

ISART Panel Presentation

# Spectrum Sharing in the Land Mobile Radio (LMR) Bands

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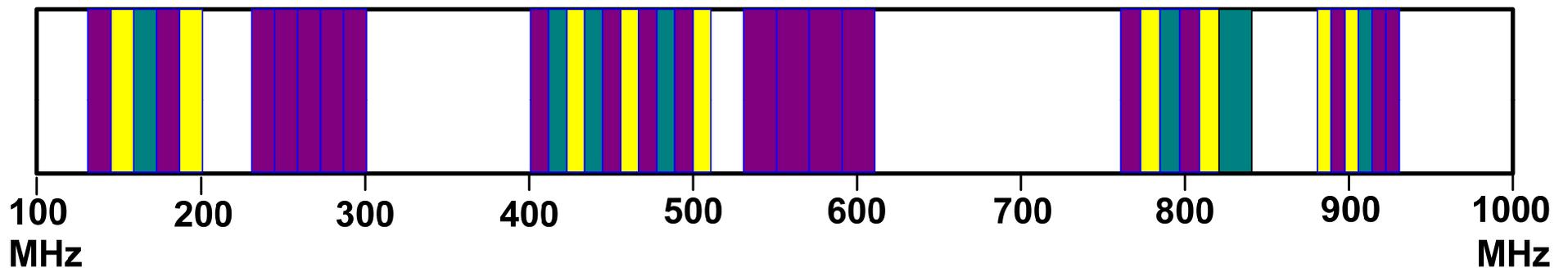
**NCE**

# The Current LMR Environment in the United States

- ▶ LMR is primarily two-way push-to-talk radio
  - Typically one-to-many communication
  - Often supports dispatch
  - Thousands of small networks, some trunked networks
- ▶ Different classes of users, each assigned its own spectrum
  - Critical infrastructure (Business/Industrial)
  - Non-military Federal
  - Public safety
  - Military
- ▶ Eligible organizations build independent radio systems
  - Acquire dedicated spectrum through frequency coordinators
  - Own and operate their own infrastructure (with limited sharing, outsourcing)



# Stove-piping of US Land Mobile Spectrum

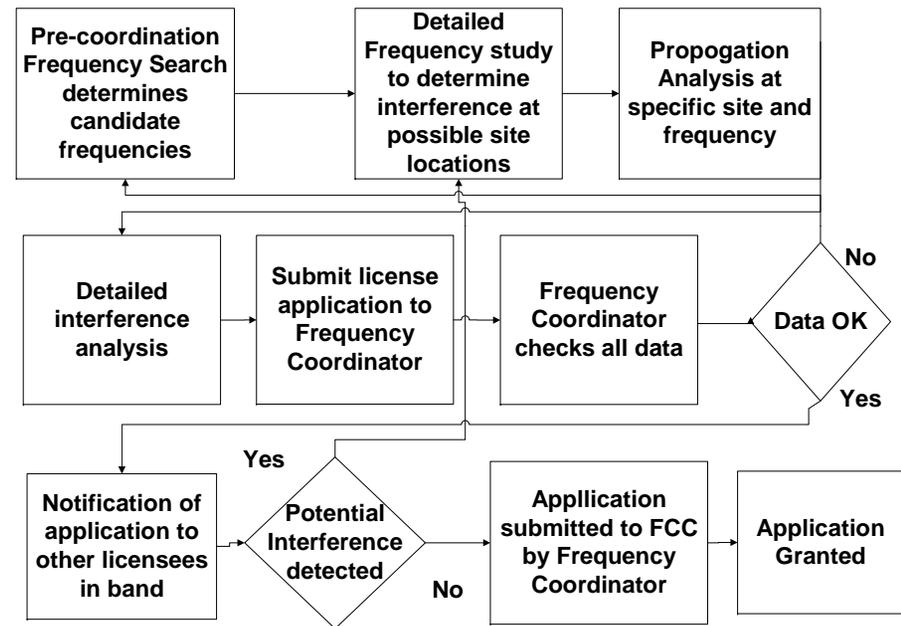


Note: Spectrum allocations are notional and do not reflect actual allocations



# LMR Bands Today: Chaotic and Arcane

- ▶ “Classes of Users” unchanged since 1927
- ▶ Licensing process still assumes one tower, not a wide area network
- ▶ Frequency coordination required for every channel on every tower
- ▶ No multi-band system equipment

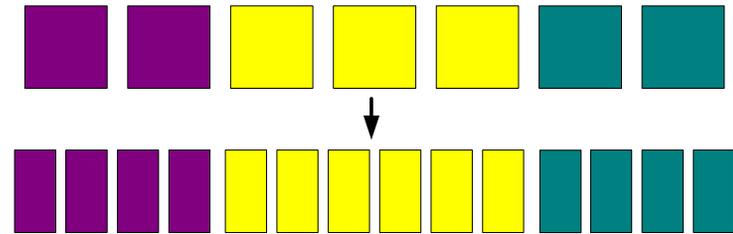


Inefficient!



# The Narrow-banding Problem

- ▶ Mandate in a nutshell:
  - Voice must be supported over narrower channels
  - Users wait until 2013 for legacy systems to depart
- ▶ Narrowing when should be broadening
  - Precludes access to better propagation characteristics in lower bands
  - Creates incentive to “up band”
- ▶ Result: exacerbates spectrum scarcity



Narrow-banding is like poor urban planning: well-intentioned hope of density followed by ghetto of abandoned spectrum

# 700 MHz, 4.9 GHz and Broadband for Public Safety

- ▶ 24 MHz in 700 band granted to public safety as expansion band in the 1990's -- but TV stations still operating there, and no equipment existed to build into these bands for LMR narrow and wideband. 50 MHz at 4.9 GHz set aside for future use.
- ▶ 2007 - FCC as a result of SPTF work - reallocated the wideband public safety reserve band at 700 MHz to a Public Safety Trust -- to be combined into the D Block Auction. Public Safety requirements and the minimum bid threshold for the D Block operator caused the auction to fail
- ▶ Meanwhile trials in SFO, DC and NYC show pent up demand for broadband applications -- 700 MHz Waivers for several states and major cities were granted this summer with possible Federal BTOP funding.
- ▶ Public Safety lobbies for D-Block to be allocated to public safety to increase 700 MHz PS allocation to 20 MHz. FCC position -- public safety doesn't need the D Block, can't afford a national BB network on its own
- ▶ LTE, WiMAX, EVDO cause architecture confusion
- ▶ Meanwhile--public safety forced to focus on narrowbanding and Nextel re-banding
- ▶ Smartphones, consumer demand squeeze all existing business models--Is this who we are sharing with?



# Reforming LMR Spectrum Management Principles

## ▶ **Dynamic Access, Not Licenses**

- Don't leave spectrum fallow just because its "reserved"

## ▶ **Band impartiality**

- Don't create artificial incentives for people to use particular LMR bands over others
- Perfect world: propagation characteristics drive band choices

## ▶ **Shared Infrastructure (radio resources)**

- Lower cost to users
- Accelerate innovation

## ▶ **"Lights and Sirens" Access**

- Prioritize access based on the criticality of the communication

## ▶ **Combine the Pools**

- Don't limit a user's access to spectrum when they need it
- Your class ≠ value of your communication
- Less segregation → more efficiency, more interoperability



# Assumed Benefits of DSA in LMR Bands

Principle	Benefit
Spectrum efficiency	▶ Eligible users can dynamically access spectrum from a pool of spectrum when it is not in use
Band impartiality	▶ Broadband, narrowband in all bands (e.g., UHF, VHF, 800MHz)
Competition	▶ LMR operator competition leads to lower prices and innovative services (e.g., nationwide roaming)
Criticality-driven priority of service	▶ Life-saving communications always gets first priority
Class Integration	▶ All users can access full LMR spectrum to meet emergency needs, protect critical infrastructure, interoperate with first responders



## Panel Discussion

- ▶ **Dale Hatfield** - Exec Dir. Silicon Flatirons Center for Law, Telecom and Entrepreneurship, former FCC OET Chief, Obama Telecom Transition Team and co-chair of the Commerce Spectrum Management Advisory Committee
- ▶ **Steve Devine** - Interoperability Program Manager - Missouri Dept of Public Safety, Missouri Interoperability Coordinator, chair MS SIEC, vice chair of National Regional 700-800 planning committee
- ▶ **Fred Franz** - Chair Wireless Innovation Forum's Public Safety Special Interest Group, NIJ CommTech Program
- ▶ **Chris Algieri** - Wireless Services Branch, Department of Homeland Security, IRAC representative for DHS, formerly with NTIA



## Discussion Topics

- ▶ Is LMR spectrum scarce?
- ▶ Is Spectrum Pooling Feasible in LMR?
- ▶ Does Spectrum Priority trump spectrum ownership?
- ▶ Will Users Permit Dynamic Spectrum Access?
- ▶ Can we Decouple Infrastructure-Create Portable Spectrum ? -- Allow LMR operators to compete for “portable” users
- ▶ What are the prerequisites?

## Panel Discussion

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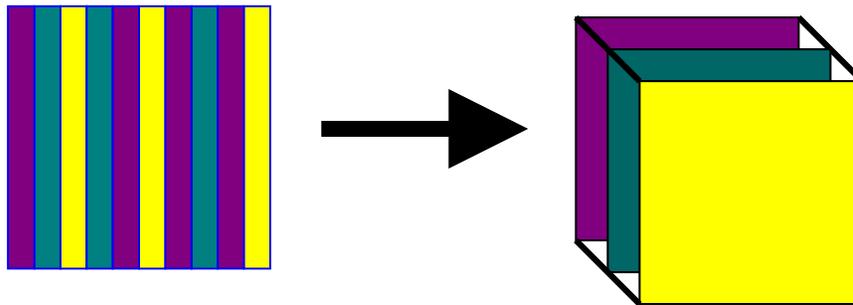
# Is LMR spectrum scarce?

- ▶ Demand is increasing:
  - Users more dependent on wireless communications
  - New applications, especially broadband
  - Population\economic growth
  
- ▶ Do we need a separate broadband network for public safety?
  - Can public safety afford to build and operate a national broadband network?
  
- ▶ Should narrowbanding be rescinded?
  
- ▶ Are vendor monopolies controlling system design and efficiency?-- cost to upgrade is too high
  - No multi-band equipment



# Is Spectrum Pooling Feasible in LMR?

- ▶ Can we undo licensing? And replace access rights with priority?
- ▶ Could we combine the LMR spectrum blocks and make them available across all classes of users?
- ▶ Can we write the prioritization scheme?
- ▶ Is organizational resistance a bigger problem than physics?



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# Does spectrum prioritization trump spectrum ownership?

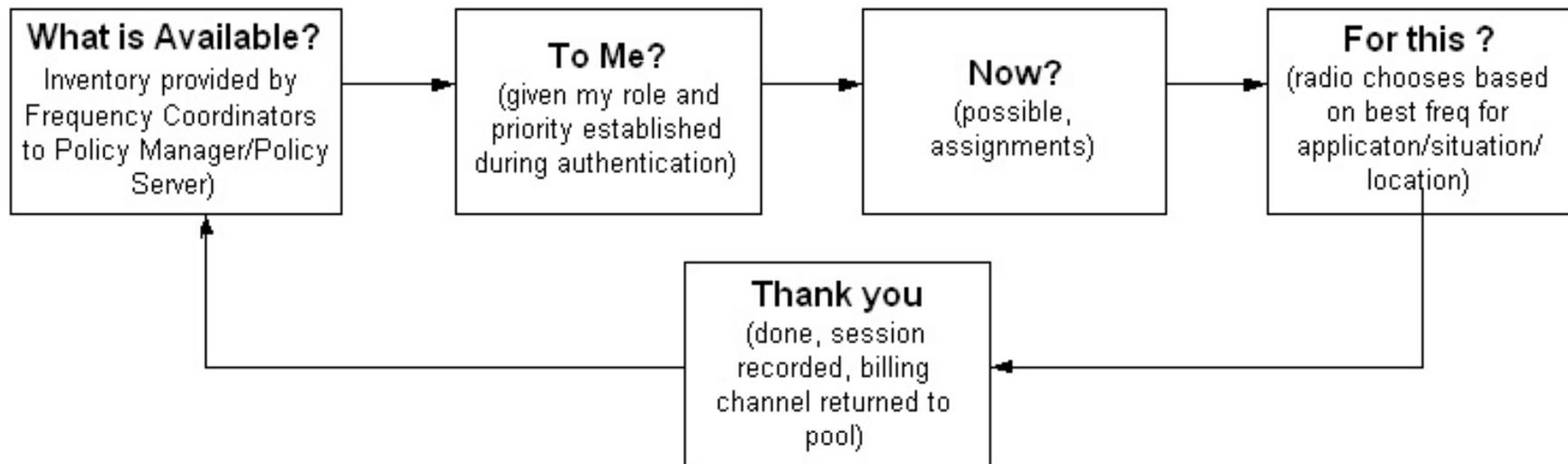
- ▶ Are we done with the primary/secondary user model when prioritization confers rights, not licensing?
- ▶ Can prioritization work across classes of users and business models (in other words will lights and sirens interruptions make a network less economically viable)?

# Will Users Permit Dynamic Spectrum Access?

- ▶ What models of CR architecture look promising for these classes of users? (policy based radios, ad hoc networks, etc)
- ▶ Who would manage spectrum pools? If we have Spectrum Managers not licensees could we create a dynamic (on-line) reservation system for LMR spectrum?
- ▶ Does the National Incident Management System (NIMs) provide a prioritization and authorization model for day-to-day and emergency response? Can we write something like NIMs into radio policies?
- ▶ Can we start in the broadband world where we have a greenfield?
  - 700 MHz and 4.9 GHz



## How Policies Resolve (Lehr Jesuale)



# Can we Decouple Infrastructure-Create Portable Spectrum ? -- Allow LMR operators to compete for “portable” users

- ▶ Can spectrum rights be portable over any available infrastructure? (If there is no user, there is no spectrum)
- ▶ Could Operators be licensed to provide service to any eligible in pooled blocks
  - Decouples spectrum access from infrastructure provision
  - Could multiple operators could co-exist in same geography?
  - Operator licenses permit infrastructure service for a particular area across bands
- ▶ Eligible users have “portable” spectrum access rights
  - Can roam to other jurisdictions to support major incidents



# What are the prerequisites?

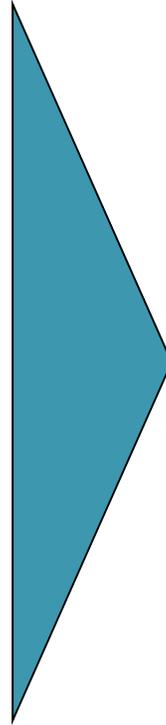
- ▶ Cognitive radio - what flavor?
- ▶ Radio standards
  - Meta-language to describe radio policies in different jurisdictions (e.g., for expressing mutual aid agreement)
  - Dynamic spectrum access protocol
  - Priority of service protocols
- ▶ Enhanced and dynamic frequency coordination function
  - Concept of operations for formulation and distribution of policy
  - Supporting information systems for spectrum allocation reservations
- ▶ LMR internetworking (gateways, roaming agreements, etc.)



# Summary

## As Is

- ▶ LMR users want greater access to fragmented spectrum
- ▶ Narrowbanding mandate → “graveyard” in lower frequencies
- ▶ Current infrastructure is redundant and does not support interoperability



## To Be

- ▶ Pooled spectrum → more spectrum available to each user
- ▶ Flexi-banding → broadband services that can also carry voice
- ▶ Dynamic spectrum access → More efficient use of spectrum, no more “scarcity”
- ▶ LMR operator competition → lower costs, innovation, interoperability, nationwide roaming

# Questions

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