



# Public Safety Communications Research (PSCR)

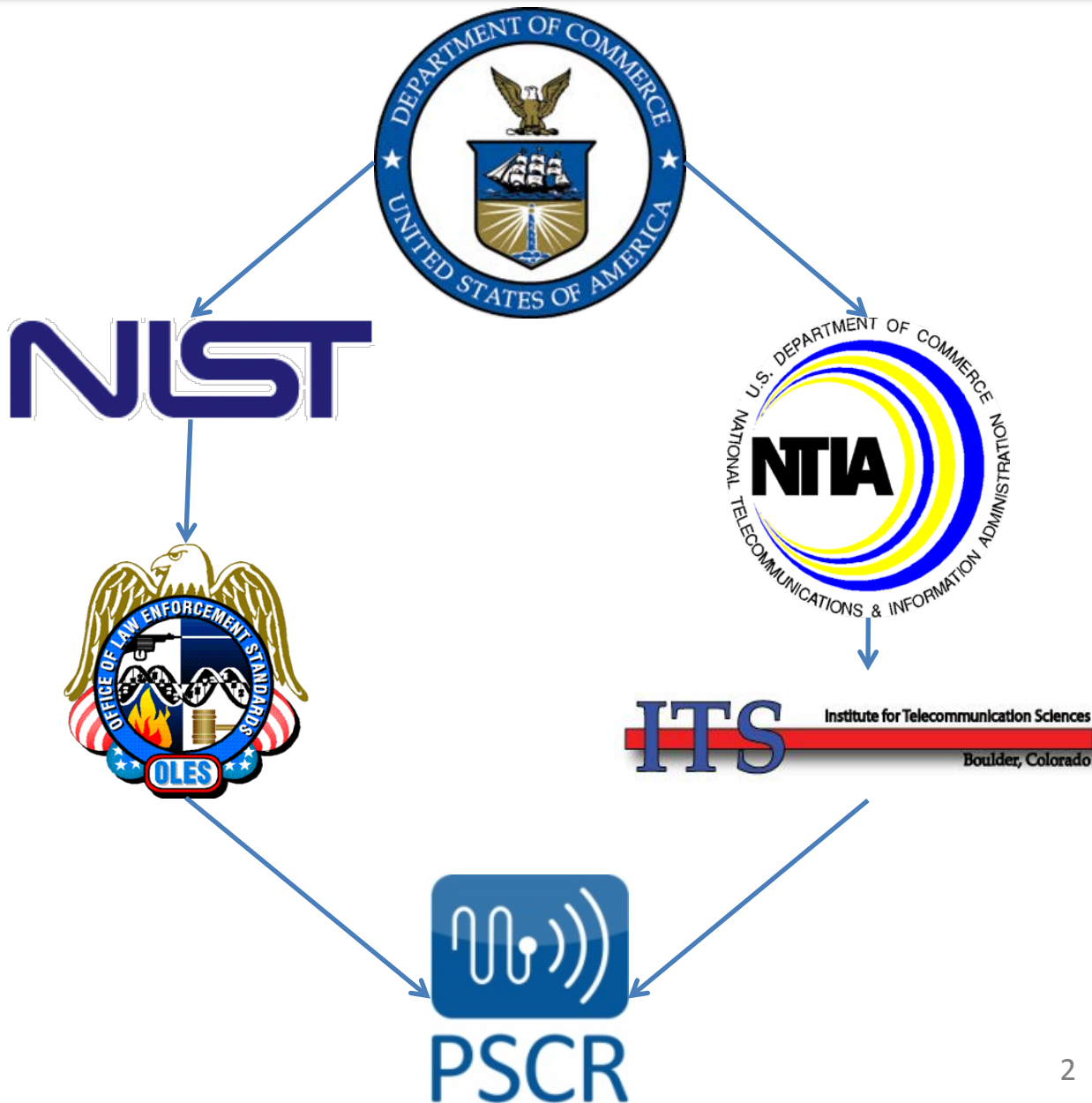
Department of Commerce – Boulder Labs

# Public Safety Communications Research Program

*Located at the  
Department of Commerce  
Boulder Labs in Colorado*

The PSCR Program is a  
joint effort between:

NIST's  
Office of Law  
Enforcement Standards  
(OLES)  
and  
NTIA's  
Institute for  
Telecommunication  
Sciences  
(ITS)



# PSCR Sponsors



## Homeland Security

Department of Homeland Security

Office for Interoperability and Compatibility



## COPS

Department of Justice

Office of Community Oriented Policing Services

# PSCR Portfolio

<b>LMR Standards and Technologies</b>	<b>Broadband Standards and Technologies</b>	<b>Emerging Standards and Technologies</b>
P25 Standards and CAP*	Demonstration Network*	Bridging LMR & LTE*
P25 Test Tools* and Simulation	Requirements and Standards*	Video Quality*
Public Safety VoIP*	Mission Critical Voice*	
Audio Quality*	Modeling and Simulation	
RF Propagation Studies	RF Propagation Studies	

\* Project funded by DHS Office of Interoperability and Compatibility

# NIST and the Legislation

- The legislation provides **\$100 million** to NIST after successful spectrum auctions net \$7.2 billion or more
  - An additional **\$200 million** will be allocated to NIST if spectrum auctions net more than \$27.6 billion
  - These spectrum auctions could take upwards of 7 years.
- Until the **\$100/\$300 million** is allocated to NIST, the agency's expertise and technical objectivity is required to ensure the early success of the network

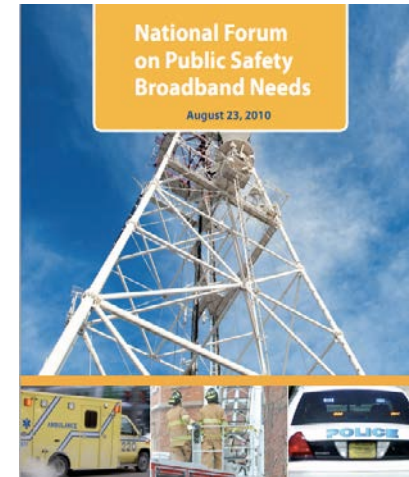
# FirstNet Requirements Related to PSCR Activities

Subsection B of the legislation mandates FirstNet to (among other things):

- **Requirements:** Develop requirements for safety, security, and resiliency of the network
- **Standards:** Ensure there are nationwide standards for use and access of the network
- **Testing:** Implement a robust infrastructure and device certification regime
  - **Maintenance and Upgrades:** Ensure seamless maintenance and upgrades of the network through this testing program
- **Research & Development:** Though FirstNet is not required to perform R&D per the legislation, NIST's Organic Act will cover the R&D that is necessary to ensure success for public safety's early adoption of network technologies.

# Requirements

- PSCR chairs the **NPSTC Broadband Working Group**
  - 200+ public safety members
  - Developed the [700MHz Broadband Statement of Requirements](#)
    - Currently being updated at Workshops in Boulder, CO May 23-24, Denver, CO June 26-27, and Boulder, CO August 8-9
    - Will be delivered to FirstNet upon instantiation in August 2012
  - Defined [Mission Critical Voice](#) Communications Requirements for Public Safety, August 2011



- PSCR leads **5 BBWG Task Groups**
  - Local Control
    - Published a Definition of Local Control document, February 2012
  - Multimedia Emergency Services
  - Priority/Quality of Service
  - Security
  - Voice



APCO

- PSCR is active in **other broadband requirements gathering efforts**

- APCO Broadband Working Group
- DOJ's National Forum on Public Safety Broadband Needs
- PSST Operators Advisory Council



NPSTC

# Standards

PSCR has historically provided insight and direction to IT and wireless standards committees that are developing standards for voice, data, image, and video communication specific to public safety.

PSCR's work is currently focused in these SDOs:



The **3<sup>rd</sup> Generation Partnership Project (3GPP)** produces the technical standards and specifications for LTE, uniting numerous telecommunications standards bodies under one group.

- PSCR is a member of 3GPP and represents public safety's requirements
- PSCR has introduced a work item into 3GPP to address Direct Mode (Proximity Services) communications



The **Alliance for Telecommunications Solutions (ATIS)** is the North American standards body representative in 3GPP.

- PSCR is a member of ATIS and represents public safety's requirements
- PSCR has created an issue statement that would give the ATIS WTSC the ability to work on public safety specific issues



The **GSM Association (GSMA)** is an association of mobile operators and related companies that support the standardization of the GSM system.

- PSCR is actively seeking membership to GSMA in order to represent public safety's requirements to their Voice over LTE (VoLTE) initiative



The **Global Alliance of the APCO and TETRA Critical Communications Association (TCCA)** have officially announced their support of first-responder LTE standards work being conducted by PSCR.



# Testing

*FirstNet will need to stand up a robust compliance and interoperability testing program for devices and infrastructure on the network.*

- PSCR is working with the **PCS Type Certification Review Board (PTCRB)** and the **MultiService Forum (MSF)**, both international testing bodies, to understand how other segments of the cellular industry perform certification testing on both devices and infrastructure.



- Additionally, PSCR has experience designing and launching a compliance assessment program for Project 25 land mobile radios.
- This well-documented and formal test process will also help FirstNet manage **maintenance and upgrades** across the network and across multiple manufacturers equipment.

# R&D: Demonstration Network

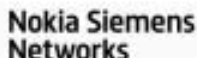
*The only government or independent lab facility located in the United States to test and demonstrate public safety 700 MHz broadband networks and applications*

The Demonstration Network provides:

- A place for manufacturers and carriers to deploy their systems to test them in a multi-vendor environment. This provides integration opportunities.
- A place for public safety to see how these systems will function, specific to their unique needs. Interested agencies can visit the network and get hands-on experience with these systems, as well as run public safety specific test cases that relate directly to their operational environments.
- A place where early builders can ensure that the systems they might procure will in fact work in the eventual nationwide network, assisting agencies in their procurement process.



# R&D: Demo Network CRADA Partners



# R&D: Demonstration Network Study Items

- **Network Identifiers:** Developing requirements for a single nationwide public safety 700-MHz public land mobile network (PLMN), as well as test cases to evaluate such requirements.
- **Network Performance:** Defining basic and public-safety-specific 700-MHz LTE demonstration network requirements for coverage, use planning and implementation, metrics and test strategy.
- **UE Testing:** Determining UE test cases for UE deployments in the public safety 700-MHz demonstration network. The goal is to ensure that UE deployments meet performance and interference requirements identified by Federal, state, and local agencies.
- **Infrastructure Testing – RAN & EPC:** Defining test processes, requirements, and specifications to cover minimum performance and conformance to LTE/3GPP specifications. The infrastructure testing group is also addressing the same issues related to interoperability of network infrastructure.
- **Roaming & Clearing:** Defining standards, recommending architecture, and creating test cases for possible LTE roaming scenarios applicable to the public safety 700-MHz demonstration network.
- **Universal Integrated Circuit Card (UICC):** Defining an initial set of parameters and requirements for the UICC, including software features.

# R&D: Audio Quality Testing

## Audio Quality Testing:

- Firefighter reports showed that some background noises created by firefighting equipment can interfere with digital narrowband communication
- Similar audio quality issues may arise as voice is introduced to the public safety broadband network
- PSCR is initiating broadband audio quality testing with:
  - A transcoding study between the Adaptive Multi-Rate Narrow Band vocoder (the fallback vocoder for Voice over LTE) and the Project 25 vocoder
  - A subjective experiment to understand the effect of background noise on the new vocoder

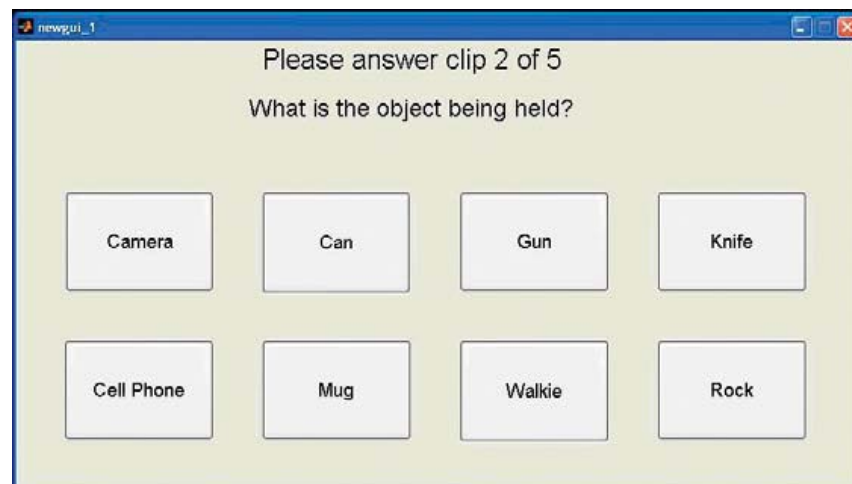
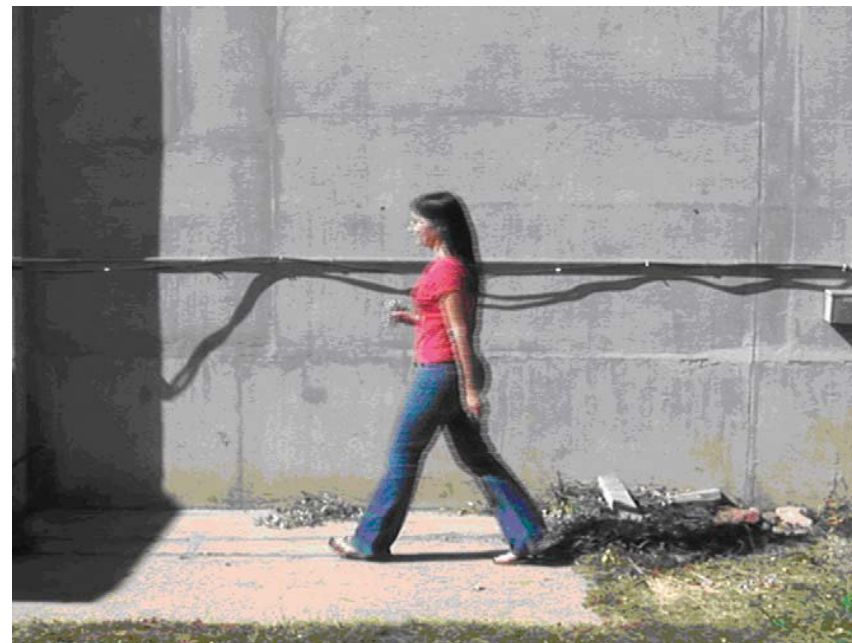


# R&D: Video Quality Testing

## Video Quality Testing:

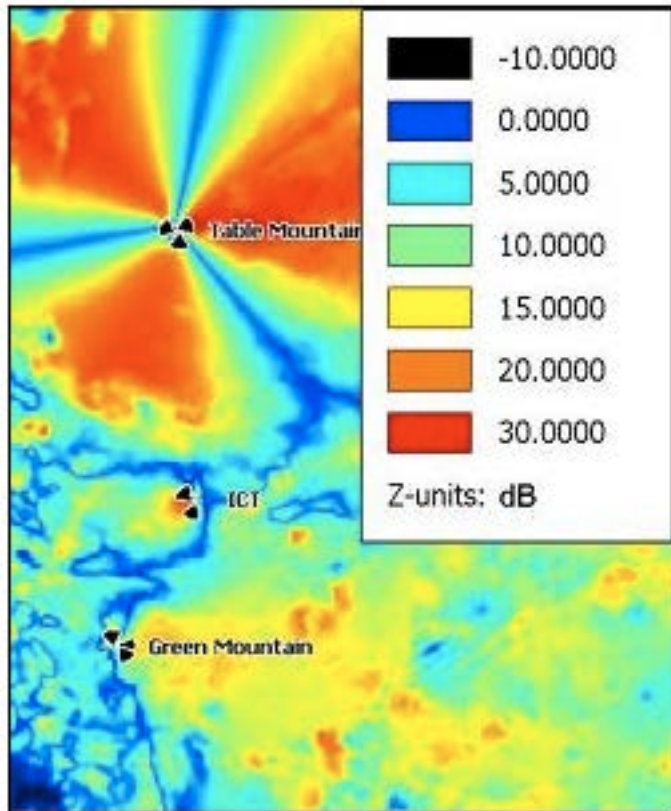
*Video is one of the most commonly identified use cases for the network and also the most likely to congest it.*

- Traditional methods of evaluating perceived broadcast video quality are not appropriate for public safety video.
- PSCR has been conducting research to develop task-specific video quality requirements for public safety applications.
- This work has been incorporated into International Telecommunication Union (ITU) standards for subjective task-based video quality.
- Outputs of this research will allow for informed decisions on quality of service parameters for the public safety network.



# R&D: 700MHz Modeling & Simulation

## 700MHz Modeling and Simulation:



Work performed by:  
**NIST Information Technology Laboratory**  
and  
**NIST Physical Measurement Laboratory**

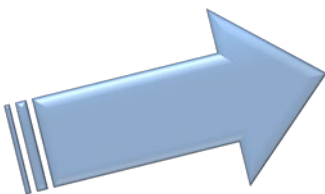
- Providing the public safety community with the performance analysis tools needed to better understand emerging network technologies, including:
  - The evaluation of worst/best case network deployment scenarios
  - The investigation of how well new technologies support public safety requirements
  - The development of quantitative requirements for public safety communications
- Informing build out of the Demonstration Network and using the network's data to inform models
- Driving the development of next generation network standards in support of public safety communication needs

# R&D: LMR to LTE Interface

## LMR to LTE Interface:

*For the foreseeable future, public safety will be leveraging narrowband for voice and broadband for data communications, but there must be the capability to connect the narrowband and broadband systems together to create more dynamic communications capability amongst all existing systems.*

- Through the NPSTC BBWG Broadband Voice Task Group, PSCR is looking at LMR/Broadband integration, including mission-critical voice over broadband and requirements for direct mode communication



- In developing a specification for an LMR to LTE interface, PSCR is leveraging its past work in:
  - **Radio over Wireless Broadband (ROW-B)**, which successfully integrated radios operating on an existing Land Mobile Radio (LMR) system with a 700MHz broadband network
  - **Voice over Internet Protocol (VoIP)**, in which PSCR led a coalition of public safety officials and bridging systems vendors to develop an VoIP implementation profile so one emergency response agency could seamlessly connect its radio system to another agency's system over a network—regardless of manufacturer



# Moving Forward

## Providing objective technical information about the network

- The PSCR Demonstration Network provides a central and independent test bed/laboratory to help public safety understand 3GPP Release 9, 10, etc.
  - Provides an objective forum for public safety to test and verify new capabilities

## Ensuring the network has the crucial long-term capabilities to meet public safety's needs

- Coordinating development of crucial capabilities to make the network successful across multiple requirements efforts and standards bodies:
  - Audio Quality over LTE testing
  - LMR to LTE

## Uniting public safety to ensure the network meets long-term needs

- PSCR is currently interacting with the vast majority of the key stakeholders across these multiple efforts
  - Requirements Development
  - Standards Representation
  - Demonstration Network
  - Other R&D