation because responder to responder talk is not always achieved.
- Dispatch acknowledges and repeats information to all responders. In essence, this is a lot like playing the childhood game "telephone".
  - Have someone relay information increases the chance of misinterpretation which, in a life and death situation, could be fatal. Having to wait for the relay of information also costs precious time during an emergency.

Goal

Responders for each incident are assigned a unique channel, freeing up dispatch time.

Slide 6 – Zone to Zone Issues

Today's challenges

- When moving from one zone to another, the radio channel must be changed while moving down the road at high speed.
  - With our current system, the user must change the channel when moving from one zone (area served by the radio tower) to another zone.
  - When there are multiple responding vehicles, we have to deal with multiple responders in different zones and thus on different channels. While on a different channel, they cannot hear or speak to each other.
- The reception is lost slowly, like a radio station. Because of this, the reception becomes fuzzy for a while between zones.
  - The quality of the audio is compromised as the responder moves from one zone to another. Because this happens slowly, the responder must use his/her best judgment on changing the channel. Think of when the radio station you are listening to begins to get static and starts to fade while driving from Anchorage to the Matanuska Susitna Borough. You can hear some of the words, but not all. The static makes it difficult to concentrate on the words of the song. Finally, you just change the channel. Now, think of this in terms of a lifesaving event. Critical communication should never be compromised when the public's safety is at risk.

Goal

Responders remain on the same Talkgroup from the beginning to the end of the incident.

Slide 7 – Distorted and Garbled Communication

Today's challenges

- Building penetration is spotty or non-existent. Communication is compromised.

ALMR October 15th, 2016 issue has an article titled Why FirstNet Should be Data Only**.** In this article, building penetration is discussed: "LMR systems generally cover the geography needed by the public safety agencies they serve, but in-building coverage has become an increasingly important issue. Providing in building coverage for FirstNet will be expensive, and it is not budgeted for. For some time to come, LMR systems will be better able to provide in-building coverage than FirstNet will."

  - More buildings, including more schools, mean a greater potential for a breakdown in coverage.

From the 9/11 Commissioners Report: The FDNY's radios performed poorly during the 1993 WTC bombing for two reasons. First, the radios signals often did not succeed in penetrating the numerous steel and concrete floors that separated companies attempting to communicate; and second, so many different companies were attempting to use the same point-to-point channel that communications became unintelligible.
http://www.911commission.gov/report/911Report_Ch9.htm

- A member of the public is tying up the channel.
  - Anyone can find our public safety frequency and begin talking and tying up the channel that could be used to save lives.

- Interoperability between systems is not possible on our primary system.
  - Our current system does not have the capability to communicate with other agencies like the DOT, DOD, DOF and law enforcement. This is why we have ALMR as a back-up system today.

The article below titled Fatal Confusion: A Troubled Emergency Response; 9/11 Exposed Deadly Flaws in Rescue Plans explains why interoperability is so crucial to public safety.*

- Clear recording of the incident is compromised due to the congestion and latency issues.
  - Today, we are able to capture recordings for liability purposes; however, the conversations are often garbled and unintelligible because of the congestion. We have an example to play for you (play audio).

Goal

Clear communication for all involved whether the responder is in a building, outside of the building or on the road.

***A note about interoperability from the article Fatal Confusion: A Troubled Emergency Response; 9/11 Exposed Deadly Flaws in Rescue Plans.**

Minutes after the south tower collapsed at the World Trade Center, police helicopters hovered near the remaining tower to check its condition. "About 15 floors down from the top, it looks like its glowing red," the pilot of one helicopter, Aviation 14, radioed at 10:07 a.m. "It's inevitable."
Seconds later, another pilot reported: "I don't think this has too much longer to go. I would evacuate all people within the area of that second building."
Those clear warnings, captured on police radio tapes, were transmitted 21 minutes before the building fell, and officials say they were relayed to police officers, most of who managed to escape. Yet most

firefighters never heard those warnings, or earlier orders to get out. Their radio system failed frequently that morning. Even if the radio network had been reliable, it was not linked to the police system. And the police and fire commanders guiding the rescue efforts did not talk to one another during the crisis. Cut off from critical information, at least 121 firefighters, most in striking distance of safety, died when the north tower fell..
http://www.nytimes.com/2002/07/07/nyregion/fatal-confusion-troubled-emergency-response-9-11-exposed-deadly-flaws-rescue.html?_r=0

Slide 8 – Research

The telecommunications team here at the Mat-Su Borough, along with help from a vendor, has researched many solutions. Our research included:

Researched

- Solution options: many solution options were considered including varying technologies.
- Case Studies: We also researched other boroughs and counties in the U.S. to find out how they are using the solutions researched and what has worked and what hasn't. Examples include San Francisco and Anchorage.
- Grants: researched for funding consideration.
- Costs for each of the options: Costs were estimated for each option considered.

Performed

- Testing: Field testing was done to help us in our research efforts. We will talk about some of the results today. The complete test results are included in this presentation packet.
- Research: Several options were researched in our quest to find the best solution to meet the needs of our community.
- Interviews: We reached out to others in the public safety communications field – providers and users.
- Briefing: We briefed the assembly a couple of months ago and again today.
- Rating the options: Each option was given a score based on how well it solved our current problems.

Researched Solutions:

- Do nothing.
- Add to our existing network.
- Satellite.
- Long Term Evolution (LTE) and FirstNet.
- Other Land Mobile Radio (LMR) solutions.

Speaking of looking to upgrade their current system, a Dubuque County spokesman stated:
"That's our main focus – redundancy and interoperability," Berger said. "The main thing is the reliability to talk to one another.
http://psc.apcointl.org/2015/07/29/dubuque-e9-1-1-center-seeks-new-communication-system/

What is *our* Goal?
Find a viable solution that will meet the needs of the Mat-Su Borough for years to come.

Slide 9 – Do Nothing

Do Nothing

Work with what we have

This was an option early and briefly entertained. We cannot in good conscience continue to operate as we are today.

We've talked about the increase in population and structures. One example of this is the increase in the amount of schools we have here in the valley. The Borough has a total of 51 schools and has built 5 new schools in the past 5 years.

Pros

- No Capex cost
- Continued Opex cost

Cons

- Continued communication issues
- Continued interoperability issues
- Increasing risk of emergency failures
- Increasing risk to emergency personnel
- Increasing risk to public safety

So, what if we do nothing?

Communication – or the lack of – is the number one reason for failure.
According to the 9/11 Commission Report, "As of September 11, FDNY companies and chiefs responding to a fire used analog, point-to-point radios that had six normal operating channels. Typically, the companies would operate on the same tactical channel, which chiefs on the scene would monitor and use to communicate with the firefighters. Chiefs at a fire operation also would use a separate command channel. Because these point-to-point radios had weak signal strength, communications on them could be heard only by other FDNY personnel in the immediate vicinity. In addition, the FDNY had a dispatch frequency for each of the five boroughs; these were not point-to-point channels and could be monitored from around the city.
One challenge on 9/11 was the sheer number of users clogging the radio frequencies. Even on a normal day, if two officers try to talk at once, only one gets out. If commanders are trying to talk to other commanders on the same channel that units on scene are trying to use, no one can be heard. Now imagine hundreds of responders all trying to communicate at once.
Interoperability in public safety is more than just radio frequencies and SOPs. For first responders, interoperability also means the ability to work together across jurisdictions and agencies. It is everyone; fire, police, EMS and dispatch on the same page, working toward the same goal, using the same format. It's learning from the lessons of the past and creating a better plan for the future.
http://psc.apcointl.org/2011/09/06/911-10-years-later/

After the (Boston) marathon bombings that killed three and injured more than 200, every layer of law

enforcement scrambled to coordinate. Upgrades to communications technology in the years following the Sept. 11 attacks allowed for reliable voice contact among first responders.
http://psc.apcointl.org/2013/05/08/communication-failure-after-boston-bombings-reinforces-network-need/

Summary

We cannot continue to serve the ever increasing population with what we have today.

Slide 10 – Add to our current communications system

Building out our sites for better coverage but remaining on a conventional VHF system.

Today, we have a conventional VHF analog system that uses repeaters located throughout the Borough. We are also using ALMR as a secondary system.

Currently, our area wide repeater at Beckwith Bluff north of Wasilla serves the entire core area (Palmer-Wasilla area) and is often overwhelmed by user demand.

With this solution, the risks outweigh the cost savings. In addition, the money spent to band aid an outgrown network would be money wasted as we would need to upgrade eventually to a primary system that is compatible with Wasilla, the State, the Department of Defense etc...

Pros

- Lowest Cost

Cons

- Continued communication issues – as sites are built out, there will be more channels to switch and more channels for dispatch to manage.
- Continued interoperability issues.
- Continued security issues - no change from today. Anyone with a VHF radio can tie up the communication system! This was explored and exposed during AK Shield. One scenario proved hackers were able to key into the tower.
- Most grants today require a trunked system to be eligible.
- Throwing money into a solution that will need to be replaced down the road anyway.
- Not a forward motion solution.

There has been a lot of talk about conventional verses a trunked system. What does this really mean? A conventional system uses a fixed infrastructure (such as a repeater network) that serves to repeat radio calls from one frequency to another. A trunked system uses a controller in the infrastructure which assigns calls to specific channels.

Summary

If we want to move forward, we cannot stay where we are at. If we want to serve the ever growing Matanuska-Susitna Valley, we must provide a public safety communication system that will be responsive, reliable and always ready!

Slide information: The same Borough map now displays more repeaters. More repeaters do not solve the one channel issues or the fact that the responder needs to physically change the channel.

Slide 11 – Satellite

Satellites create a communication channel between source transmitters and receiver(s) at different locations on Earth.

Wikipedia defines a communications satellite as an artificial satellite that relays and amplifies radio telecommunications signals via a transponder; it creates a communication channel between a source transmitter and a receiver(s) at different locations on Earth. Communications satellites are used for television, telephone, radio, internet, and military applications.
There are three different types of satellite systems.

1. International satellite communication system INTELSAT.
2. Domestic satellite system DOMSAT.
3. Search and rescue system SARSAT.

http://www.tutorialsweb.com/satcom/fundamentals-of-satellite-communications.htm

The SARSAT system uses NOAA satellites in low-earth and geostationary orbits to detect and locate aviators, mariners, and land-based users in distress. The satellites relay distress signals from emergency beacons to a network of ground stations and ultimately to the U.S. Mission Control Center (USMCC) in Suitland, Maryland (used by the USMCC).
http://www.sarsat.noaa.gov/

Companies researched: Iridium, ICO, AMSC and Globalstar, Immarsat, Remote Satellite Systems International
http://www.remotesatellite.com/network-service-areas/vsat/

Satellite for public safety examples

- Iridium is a company that offers Low-earth-orbit satellite systems (LEOs).
  - Small and low-powered.
  - Orbit the earth rapidly.
  - Do not require much power.
  - Expensive.

- ICO Global Communications offers Medium orbit systems.
  - Covers the earth with fewer satellites; however, the further out the satellites, the less coverage.
  - Expensive.

- Inmarsat offers GEO systems
  - Placed in orbit over the equator at precisely the right altitude.
  - Has an orbital speed exactly the same as the earth's rotation on its axis.
  - Expensive.

* Low-orbit systems - Low-earth-orbit satellite systems (LEOs) are relatively small and low-powered. They orbit the earth rapidly. Because they are close to the earth's surface, they do not require as much power. This also means that the mobile transceiver requires only a relatively small omnidirectional antenna. LEO satellites are cheaper to build and to put into orbit. On the other hand, with LEOs you need more satellites to provide global coverage. The switching scheme is more complex because the rapidly moving satellites are constantly having to hand off calls to each other, and a worldwide infrastructure of ground stations is required. Iridium, Teledesic and Globalstar are LEO systems.

* Medium-orbit systems - The next group of satellites are medium-earth orbit (MEOs). They are also sometimes called ICOs, for "intermediate circular orbit." With a MEO system, you can cover the earth with fewer satellites, but the higher-powered spacecraft are more expensive to build and to launch into orbit. Spaceway and ICO Global Communications are both examples of MEO systems.

* Geosynchronous systems - Finally, there are geosynchronous satellite systems (GEOs). The GEO systems are based on the premise that a satellite placed in orbit over the equator at precisely the right altitude has an orbital speed exactly the same as the earth's rotation on its axis. This means that the satellite's position in the sky relative to a fixed point on the ground will always be the same. This has obvious advantages for fixed antenna systems such as home TV systems. It also has the benefit of being able to offer nearly global cover age with only a few satellites. On the other hand, the orbital distances are such that much larger, high-powered satellites are required, and they are far more difficult and expensive to launch into orbit. Probably the best-known GEO system in mobile communications is Inmarsat, which was originally created for maritime communications with ships on the high seas. The Inmarsat system has also won a considerable share of the land-mobile market with the latest generation of relatively small briefcase-size satellite terminals.

Pros (what sites have stated)

- Secure.
- Less likely to be affected by natural disasters.
- One-to-many voice communications system.
- Tracking ability.

Don West Communications Director, Emergency Response Division, Indiana DHS
"According to West, the satellite-based system is superior to other terrestrial systems primarily because it is unaffected by natural disasters. The one-to-many voice communications system works similar to a trunked radio system, with which most users are already familiar. Individual units are powered by either AC/DC or a built-in battery. Users who take advantage of LightSquared's telephone capabilities receive U.S. phone numbers, unlike many satellite phones that require international calling and commonly charge additional fees."
http://psc.apcointl.org/tag/satellite/feed/

Cons

- With global coverage, PTT phones are limited to defined operational service regions defined in the Command Center Portal.
- "No infrastructure". Would need to define what this means for dispatch and other areas.
- Cannot be more than 1,000ft from vehicle for building penetration.
- Iridium and ICO have filed for bankruptcy.
- Any latency* could be significant when real time communication is necessary for life & death situations.
- Would require a backup solution just in case a satellite went down. Technical issues, severe weather, among other factors could inhibit 24/7 communication. Public safety counts on us to be connected without interruptions.
- Speeds cannot be guaranteed.
- Can be affected by atmospheric conditions.

*Latency is defined as the time it takes between the information provided and the information received.

Quotes

"Speeds are not guaranteed as it is impossible to know if all other subscribers sharing the channel are not simultaneous downloading a data intensive video file, which would slow a connection for all of the users."
August 1, 2016 http://www.groundcontrol.com/How_Does_Satellite_Internet_Work.htm

"Allegany County, Md., like many other parts of North America, is located in a rural, mountainous region

where cell phone coverage can be unreliable — a challenging situation for public safety officials who rely on communication for coordinating both day-to-day operations and rescue efforts during an emergency. ...The satellite equipment helps ensure that the county has a reliable backup communications system available that it can depend on in times of emergency."
http://www.officer.com/article/10232737/satellites-in-public-safety

Cost/Fees

Depending on the vendor used, equipment can be purchased or rented or both. An example of costs follows:
There are three parts to billing any Iridium PTT account... First is the monthly per handset fee. Next is the Talkgroup Service Monthly Fee which is groups of PTT handsets that communicate with each other and third is the Standard Iridium Satellite Phone Service which is totally optional.
Example of fees that may fit our needs:

- Handset Fee - $120 per handset per month
- Talk group Fee - $500 per month
- Phone Service Fee – Free with service
- Phones – $1,699
- Ground Satellites range from $399-$839 per month for 10 days use, plus an additional 20% fee and an initial fee of $349
  http://www.groundcontrol.com/Dual_Matrix_Satellite.htm

Prices do not include holders, cases, or any other equipment. There may also be other infrastructure changes that are necessary and not included in the above costs.

Total ongoing monthly costs would be about $1459.00 a month or $17,508 per year (figuring on only a dual satellite). There is no guarantee that this cost would not rise so the yearly Telecommunications budget would need to be increased by at least this much. Approximate cost for the phones will be $1,433,956.00. The phone service fee is free as an introductory so the unknown is what it could be down the road. The other equipment is a huge unknown since we would need to have research down on how many ground satellites we would need, along with other infrastructure equipment.

Summary

- A very expensive option that comes with some of the same challenges we face today.
- Renting as opposed to "owning" equipment would not provide the autonomy the Borough enjoys today.
- Could be something to keep an eye on as the products get better, cheaper.

Slide 12 – Long Term Evolution (LTE) and FirstNet

LTE is a wireless communication with high speed data for mobile phones.

The National Institute of Standards and Technology (NIST) is the first federal agency to research guidelines for telecommunications and information technology standards for interoperability and information sharing among public safety agencies. NIST, through its Public Safety Communications Research (PSCR) program, is building a 700 MHz public-safety broadband trial network to give manufacturers and first responders a location to deploy and test their systems in a multivendor, neutral host environment. The goal is to demonstrate and evaluate the behaviors of 3GPP/LTE technology deployed in the 700 MHz bands, specifically to meet the needs of public-safety agencies.
LTE is a new, all-IP, high-bandwidth, wireless technology that enables the delivery of new, advanced services in a guaranteed, secure and reliable way. The U.S. government has already licensed the 700 MHz frequency range for the access network for LTE and the new Public-Emergency System will use band 14 within this range.

..LTE systems for critical communications have special features and requirements that the commercial networks don't have to worry about. The primary concern being that it needs to be much more reliable as lives are at stake. It also has to operate in conjunction with existing LMR networks which are oftentimes in the same frequency band.
https://dl.cdn-anritsu.com/en-us/test-measurement/files/Technical-Notes/White-Paper/11410-00961A.pdf

How it works

LTE utilizes the E-UTRAN, which runs on 3GPP's network architecture standard, EPC. This simplifies functionality, eases handovers from one network to another and improves the quality of service for end users. In the physical layer, two key technologies such as OFDM and MIMO characterize major changes from 3G systems. Another key aspect of LTE systems is its simplified flat network architecture resulting from it being an all-IP, packet-based network that reduces latency and increases spectrum efficiency while simplifying network operations. Interference, an underlying problem with radio transmissions, is mitigated in LTE by making use of OFDM and MIMO techniques, along with many unique features such as inter-cell interference coordination (ICIC).
https://transition.fcc.gov/pshs/docs/LTE_Info_Sheet_09082010.pdf

FirstNet

FirstNet was signed into law on February 22, 2012, the Middle Class Tax Relief and Job Creation Act created the **First Responder Network Authority (FirstNet)**. The law gives FirstNet the mission to build, operate and maintain the first high-speed, nationwide wireless broadband network dedicated to public safety. FirstNet will provide a single interoperable platform for emergency and daily public safety communications.

The coverage challenge is to provide service to 60,000 public safety agencies, 3,144 counties, and 566 federally recognized tribes in coverage areas including urban and rural. Projected operation for most areas is 2022.
http://www.firstnet.gov/sites/default/files/FirstNet%20By%20the%20Numbers_Updated%2010042016.pdf

Where is Alaska at in this process?

John Rockwell, the current SPOC for First Net Alaska stated the following:

- Only data will be available towards the end of 2018.
- Costs to implement this piece are still unknown.
- Years until Push-To-Talk (PTT).

Pros

- Real-time video
  - Face scanning and recognition for quick verification against centralized facial recognition databases from any location.
  - Video surveillance of areas not served with a fixed connection (for example, coastal areas and deserts) resulting in better security.
  - Instant visual emergency assessments.

- E-mail
  - Fast and reliable delivery

- Recorded communications
  - Database interrogation.

- Fast access to suspect information from anywhere.
- Fast retrieval of information needed during an emergency.
- Higher-quality transmissions and transcriptions.
  www.jdsu.com/test

Cons

- Relies on internet connection and smart phone capabilities. Issues still need to be vetted, such as a major earthquake where we would most likely lose phone and internet service.
- Interoperability may be an issue unless the state and other groups join in.
- Still going to require an intrinsically safe radio when operating in a hazardous environment.
- Right now, device to device cannot happen with this solution.
- Still in the infancy stages of development.

Quotes

ALMR's October 15, 2016 issue has an article titled Will LTE Replace Traditional LMR Technologies?. "There are many questions and concerns by the end users about LTE that must be addressed before it is accepted. LMR systems are a known quantity and reliable voice communications is the number one requirement for any public safety system. Beyond reliability, one basic question is how well will LTE be able to handle voice and data. These questions can only be answered with empirical evidence once actual systems are in operation."

LTE and LMR

WILL THE FIRSTNET NETWORK SHARE SITES WITH LMR NETWORKS?

The FirstNet network will leverage existing infrastructure where it makes engineering and economic sense. Our goal is to keep costs down and reduce the time it takes to build out the new Band Class 14 FirstNet network. Band Class 14 is the portion of spectrum allocated to public safety for operation of the FirstNet nationwide public safety wireless broadband network. Whether FirstNet shares sites with LMR networks will depend on the availability of space to house FirstNet equipment and whether the location proves to be the best option for meeting our network design, coverage, and cost requirements.

WILL THE FIRSTNET NETWORK CONNECT TO LMR NETWORKS?

In order to access one or more LMR networks, a dedicated handset must be within range of the specific towers within the frequency band on which it operates. Public safety personnel utilize a propriety subscriber unit and must sometimes carry multiple units to execute their daily mission. Headquarters personnel, ad hoc users or neighboring jurisdictions are routinely provided with units when needed for mutual aid. There are many solutions that will allow FirstNet users to improve efficiency by extending LMR access to smartphones, tablets and PCs. Through a simple Internet Protocol (IP) gateway, users will be able to transmit and receive voice traffic on any device that is authenticated to an LMR network via a Push to Talk (PTT) voice application.
http://www.firstnet.gov/sites/default/files/firstnet-lmr-factsheet.pdf

"John Rockwell, who was the Alaska Single Point of Contact (SPOC) at the time of the 2015 AK FirstNet meeting and Acting Statewide Interoperability Coordinator (SWIC), emphasized the ongoing importance of maintaining the Alaska Land Mobile Radio (ALMR) system, while also being fully engaged in the development and opportunities that mobile data could provide. "
http://www.firstnet.gov/newsroom/blog/alaska-demonstrates-benefits-mobile-data-public-safety-during-initial-consultation

..." Technical challenges include RF coverage and other system considerations. LMR handsets typically transmit with 3-5 Watts of power, whereas, an LTE handset may only be capable of transmitting with about 1 Watt. This translates directly into longer range for LMR systems. So, for an LTE network to

provide the same coverage area as an LMR network, operators will need to install many more sites spaced closer together resulting in higher equipment and maintenance costs. Because of infrastructure costs, a broadband network at 700MHz will not be able to replace LMR in many locations across the US due to RF propagation properties and matching LTE to LMR coverage and reliability is just too cost prohibitive.
There is no way to give preemptive priority to public safety traffic so a dedicated private network for public safety is necessary."
https://dl.cdn-anritsu.com/en-us/test-measurement/files/Technical-Notes/White-Paper/11410-00961A.pdf
Anritsu Corporation is a Japanese company specializing in the test and measurement equipment market

Cost/Fees

While final costs have not been set, FirstNet intends to offer services at a compelling and competitive cost to attract millions of public safety users and make FirstNet self-sustaining. The use of FirstNet's services and applications will be voluntary.
http://www.firstnet.gov/sites/default/files/NextGen911Factsheet_160418_v2.pdf

Summary

Since a solution is needed now, it would be wise to follow the suggestion from the FirstNet website: First responders currently use land mobile radio (LMR) networks for mission critical voice communications. When the nationwide public safety broadband network (NPSBN) is launched, it will not replace their LMR systems. The network is expected to initially transmit data, video, and other high-speed features, such as location information and streaming video, as well as non-mission critical voice. Public safety entities will continue to use LMR networks for their mission critical voice needs.
http://firstnet.gov/network/lmr

Summary: First Net is not ready for us; however, LMR is available and the recommended solution by First Net. So, let's take a look at what LMR possibilities we have for the Borough.

Slide 13 – Land Mobile Radio (LMR)

Land mobile radio system (LMRS), also called **public land mobile radio** or **private land mobile radio**, is a wireless communications system intended for use by terrestrial users in vehicles (mobiles) or on foot (portables). Examples are two way radios in vehicles. Land Mobile Radio is what the State of AK has today. Radios can be UHF or VHF. We currently operate in VHF.

Pros

- Infrastructure is already there – it just needs to be enhanced.
- It is what ALMR and AWARN use. It is what the DOT, law enforcement, and Dept. Of Forestry and DOD uses.
- Equipment provides interoperability with ALMR, law enforcement, DOT, DOD and the DOF.
- It is what FirstNet recommends we continue to use.

Cons

- The cons will vary with each of the LMR solutions.

Quotes

ALMR Insider October 15, 2016 Issue: While voice capabilities are offered through other technologies (e.g., Voice over Internet Protocol, Voice over LTE, commercial voice push-to-talk), none of these guarantee the level of reliability, expedience and control needed for the demands of mission-critical voice exchanges. At present, there is no other more reliable choice to achieve the same level of mission-

critical voice capabilities as that provided by public safety LMR systems. LMR provides a critical combination of quality, reliability and assurance of access to priority communications that public safety officials need in emergency responses. Therefore, public safety agencies must continue to seek funding for LMR systems, equipment and enhancements in order to sustain and improve mission-critical voice communications for public safety responders. Decision-makers must consider the needs of public safety agencies and the impact of funding decisions on the ability of public safety responders to effectively communicate during day-to -day incidents, emergencies, and natural and man-made disasters. Without continued investment in LMR systems, capabilities could be compromised during response operations.
(Prepared by Mr. Del Smith from SAFECOM E-pub Feb 2016)

When FirstNet launches the NPSBN, the network will initially provide mission-critical, high-speed data and video services that will supplement today's LMR networks. The network is also expected to provide non-mission critical voice at launch. Public safety entities will continue to rely on their LMR networks for mission critical voice features – such as Group Communications and Direct-Mode – that are needed in an emergency response setting. In the near term, public safety entities will need to maintain and/or upgrade their LMR networks, as appropriate.
http://www.firstnet.gov/content/mission-critical-voice-land-mobile-radio

Cost/Fees
Currently, we spend approximately $470,000 for operating, maintenance and personnel costs. Of this, about $72,000 is spent annually for space, power and circuit costs.
The future operating and maintenance costs will vary with each of the LMR solutions.

Summary
The LMR network provides mission critical communications that are proven to provide for the public's safety.
Land Mobile Radio – in some form – is operated throughout Alaska within the public sectors. This includes Federal, State and local entities.
Interoperability with these groups is critical for emergencies and disasters.

We cannot stay where we are at. We are dealing with a Radio Network that cannot serve the increase in population or the various needs that we have as a result of this increase in population (at least in the core with the increase in building structures).

The cost to upgrade the existing network is not as great as the cost to go with a Satellite system. When First Net is ready to deploy in Alaska, it will be able to be used with the 700MHz radio system, which makes staying with the Land Mobile Radio network the best solution for our needs, now and in the future.

We must move forward while also keeping a pulse on emerging and affordable technologies.

What are the proposed LMR solutions?

Slide 14 – Alaska Land Mobile Radio (ALMR)

Using ALMR as our primary communications system

ALMR is a P-25 trunked, voice over IP communications technology with 4 zones band radios and is interoperable with AWARN. It began in 2002 and has over 16,000 subscriber units (vehicle and handheld).

http://doa.alaska.gov/ets/almr/ALMR%20January%2025%202012%20Presentation.pdf

Pros

- This is the least expensive solution that we will be discussing in detail.
- We have over 700 radios ALMR ready. That is approximately 70% of our total inventory!
- ALMR is statewide with 22 states, 17 Federal Non-DOD and 6 DOD agencies.
- With ALMR, responders do not need to switch channels when going from zone to zone. This is one advantage of a trunked system.

Cons

- Does not offer us anything we don't have today. As we will see later on, congestion will continue to be an issue with this option.
- ALMR as it sits today does not meet our communication needs for the whole borough. Why? Because of the radio frequency used, building penetration is an issue in the core.
- ALMR and the budget concerns
  - The long term sustainability of ALMR with the legislature concerned about the expense of maintaining the network in a declining budget environment.
  - Subscriber fees have never been charged and, if charged now, the fees will likely be based on system use rather than head count. That being said, we have no idea what, if any charges will be levied on subscribers.
- Maintenance concerns
  - Little if any ability to manage our environment. Zone controller still belongs to the State and they will decide where the network goes.
  - If the Borough commits to ALMR we will still need to support the existing standalone repeater network for paging responders and as a backup to ALMR. While not ideal, it does provide us with communications. If we commit to ALMR and abandon our network we will be in the same position as the troopers who rely on ALMR and have no valid alternative if it fails. We need to maintain the secondary system for paging and ISO credit.

Immediate Costs: $2,127,000. This includes equipment, radios, personnel, training, and project management costs. The actual breakdown of costs will be shown later on in this presentation.

Additional Maintenance Costs (yearly): $175,000 operating and maintenance (O&M) plus another $112,000 for a full time technician. Total project annual cost equals $287,000.

Slide 15 – Anchorage Wide Area Network (AWARN)

Partnering with AWARN for our primary system

AWARN is a P25 trunked system, Zone 4 of ALMR with 700 MHz radios and is interoperable with ALMR within the AWARN area.

Pros

- **Cost savings in sharing a network**
  - Avoid higher entry cost of providing a zone controller.
  - ANC already has system administration personnel to maintain and operate the zone controller.
  - Sharing costs fits right in with our SMART communities goals.
- **Greater control**

- Our jurisdictions do not overlap so we would be somewhat of an autonomous neighbor with good interoperability with our closest major jurisdiction.
- Should be able to configure Borough facilities any way we choose and have precedence on our sites as well as access to their sites.
- Larger ownership role so more leverage on how our part of the network is managed

- **Growth opportunities**
  - System provides a significant level of sophistication and functionality and would likely meet our needs for years to come.
  - They have had this system for years and we would be able to leverage their experience in implementing our own.
- **Capable security which comes with a trunked system.**

Cons

Cost

- Requires increasing radios at each site from the current 1 to a proposed 5-6. This provides a much more robust functionality with options for multiple concurrent conversations, but will increase the need for maintenance and support.
- Responsible for all facets of our portion of the network. While they manage the zone controller, the additional technology needed to participate in a trunked network will require an annual commitment to supporting a complex technology.

Immediate Costs: $8,622,000. This includes equipment, radios, personnel, training, and project management costs. The actual breakdown of costs will be shown later on in this presentation.

Additional Maintenance Costs (yearly): $175,000 operating and maintenance (O&M) plus another $224,000 for two full time technicians. Total additional annual cost equals $399,000.

Slide 16 – Independent 700 MHz and VHF

We could go out on our own and either build up a P25 trunked system with 700MHz radios and 1 zone controller or remain on VHF.

Pros

Both 700 MHz and VHF:

- This solution will provide the highest level of autonomy. The Borough can do whatever it wants regarding design, configuration, and operation.
- This would be totally customizable to meet our needs.
- Interoperability with AWARN and ALMR.

Cons

Cost

- Both 700 MHz and VHF: Highest CAPEX (entry level) costs.
- Both 700 MHz and VHF: Highest OPEX (operational) costs.
- Both 700 MHz and VHF: Training would be an added required expense for current employees.
- Possible failures
- Both 700 MHz and VHF: 3 FTE's would be needed for this plan.
- VHF: Unless the Borough decides to connect with ALMR, the system would be standalone

without a backup zone controller. Failures would significantly impact function.

- VHF: VHF spectrum availability may not support that many additional frequency pairs for the additional repeaters. Without spectrum from the State or Muni, the MSB may have to look at alternate spectrum options which are possible but could be expensive.

Immediate Cost

- MSB VHF: $8,067,000. This includes equipment, radios, personnel, training, and project management costs. The actual breakdown of costs will be shown later on in this presentation.
- MSB 700 MHz: $10,467,000. This includes equipment, radios, personnel, training, and project management costs. The actual breakdown of costs will be shown later on in this presentation.

Additional Maintenance Costs (yearly, for either path)

$200,000 plus another $336,000 for two full time technicians would be needed. Total additional project annual cost equals $536,000.

The one thing in common with these three proposed LMR solutions is that they are all Trunked systems.

How does Trunking work?

- Signal transmits to a control station.
- The control station chooses an available frequency and sends it to the receiving radio.
- All radios are on the same talkgroup.
- Works similar to a cell phone.
- In trunking there is no portable-to-portable communication. All radio traffic is repeated.
- Provides us more usable channels.

Summary

A Land Mobile Radio solution is viable, affordable.

Slide 17 – Single Channel Resolution

Today's challenges

- Paging and radio communication are on the same single channel.
- Dispatch continues to relay channel communication while also trying to answer other 911 calls.
- Dispatch acknowledges and repeats information to all responders. In essence, this is a lot like playing the childhood game "telephone".

In the childhood game of telephone, the word the last person hears isn't usually what the first person whispered. It's funny when you are playing a game. But public safety isn't a game. Saving lives depends on clear communication that is prompt and accurate.

Now, try to picture several groups in the same room playing telephone. Not only do you get second, third, fourth hand information, you have to fight to listen and hear only what pertains to your group.

How is each of these challenges met by the options?

- **Single Channel**
  - ALMR: Able to assign a unique channel (Talkgroup) but capacity could be an issue due to the amount of users. Currently, only 3 channels and we would need to use two. We

could possibly get an agreement to add channels but could still be bumped in a national disaster situation.
    - AWARN & MSB: Able to assign a unique channel (Talkgroup). Ability to build capacity in the system because we will be using our sites.
- **Dispatch Work**
    - ALMR, AWARN & MSB: Dispatch work alleviated.
- **Playing Telephone**
    - ALMR, AWARN & MSB: Alleviated.

Note: In a trunked system, each incident is assigned a 'talkgroup'. Simply put, a talkgroup is much like having a private telephone line. There is no need for a dispatcher to relay information.

Slide 18 – Zone to Zone Resolution

Today's challenges

- When moving from one zone to another, the radio channel must be changed while moving down the road at high speed.
- The reception is lost slowly, like a radio station. Because of this, the reception becomes fuzzy for a while between zones.

How is each of these challenges met by the options?

- **Channel Changing**
    - ALMR, AWARN, MSB: No need to change channels.
- **Reception Loss**
    - ALMR & MSB VHF: Dead spots in between zones.
    - AWARN & MSB 700 MHz: Reception loss would be minimized.

Slide: Notice now that there are no channels to change. Each response is provided its own talkgroup that remains with them throughout no matter where the incident takes them!

Slide 19 – Distorted and Garbled Communication Resolution

Today's challenges

- A member of the public is tying up the channel.
- Interoperability between systems is not possible on our primary system.
- Building penetration is spotty or non-existent. Communication is compromised.
- Clear recording of the incident is compromised due to the congestion and latency issues.

How is each of these challenges met by the options?

- **Public Intervention**
    - ALMR, AWARN & MSB: Problem solved.
- **Congestion**
    - ALMR: During a major emergency, this could actually get worse, causing responders to get kicked off of the Talkgroup. Otherwise, congestion is minimized.
    - AWARN & MSB: Alleviated – there are more talkgroups available than with ALMR.
    - AWARN & MSB 700 MHz: Quality increased! Field test results showed 30% coverage for

MSB 700 MHz Utilizing the Anchorage 700 MHz system, communications increased to 100%.

- **Interoperability between responders in different systems**
  - ALMR, AWARN and MSB: Communication would be achieved with all responders.
- **Building Communication**
  - ALMR & MSB VHF: Problematic. Field test results showed 0% coverage within Walmart.
- **Recording the Incident**
  - ALMR: Quality would be improved unless we are in a disaster situation that has many responders.
  - AWARN & MSB: Recording will be clear and uninterrupted.

ALMR October 15th, 2016 issue has an article titled Why FirstNet Should be Data Only. In this article, building penetration is discussed:
"LMR systems generally cover the geography needed by the public safety agencies they serve, but in-building coverage has become an increasingly important issue. Providing in building coverage for FirstNet will be expensive, and it is not budgeted for. For some time to come, LMR systems will be better able to provide in-building coverage than FirstNet will."

Note: Research has been done and our own testing has proven that the communication within the buildings is best served with the 700MHz band. Information about the 700MHz band is as follows:

- Looking at 108MHz from 698-806MHz; Upper 700MHz (746-806MHz) is where Public Safety allocations currently reside
- Public Safety Broadband (FirstNet holds the license): 758-769MHz and 788-799MHz
- Public Safety Narrowband: 769-775MHz and 799-805MHz.
- Commercial LTE allocation: 775-788MHz.

Considering the differences between 700 MHz and VHF:

- Costs to others:
  - VHF would still require buildings to have a Distributed Antenna System (DAS) in order for responders to communicate within the building.
- Noise floor:
  - VHF is more susceptible to man-made and natural noise simply because there are more users.
  - 700 MHz has fewer users; therefore, it has less noise.

Why 700 MHz and not 800 MHz?

- It is the band AWARN is using.
- Research has shown that there isn't enough difference between 700 MHz and 800 MHz to consider 800 MHz over 700 MHz
  http://www.howardforums.com/showthread.php/1362027-700-mhz-vs-800-mhz

How is each of these challenges met by the three options?

- **Channel Changing**
  - ALMR, AWARN, MSB: No need to change channels.
- **Reception Loss**
  - ALMR & MSB VHF: Dead spots in between zones.
  - AWARN & MSB 700 MHz: Reception loss would be minimized.

- **Interoperability between responders in different systems**
  - ALMR, AWARN and MSB: Communication would be achieved with all responders.
- **Building Communication**
  - ALMR & MSB VHF: Problematic. Field test results showed 0% coverage within Walmart.
  - AWARN & MSB 700 MHz: Quality increased! Field test results showed 30% coverage for MSB 700 MHz Utilizing the Anchorage 700 MHz system, communications increased to 100%.

  Note: Repeaters: Individual building repeaters help but most of the buildings in the valley, including the schools, do not have repeaters.
- **Recording the Incident**
  - ALMR: Quality would be improved unless we are in a disaster situation that has many responders.
  - AWARN & MSB: Recording will be clear and uninterrupted.

Field testing results in their entirety:

Field Testing Results for 700 MHz Radio on Beckwith Bluff

The following testing information was created using 2, APX-4000 700 MHz radios. One radio stayed at our office at the Breedon Building and the other was at the testing location. ALMR testing utilized 2, APX-4000 VHF radios. Once again, one radio stayed at our office at the Breedon Building and the other was at the testing location. All 700 MHz testing occurred through a single digital repeater on Beckwith Bluff with a second test utilizing the Anchorage 700 MHz trunked system. All ALMR radio testing occurred utilizing all ALMR sites within range of the testing location.

Propagation mapping that was produced was very consistent with our testing results. Everything in green to green/blue indicated as -85 Db. matched the coverage results we recorded while using an APX handheld. Any areas in blue with a signal level of a -95 Db. or less had garbled transmission significant enough to affect communications. You should consider all areas with a signal of -85 Db. to be your effective handheld coverage for the 700 MHz system.

In building coverage in the core was better than ALMR but still limited. Here are the results from some buildings with historical coverage issues:

Wasilla Fred Meyer:

Coverage testing of the interior of Fred Meyer's resulted in 100% coverage while utilizing the Beckwith 700 MHz repeater. Four testing sites throughout the store tested clear with no distortion. There was no net gain to be found when we additionally tested the Anchorage 700 sites.

ALMR looked to provide between 50 and 60% coverage of the store.

Wasilla Sears:

When testing on the Beckwith 700 MHz repeater, we covered about 60% of the Sears store interior. Utilizing the Anchorage 700 MHz system gave us a net gain of 15%. If we utilized both systems, we would cover approximately 75% of the store interior.

ALMR had 5% coverage in the Sears interior.

Wasilla Target:

Coverage testing on the Beckwith 700 MHZ repeater resulted in 100% coverage in the target store interior. There was no net gain when using the Anchorage 700 MHz system.

Wasilla Lowes:

We had 100% coverage inside the Lowes store. There was no net coverage gain when we utilized the Anchorage 700 MHz system. ALMR testing revealed about 10% coverage within the store.

Wasilla Walmart:

The Beckwith 700 MHz repeater had about 30% coverage within Walmart. Utilizing the Anchorage 700 MHz system, communications increased to 100%.

ALMR testing resulted in 0% coverage within the interior of Walmart.

Wasilla Valley Cinemas:
The Beckwith 700 MHz repeater provided 10% coverage inside the Valley Cinema. Coverage increased to 90% when we additionally tested the Anchorage 700 MHz system.
ALMR coverage testing showed 5% coverage within the facility.

Wasilla Extreme Fun Center:
The Beckwith 700 MHz repeater provided 90% coverage in the Fun Center. There was no gain when we additionally tested the Anchorage 700 MHz system.
The ALMR system provided about 40% coverage within the fun center.

Slide 20 – Comparing the Options

Recap of our public safety communication needs

Emergency responders need

- 24/7 reliability wherever they are.
- Secure, clear, uninterrupted communication.
- A system that is able to track and record an incident.

Using a scale to rate how the proposed solutions meet each of these challenges helps us to identify at a glance, which solution will best meet the Mat-Su Borough's needs.

Rating scale

4 = problem introduced
3 = problem will continue to exist
2 = problem will be alleviated
1 = problem will be solved
0 = not applicable

Challenges	Options			
	ALMR	AWARN	MSB – 700MHz	MSB – VHF
Single channel	1	1	1	1
Dispatch work	3	2	2	3
Playing telephone	1	1	1	1
Channel Changing	1	1	1	1
Reception Loss	2	1	1	2
Public Intervention	1	1	1	1
Congestion	2	1	1	1
Kicked off channel	4	0	0	0
Interoperability	2	2	2	2
Building Communication	3	1	1	3
Clean Recording	1	1	1	1
Totals	21	12	12	16

Slide 21 – The Costs

What will define success? Improve upon what we have while being cognizant of the costs.

Note: All options are ROM (Rough Order of Magnitude) estimates.

Cost Type (per year)	Options			
	ALMR	**AWARN**	**MSB – 700MHz**	**MSB – VHF**
Equipment Cost	$1.15M Required upgrades for improved coverage and capacity in the core.	$4.2M 700MHz vice VHF, TDMA vice FDMA, and RF site connection to an existing master site vice interzone links to three existing master sites.	$5.9M Five Motorola Astro 25 repeater sites (trunked, antenna system combinersk ASTRO 25 TDMA, Dynamic Dual Mode, 5 GTR 8000 repeaters) with a master site controller, interzone links for connection to 3 existing 7.13 version master sites (ALMR North/South, AWARN).	$5.9M Five Motorola Astro 25 repeater sites (trunked, antenna system combinersk ASTRO 25 TDMA, Dynamic Dual Mode, 5 GTR 8000 repeaters) with a master site controller, interzone links for connection to 3 existing 7.13 version master sites (ALMR North/South, AWARN).
Subscriber radios	$600K Subscriber radio replacements	$3M Dual band (700MHz/VHF) radios: Core = $1.75M Outside Core = $875K 700 MHz radios: Core = $250K Outside Core = $125K	$3M	$600K
Personnel Cost *(recurring)*	$112K One additional FTE	$224K Two additional FTEs	$336K Three additional FTEs	$336K Three additional FTEs
Training Cost	$165K Motorola technician training: $33k per tech, including travel costs.	$198K Motorola technician training: $33k per tech, including travel costs.	$231K Technician training costs are vendor specific (estimated at 33K each for budgetary purposes).	$231K Technician training costs are vendor specific (estimated at 33K each for budgetary purposes).
Other Project Costs	$100,000	$1M	$1M	$1M
O&M Costs *(recurring)*	$175,000**	$175,000	$200,000	$200,000

Total Cost to Implement	$2,302,000	$8,797,000	$10,667,000	$8,267,000
Total Cost to Maintain*	$757,000	$869,000	$1,006,000	$1,006,000
Cost Score* **	1	3	4	2

**Current yearly maintenance costs are $150,000 and Personnel costs are $320,000 for a total yearly maintenance cost of $470,000. Total Cost to Maintain in chart above includes this amount.

**ALMR costs are currently a big unknown; therefore, this is a very rough estimate.

***Cost rating scale: 1-4 with 1 representing the lowest cost.

Total Overall Score				
Summary	**ALMR**	**AWARN**	**MSB-700 MHz**	**MSB-VHF**
Options Score	21	12	12	16
Cost Score	1	3	4	2
Overall Score	22	15	16	18

The overall lowest score (listed in red above) represents the best option for cost while also meeting the public safety communication issues the Borough is facing today.

Slide 22 – Recommendation

Primary system: AWARN
Secondary system: ALMR

How do we get there?

- Phased roll-out approach utilizing AWARN in the core area, which includes Palmer, Wasilla, and parts of Big Lake, Houston and Knik.
- Continue to utilize ALMR in the outer areas during the phased roll-out.

Timeline

- 3 years to completion.
- Contingent on funding.
- Dependent on the completion of the Microwave Core Network project. This project is currently funded and being implemented.

The First Year Goals

- Deploy an Expandable Site Subsystem (ESS) up at the Grubstake site. This will upgrade us to the trunked system in the core when combined with the existing AWARN sites.
- Install new equipment and purchase the necessary 700MHz* radio's to serve the core, where the building penetration issue is the greatest. The core will be serviced by AWARN.
- Sign agreement with ALMR to continue to serve the outlying areas. There will be radios in the outlying areas that need to be upgraded to align with ALMR. The radios being replaced in the

core that are ALMR ready can be sent to the outlying areas, which will help keep costs down.

The Second Year and Third Year

- Continue to build out the remaining four MSB sites to handle the trunked system. More information on this will be available once we have the engineers assess and estimate the sites.
- Continue to purchase 700MHz* radios for the outlying areas.

*We will be looking at frequencies in the narrowband blocks for our trunked system. Spectrum availability in the 700MHz range should not be an issue for us. Right now, agencies licensed in the 700MHz in the Borough are the State of Alaska (SOA), Municipality of Anchorage (MOA), Matanuska-Susitna Borough (MSB), and the City of Wasilla.

Estimated time of completion is three (3) years. This timeline is contingent on funding and is dependent on the Microwave Core Network project. At the end of the project, the entire Mat-Su Borough will be connected with AWARN either directly or via ALMR.

With a phased rollout of 700MHz, approximately $2M in subscriber radios would be required in the core at initial deployment. The $1M in the outer areas would be spent in phases as we continue deployment, and this assumes we will be able to repurpose VHF radios from the core that have been replaced.

Maintenance Costs

- Operating and Maintenance costs utilizing the AWARN option is estimated at $175,000. Today's O&M costs are $150,000.
- There will also be a recurring cost for the extra personnel, estimated at $224,000. Today's personnel costs are $320,000.
- The total maintenance increase is approximately $399,000 per year.

Slide 23 - Funding

Where will the money come from?

Several different options considered:

- Telecommunications operating budget.
- E911 budget.
- City of Wasilla transportation safety grant.
- Bonding.
- Borough tax specifically for Public Safety.
- Federal and other grants.

Telecommunications operating budget

IP-based microwave network: ~$250K annually for the last two years. This can help fund purchase of radios.

E911 budget

$2.2M annual revenues, $1M placed in project fund in each of the last five years. We are currently working with the state to change the statute language to allow more flexibility with how monies are spent.

New York also applies a cell phone surcharge where 30 cents is applied to E911 and $1.20 is applied to Public Safety Communications systems.

City of Wasilla Transportation Safety Grant

There is potentially $2M available. We are working with the City of Wasilla to see if some or all of this can be appropriated to improving public safety through this project. This would apply to ALMR related costs only.

Bonding

E911 fund payoff could potentially help pay for this project. As stated earlier, when someone calls 911, they are expecting a responder to come to their rescue. Calling 911 does not alone drive public safety. It is the entire system that keeps our community safe. Note: Bonding cannot be used for anything beyond the infrastructure costs.

Borough Tax for Public Safety

When Wasilla needed a police department, they instituted a city tax to fund it. It is not unusual for counties or boroughs to institute a tax to pay for the public safety necessities, such as the department of emergency services. For example, Gwinnett County in Georgia has a SPLOST (Special Purpose Local Option Sales Tax) in place and part of this purpose is Public Safety.
https://www.gwinnettcounty.com/portal/gwinnett/Departments/BoardofCommissioners/SPLOST
Everyone who comes through the Matanuska-Susitna Borough or uses our services would be contributing to the services they may need to call upon, instead of just the property owners.

Grants

There are several grants out there to take advantage of; however, most of the grants now require P25 compliance. For those that do not require it, the user must provide a good reason why they haven't upgraded to P25.

Below is an excerpt from the Safecom grant that talks about the P25 compliance:

Safecom

To support this priority, grantees should target funding toward standards-based equipment that enables the entity to:

- Sustain and maintain current LMR capabilities
- Use Project 25 (P25)-compliant LMR equipment for mission critical voice communications16
- Support planning efforts for the deployment of the NPSBN while ensuring compliance with statewide plans and FirstNet requirements17
- Meet FCC and FirstNet spectrum and authority to operate requirements
- Transition towards Next Generation 911 (NG911) capabilities
- Support standards that allow for alerts and warnings across different systems
- Sustain backup solutions (e.g., backup power, portable repeaters, satellite phones, HF radios)
- Secure equipment, information, and capabilities from physical and virtual threats

More information about LMR and grants:
https://www.dhs.gov/sites/default/files/publications/DHS_LMR%20Brochure_508_FINAL.pdf

Grants that may apply:

- FEMA: Assistance to Firefighters Grants (AFG)
  2016 open application period dates will be as follows: 8am ET October 11 through 5pm ET

November 18. Website: http://www.fema.gov/welcome-assistance-firefighters-grant-program

- FEMA: Assistance To Firefighters Grant Fire Prevention and Safety (AFG/FP&S)*
  Website: http://www.fema.gov/welcome-assistance-firefighters-grant-program
- Band 14 Incumbent Spectrum Relocation Grant Program*
  Website: http://www.firstnet.gov/sites/default/files/RelocationGrantPrgrm-FAQ_0.pdf

**Grant Closed. Grants closed at this time may open again in 2017.*

Slide 24 - Summary

Public Safety Communication System challenges

- 24/7 reliability wherever they are.
- Secure, clear, uninterrupted communication.
- A system that is able to track and record an incident.

Options Considered

- Doing nothing – Not a solution.
- Expanding our current network – Not a forward moving solution.
- Satellite – Very expensive and would not completely meet our needs.
- LTE (Long Term Evolution) and FirstNet – Still in the infancy stages.
- Building our own P25 network – Viable, but costs are high.
- Making ALMR our primary network – Viable, but not ideal for the long term.
- Making AWARN our primary network – The best solution that will help us move forward.
- Utilizing AWARN in the core and ALMR in the outer areas.

Performed

- Testing – We have talked about the highlights. The complete test results are in this hand-out.
- Research – We looked into many options with an open mind, with the responders and, most of all, the public safety in thought.
- Interviews – We reached out to others in the public safety communications field – providers and users.
- Briefing – We briefed the assembly a couple of months ago and again today.

Researched

- Case studies – We took a look at how other cities, counties, boroughs, are using these options.
- Rating the options – We provided a rating scale for each of the viable solutions based on how they meet each of our current challenges.
- Costs for each option – We estimated costs for each of the options.
- Grants – We looked into various grants and other avenues that may help us achieve our goals.

Recommendation

- 700MHz in the core utilizing AWARN

- VHF in the outlying areas utilizing ALMR
- Phased approach

Slide 25 – Q & A

Thank you for your time today!

Any questions?

Important Information

This presentation has been created as both a briefing and also as a detailed story map. In addition to the individual story maps, an overall story map has been created for the audience. The links to these three story maps are listed below.

Briefing:
http://msb.maps.arcgis.com/apps/MapJournal/index.html?appid=5ff7b46f45814b529e5d716fd560aeae

Detailed presentation:
http://msb.maps.arcgis.com/apps/MapJournal/index.html?appid=10b3d80dcf514072b06c22b91867861f

Overall (includes both the briefing and the detailed presentation):
http://msb.maps.arcgis.com/apps/MapSeries/index.html?appid=944a52bb820a4bf48563ca96f5384707