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Land Mobile Radio:
Will It Survive and Thrive?

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Agenda

- AMS Disclaimer
- Introduction
- FirstNet's First Almost Two Years
- FirstNet's Hindrances
- Moving Forward
- Will LTE Replace LMR for Public Safety Grade PTT?
- What Lies Ahead
- Questions and Perhaps Even Some Answers!

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Introduction

- Congress and the FCC believe Broadband is only form of wireless communications needed going forward
- Congress looking for more spectrum to auction to reduce U.S. National Debt
- When Congress authorized FirstNet new Public Safety Broadband network took back T-Band (470-512 MHz) used and needed by 11 major cities and surrounding areas
- Major commercial networks worldwide moving to voice over LTE (VoLTE) to ‘end of life’ their 2G and 3G networks, replace with LTE
- 3GPP standards body working on push-to-talk standard for both on-network and simplex unit-to-unit communications
- Many believe LMR is doomed, will be replaced!

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But Wait!

- Not so fast!
- There is vast difference between perception and reality
- Those making decisions do not have a clue about importance of LMR for Public Safety and/or business and industrial use
- It is more and more difficult to get non-technical people to understand ongoing need for LMR for both Public Safety and business community
- Elected officials already pushing back when Public Safety needs to upgrade LMR systems
  - Hype and miss-information is adamant that voice over LTE will replace LMR
- Need for LMR will continue for a very long time!

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Good News for LMR (perhaps)

- Morgan O'Brien and some partners from Nextel days have formed a new company: Pacific DataVision
  - Purchased 6 MHz of 900-MHz spectrum from Sprint
  - Plans to build nationwide "almost" mission-critical push-to-talk network
  - Will ask FCC to permit LTE use in the 6 MHz of spectrum, then convert LMR PTT to LTE (perhaps)
  - LMR portion of plan appears to be based on a Motorola non-P25 digital technology (Mototrbo)
- Will this system actually be built or simply transition to LTE?
- If built, could it be used for Public Safety PTT services nationwide and…
- Would Morgan pursue building FirstNet?

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LMR Spectrum: Not Good for Broadband

- One advantage LMR has today is that spectrum below about 500 MHz is not well suited for commercial broadband services
  - Antennas, filters, duplexers too big
  - Handheld devices would be larger, bulky
  - LMR frequencies could be converted for point-to-point broadband but probably not
- Congress and many in FCC do not understand different spectrum is best used for different things
  - To them spectrum is spectrum—they need to be educated
- Most LMR spectrum under 470 MHz is mixed use LMR spectrum: Public Safety, B&I, paging, federal, state, local, alarm industry, many others
  - Clearing this spectrum without providing new spectrum for these uses would be difficult and expensive

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Will Public Safety Migrate to LTE PTT?

- The Public Safety Communications Research (PSCR) group under the National Institute of Science and Technology (NIST) has been pushing for PTT over LTE for several years
  - Has been successful in getting 3GPP standards body to set up a working group
  - 3GPP, we are told, will issue push-to-talk standard for LTE by 2016, could be deployed by 2018
  - Not clear how PTT over LTE will really work or what it will support
  - Those working on standard do not seem to grasp important points of one-to-many, groups, other PTT requirements
  - Also not clear how talk-around or simplex would work over LTE
  - LTE devices at 250 MilliWatts of RF power, HTs 4 to 5 Watts
  - None of this seems to be relevant to those trying to gain passage of LTE PTT!

FirstNet and PTT over LTE

- Issues that must be resolved before PTT on FirstNet is a viable option
  - Coverage of FirstNet system must meet or exceed today's LMR coverage
    - Won't happen with FirstNet for a very long time
  - If PTT is used only for administrative purposes it does not have to be mission-critical, otherwise it does…exactly what is mission-critical?
  - PTT service on LTE requires each PTT unit in use to be registered on the LTE network, which requires some bandwidth allocation. Network capacity is not known at this time, many PTT units in same cell sector could have adverse effect on total data and video capacity of the network during an incident
- Those into marketing hype making it difficult for those who have to maintain LMR systems to continue to obtain funds for system upgrades/replacements

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Commercial Operators and PTT Services

- Nextel offered built-in PTT service
  - Because it came out of LMR world
- Sprint bought Nextel, killed it, is offering its own PTT using Qualcomm QChat
- AT&T using Kodiak Network's PTT
- Verizon switched to Kodiak Network's PTT
- T-Mobile does not offer PTT
- Most smaller commercial wireless operators do not offer PTT
- Today there is no PTT interoperability between networks
- At least 30 companies providing PTT apps that run over commercial networks including Twisted Pair (now Motorola), ESChat and a score of others

Commercial Networks Offering IP Bridges

- AT&T, Sprint, Verizon offer several choices of IP bridges and gateways between LMR and their commercial networks
  - Sales model compelling to some
  - Buy or lease PTT on commercial network for upper management
  - Install manual or fully automatic IP gateway
  - Enable LMR and commercial PTT users access to each other
  - Over time migrate LMR users to commercial PTT services
  - Cancel LMR system, give back license and have nationwide PTT on commercial network of your choice
  - PTT over commercial networks is NOT
    - Mission critical
    - As good as PTT over LMR
    - PTT over commercial has some delays—will not pass the "don't shoot" test!

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Commercial PTT Services Not Successful

- Nextel in its heyday had over 18 million PTT subscribers
- Total number of PTT users on AT&T, Sprint, Verizon is less than 4 million
- Network sales folks not selling PTT services because they don't understand it
- Network marketing folks not marketing PTT services because they have no budget to do so
- Sales are hit and miss, usually made by network corporate account types
- PTT won't become truly viable for commercial networks unless
  - All three networks can offer PTT across all 3 networks
  - Network operators find new markets: Teens love to talk one to many

The Future of LMR and PTT

- How long will LMR be around?
- Answer unknown—there are many moving pieces
  - Will FCC and Congress leave LMR narrowband channels alone?
  - When will LTE (if ever) be able to support PTT as mission-critical communications?
  - When (if ever) will LTE devices have simplex or talk-around capabilities?
  - When will commercial network operators enable cross-network PTT? (I think this is a big deal)
- For Public Safety, MOST important question can only be answered by a police or fire chief
  - When will you trust your people's lives to PTT over anything other than LMR?
- My prediction is that LMR will be around for at least the next two decades (20 years) in one form or another

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FirstNet™
First Responder Network Authority

Changing Gears!

WHAT IS GOING ON WITH FIRSTNET?

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FirstNet Was Created by Congress

- As in "Independent Authority" under NTIA/DOC
- As a board of directors given the tasks of
  - Hiring people
  - Building the network
  - Entering into public/private partnerships
  - With only $7 billion in funding
- FirstNet formed by Congress in February 2012
- This is November 2014 and FirstNet
  - Does not have a single part of the network up and operating
    - Harris County was pre-FirstNet
  - Has not finish the mandated state outreach
  - Has not formed ANY public/private partnerships
  - Has been delayed by politics for more than two years
  - It is NOT the fault of FirstNet—look instead to the NTIA!

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FirstNet's Hindrances

- FirstNet not an "Independent Authority" within NTIA
  - NTIA still involved in hiring
    - Much easier for FirstNet to hire existing federal employees than outside, perhaps better qualified people
    - Federal government salary levels not much of an incentive
    - Most of FirstNet's hires are there because they believe in FirstNet, NOT for the money
    - Process for hiring consultants long, arduous
  - Commerce Department's Inspector General conducting investigation on charges made by a board member in 2013
    - This has slowed FirstNet's progress, caused existing contractors to be terminated, and has resulted in loss of at least six months of progress
  - Recent loss of General Manager for "personal reasons"
    - GM was committed to Public Safety Broadband
    - New GM search underway
  - NTIA limits FirstNet's ability to negotiate with potential partners

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FirstNet Moving Forward

- Hopefully many of these issues now behind FirstNet
- It is moving forward after the delays, appears to be making progress in many areas including state outreach
- Still no network partners or network system design
  - What type of system will FirstNet decide to build?
  - What types of partners will assist it?
  - Will Public Safety sites be used or only commercial sites?
- Partner issues
  - How much secondary spectrum will be available in top 100 metro areas (where spectrum has most value)
    - No one knows answer to this question
  - Who are best partners?
    - Major commercial network operators?
    - Rural network operators and power/utilities?
    - Major utility companies: electric, gas, etc.?

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Moving Forward (2)

- What is in the ground and planned
  - Harris County, Texas
    - Contract to Motorola before FirstNet
    - Up and operating with 16-22+ sites
    - Finally signed spectrum lease with FirstNet
  - Adams County, CO
    - First system with “FirstNet Approval”
    - Limited coverage, 4 sites up and running
- LA-RICS
  - Spectrum lease in place with FirstNet
  - Bids returned, contracts awarded to Motorola along with LMR
- Las Vegas Public Safety LTE Trial
  - Temporary network to promote multiple vendors and interoperability
- Public Safety Communications Research (PSCR)
  - What role will it play moving forward?

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What Lies Ahead

- After some administrative and other delays, FirstNet
  - Is back in the game
  - Is moving forward but hiring still taking too long, hiring from within federal government not best option but easiest at the moment
  - Fully understands issues of working under the shadow of NTIA/DOC, trying to become more independent
- FirstNet people very dedicated, want to do their jobs to best of their ability
  - Many frustrated with time it takes to get anything accomplished
  - Changes to board of directors could be good or bad depending on who is chosen
- There is still a perceived (real) lack of information being disseminated into the Public Safety Community
  - Public Safety needs to play greater role—PSAC, NPSTC, APCO

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FirstNet Going Forward

- Back to square one
  - Is FirstNet a Public Safety network or will it be a federal network made available to Public Safety?
    - Answer will determine success or failure of FirstNet
- LA-RICS will be important milestone for FirstNet
  - Will it work? Will it succeed and can it be incorporated into the nationwide network? All very important questions
- Biggest issues facing FirstNet
  - States working with local jurisdictions
  - Local jurisdictions feeling included
  - Network partnerships
    - Believe this will be critical to success of FirstNet
- Biggest threat to FirstNet
  - November elections, so Jan/Feb 2015
  - Some in Congress now value FirstNet at about $20 billion!

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The FirstNet Network

- What will it really cost?
- AT&T, Verizon already spent more than $30 billion each!
  - And already had 2G, 3G systems on the air
  - Tower sites built and identified
  - Back-end (core) services in place
- Can FirstNet build the network as it needs to be built?
- Can FirstNet maintain the network with high op-ex costs?
- Will local departments sign up for service?
  - What will it cost per user per month?
  - What will they get in return?
  - How will FirstNet coverage stack up against AT&T, Verizon, and even Sprint?
    - The Answer is not very well for many years!

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With Whom Will FirstNet Partner?

- Ideally, major commercial network operators
  - However, when asked to respond to public RFIs have been less than forthcoming
  - FirstNet NOT permitted to sit down across a table and talk directly to commercial operators to make a deal—at least according to NTIA—which really runs FirstNet
- FirstNet thinking about another round of partnership RFIs and then RFPs
  - These too will fail
  - Smaller but very qualified partners will not take part
  - Major players will not provide details in public response
- How much excess spectrum does FirstNet really have
  - On a Friday night in Manhattan?
  - It has a lot in Boise, Idaho but AT&T, Sprint, Verizon don't need to share spectrum in Idaho

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A Sensible Approach to Building the FirstNet Network

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FirstNet Is LTE

- Long Term Evolution (LTE) technology
  - Improves over time, new standards, additions being released yearly
  - Vendors and operators pick and choose what new features to support and/or add to network
- Network build-out: Long Term Evolution
  - Not enough money to happen quickly
  - No partners on the horizon to assist
  - FirstNet is really a U. S. Government entity, NOT an Independent Authority
    - Slows everything down by years
    - Red tape limits what FirstNet can do, how it does it
  - A new approach is called for!
- Enter into agreements with carriers for seamless roaming
  - Single bill for both commercial and FirstNet systems as an option

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Network Build Out—Phase ONE

- Goal: Build out coverage to street-level vehicle only
  - Most cell sites omnidirectional not sectorized
- Build out to vehicle coverage
  - Employ secure Wi-Fi/4.9-GHz spectrum for device to vehicle communications (vehicle repeats to and from network)
  - Fill in with satellite back-end deployables/Cells on Wheels (COWS)
- Add suburban and rural partners, build out more robust system in those areas
- Deploy fixed cell sites in remote areas, satellite back-end
- Local communities/states can add sites as approved
- Track system usage, develop usage data for potential partnerships in metro areas
- **This system can be built for the funds available!**

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Network Build-Out—Phase Two

- Goal: Extend coverage directly to handheld devices outdoors
- Sectorize cell sites to gain capacity where needed
- Fill in sites as needed for better metro coverage/capacity
- Build where partners need/want services
- Permit states/locals to continue to add new cell sites: macro, micro, pico, and Distributed Antenna Systems (DAS)
- Work with commercial network operators to collocate FirstNet if needed, even if operator not a FirstNet partner
- Test and prove out true pre-emption priority access for first responders
- Develop plan/pricing for in-building system expansion
- Redefine partnership opportunities

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Network Build-Out Phase 3 and Ongoing

- Goal: to provide LTE broadband coverage equal to existing Land Mobile Radio (LMR) coverage
- Align additional partners, including utility companies, power companies, others
- Continue build-out with FirstNet, partner, add local organizations to maximize network investment
- Review and adjust monthly user fees as needed
- Launch and test combination LTE/LMR devices
- Launch and test non-mission-critical voice (PTT) services and monitor network usage during incidents
- Provide limited PTT bridging between LMR/FirstNet for some testing and exercises
- Build out inbuilding coverage where required

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Timeframe for FirstNet Build

- Phase One: up to 3 years
- Phase Two: 2-4 years
- Phase Three: 3-on
- Total project time
  - If FirstNet remains captive of NTIA/DOC and is required to act like a Federal Agency: 10 years
  - If FirstNet can become what it was intended to be, an “Independent Authority,” this time can be halved

- Can FirstNet, as a U.S. Government run organization, provide the network and services Public Safety needs so badly?
- Your answer here:

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Will FirstNet Replace LMR Radios?

- Not in my life time, probably not in yours!
- If FirstNet permits ANY type of PTT on its network before the network is fully operational and fully tested for data and video, it is making a really bad mistake
- VoLTE for dial-up coming to commercial networks
  - Many who use cell phones think that is what Public Safety communications is all about
  - They question our issues with interoperability; after all, they can dial 10 digits and talk to anyone in the world
  - They have no clue about one-to-many, dispatch, or group communications
  - They have no idea about simplex or talk-around
- FirstNet coverage will not begin to match LMR coverage for a very long time, if ever
  - Neither AT&T nor Verizon match LMR coverage today!

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Voice Over LTE: An update

- UK (England) has declared
  - Tetra will be replaced by 2016 with LTE data and voice services
    - Declaring a date certain before technology is available is dangerous
- PSCR and others
  - 3GPP standard for mission-critical PTT and off-network (simplex) voice will be completed by 2016, therefore
  - Mission-critical PTT will be available in 2018
- HOWEVER
  - Open Mobile Alliance (OMA) also working on a PTT standard
    - Recent meetings in France indicate 3GPP and OMA will merge efforts
    - Could delay mission-critical PTT BUT could make it better
- Bottom line
  - If you are counting on Pubic Safety grade or mission-critical PTT over LTE before 2022, be prepared to be disappointed

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Changing Gears Again!

LMR: ANALOG GOING TO DIGITAL?

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Interoperability with LMR Systems

- 9/11 and Katrina were about interoperability issues
  - Different portions of spectrum for different Public Safety services
  - Different types of communications systems for different Public Safety agencies
    - Analog and conventional
    - P25 Phase 1 and Phase 2
    - DMR or Mototrbo
    - Other Digital formats
    - Now Tetra is moving into U.S., at least for utilities
- Instead of moving closer to interoperability, seems we are moving farther away
- FCC cancelled 6.25-KHz narrowbanding in 700-MHz LMR spectrum
  - Will that mean fewer P25 Phase II systems?—I hope so!
- How do we fix this problem?

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LMR Systems

- Many smaller counties and cities will remain on FM as long as they can
  - Expensive to move to P25 and few benefits for many smaller localities
- Some smaller departments will move to DMR or Mototrbo instead of P25 again because of cost
  - Will retain some interoperability capability via DMR/FM radios
- Many regional systems have or moving to 700-MHz P25 Phase I or Phase II
- Voice interoperability remains a challenge, appears to be getting worse, not better
- This only fuels Voice over LTE crowd!
- Too many competing technologies means more industry confusion, less interoperability!

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Predications and Guesses!

WIRELESS COMMUNICATIONS GOING FORWARD!

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LMR Systems

- LMR will be around for next 20+ years
- May be some attempts to move LMR systems to LTE networks but they won't provide mission-critical PTT services
- Those who left LMR for LTE will return
- There will be LMR/LTE cross connections
- PTT over LTE will improve but NOT good enough
- Single device for FirstNet responders might be
  - LTE with screen
  - LMR on 700 MHz for simplex and talk-around
- Congress and FCC will try to push LMR off their spectrum but will not be successful
- FM systems will remain viable for at least 10 years

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FirstNet: Success or Failure?

- Could depend on politics
- FirstNet needs partners to succeed
- NTIA has short leash on FirstNet that precludes private conversations with partners
- Most potential partners do NOT want to be partners with U.S. Government, but are okay with Public Safety
- FirstNet needs to be given freedom to succeed
- Timing
  - With continued NTIA interference, over 10 years to reach 80% coverage in United States
  - With FirstNet independence: 5 years to achieve same goal
- FirstNet: Congress giveth and Congress can taketh away!
- Locals will be slow to join FirstNet due to coverage

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Morgan O' Brien and Pacific DataVison

- Will build out Nationwide PTT network on 900 MHz within 2 years
- Will attract up to about 4 million customers
  - Many will be large U.S. companies with multi-state operations
- Once completed, Morgan will turn his attention to FirstNet
  - Convince Congress he can build it out
  - Congress will approve his takeover of FirstNet

  - Use 900-MHz system for mission-critical PTT nationwide
  - Use FirstNet for data and video nationwide services
  - FirstNet will include partnerships and spectrum sharing as part of overall program
- FirstNet will be built in record time and rates will be attractive to many local first responders!

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Issues to be Resolved (Industry Wide)

- True and absolute pre-emption on FirstNet
  - Today if LTE signaling channel is overloaded it does not matter if you have priority access; the network won't even know you are trying to connect
- LTE talk-around (peer-to-peer)
  - Can it be done, will it really work?
- Will commercial network operators provide cross-network PTT services with no interconnect fees?
  - Needed to grow commercial PTT
  - SMS took off only when interconnected
  - MMS took off only when interconnected
- How do so many different voice standard co-exist in LMR?
  - P25, Tetra, DMR, others?
  - How soon will LMR FM equipment no longer be made?

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