



# Public Safety Communications Research

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**PSIC Grantee Conference  
October 5 and October 6, 2010**

# Agenda

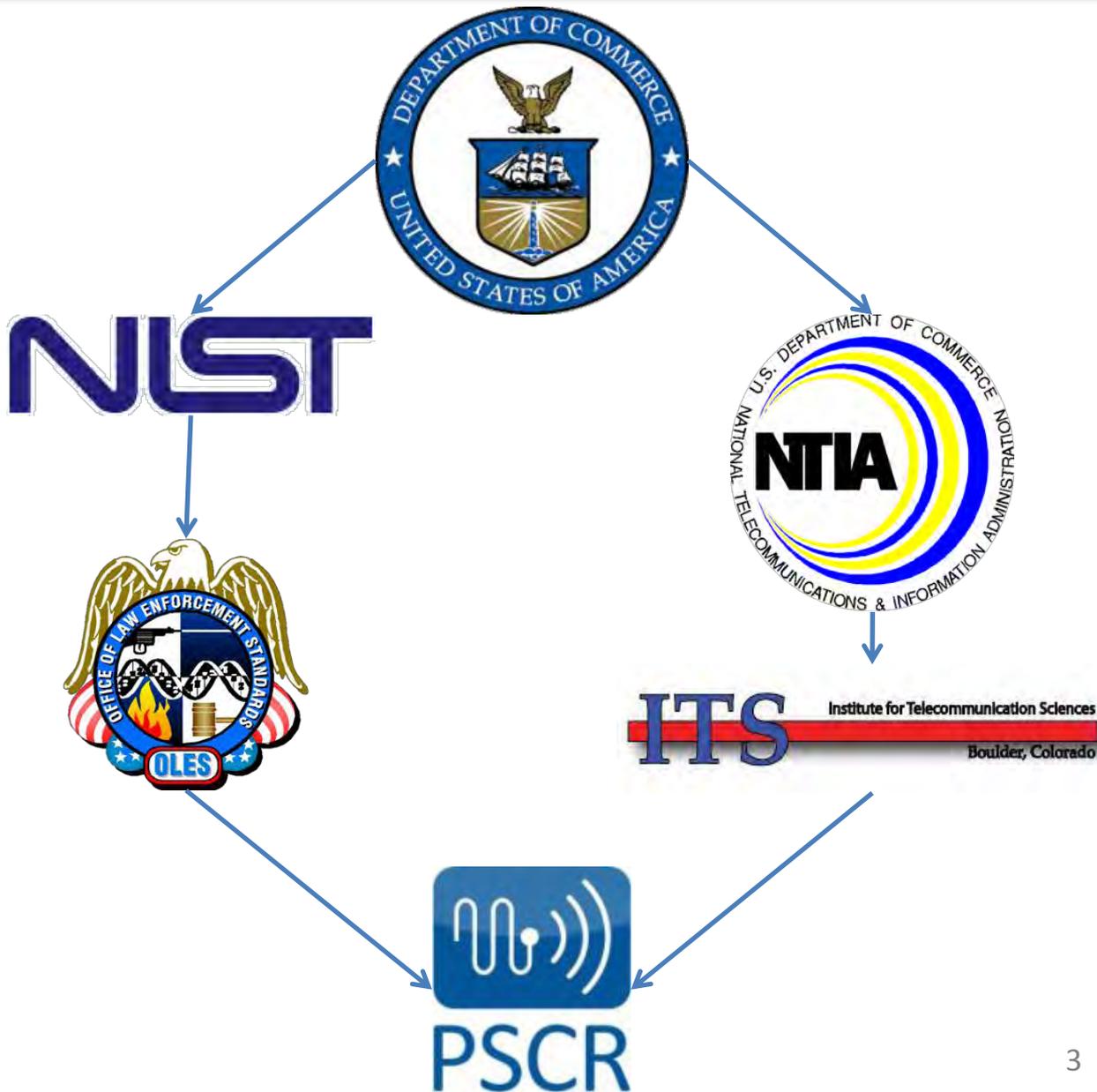
- PSCR Overview
- Key PSCR Efforts
  - Project 25 Compliance Assessment Program
  - 700MHz Broadband Demonstration Network
  - Voice over Internet Protocol (VoIP)
  - Audio Quality Testing
  - Video Quality Testing

# 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 Vision and Mission

## **VISION**

The response community nationwide can exchange voice and data seamlessly to effectively respond to any incident or emergency.

## **MISSION**

To fulfill this vision, PSCR will act as an objective technical advisor and laboratory to public safety to accelerate the adoption and implementation of only the most critical public safety communication standards and technologies.

# PSCR Portfolio

- PSCR projects are divided into 5 portfolio areas:
  1. LMR Standards and Technologies
  2. Broadband Standards and Technologies
  3. Interoperability Device Standards and Technologies
  4. Emerging Standards and Technologies
  5. Cross-cutting or Supporting Activities

# PSCR Portfolio

LMR Standards and Technologies	Broadband Standards and Technologies	Interoperability Device Standards and Technologies	Emerging Standards and Technologies	Cross-cutting or Supporting Activities
P25 CAP	700 MHz Broadband	Multi-Band Radio	P25 Security	Program Management & Reporting
Project 25 (P25) Standards Development	Public Safety VoIP	Interim Interoperability Device Testing	Technical Services Projects	Statement of Requirements (SOR)
ISSI Test Tools	4.9 GHz Broadband Task Group		Video Quality	Public Safety Architecture Framework
Audio Quality	ROW-B		RF Propagation Studies	
	Modeling and Simulation			

# Project 25 Compliance Assessment Program (P25 CAP)

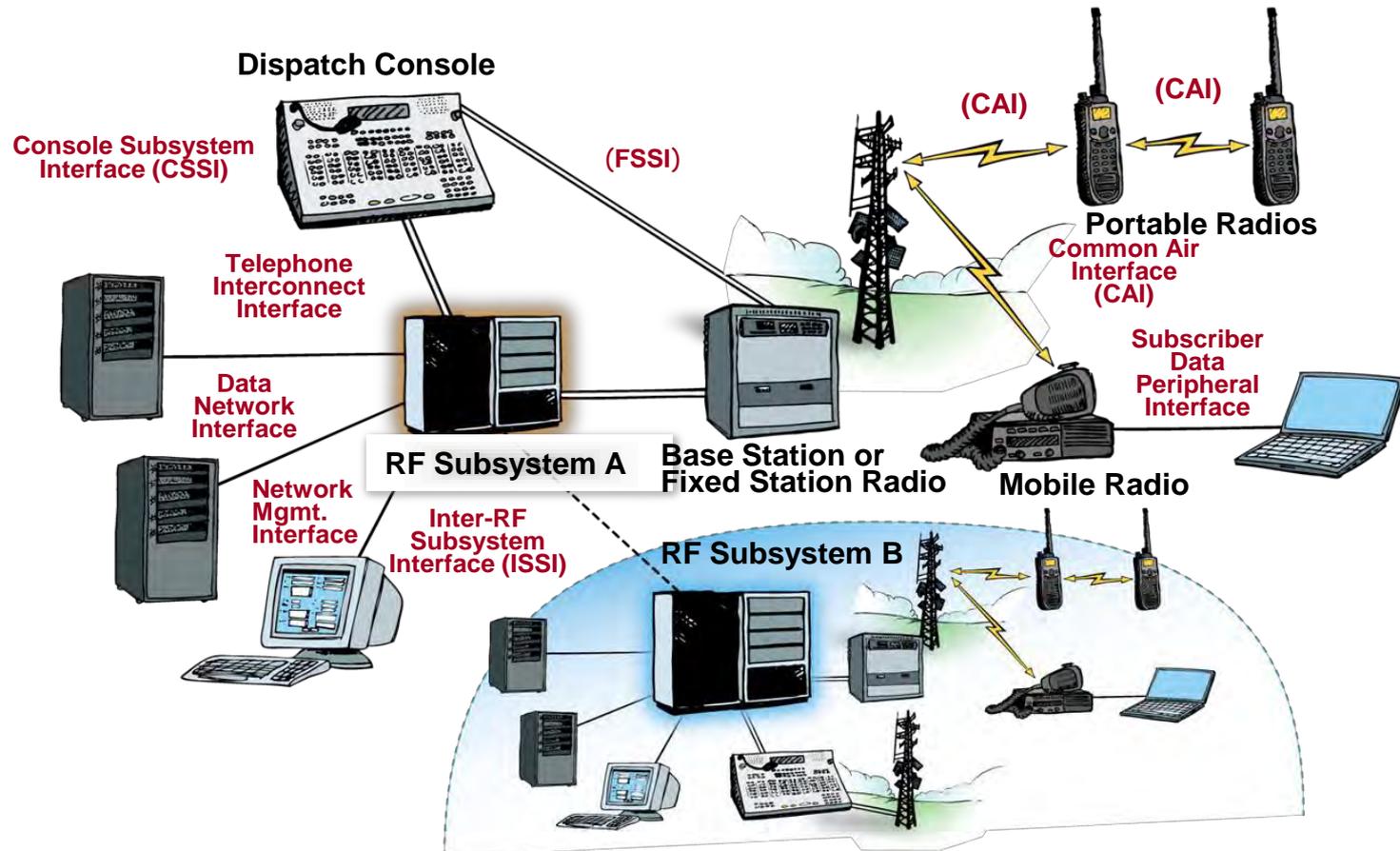
# Project 25

## Project 25 Standards are Focused on Achieving Goals that Benefit the Public Safety Community

<b><i>P25 Goals</i></b>	<b><i>Impact on Public Safety Community</i></b>
<b>Graceful Migration</b>	Allows an agency to move from a legacy system to a new system easily
<b>Competition in System Life-Cycle Procurements</b>	Users can select from multiple vendors that build innovative products to the same standards
<b>Interoperability</b>	Supports the sharing of information via voice and data signals on demand, in real time, when needed, and as authorized
<b>Practitioner Driven Approach</b>	Vendors develop public safety communications products that are driven by practitioner needs and requirements
<b>User Friendly Equipment</b>	Radio systems operate in consistent and familiar ways requiring the least mental and physical interaction by the operator
<b>Spectrum Efficiency</b>	Takes advantage of finite spectrum resources so more users can operate within limited bandwidths
<b>Robust Compliance Assessment Program</b>	<b>A comprehensive P25 assessment program will ensure that vendor products are tested and can be trusted to be P25-compliant</b>

# Project 25

There are eight P25 interfaces to be standardized, however...



# Project 25

... there are four P25 interfaces that we are focusing on right now.

- **The interfaces that are key to interoperability**
  - The Common Air Interface (CAI)
  - The Inter-subsystem Interface (ISSI)
- **Two other important interfaces**
  - The Console Subsystem Interface (CSSI)
  - The Fixed Station Subsystem Interface (FSSI)

# Key P25 CAP Program Features

- Program will review 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> party labs who will participate in the P25 CAP program
- Manufacturers must use approved laboratory to participate in the program
- Participating manufacturers must publish a Suppliers Declaration of Compliance (SDoC) and a Summary Test Report (STR)
  - SDOCs/STRs will be housed on a common website (<http://www.rkb.us>), and DHS grantees are expected to purchase equipment with approved SDOCs/STRs
- Initial phase of the program is focused on the Common Air Interface (CAI) and the Inter-RF SubSystem Interface (ISSI)

# Documentation

- **Supplier's Declaration of Compliance (SDOC)**
  - A formal declaration of compliance created for a particular set of P25 compliance tests defined by the P25 CAP.
- **Summary Test Report (STR)**
  - A predefined format for manufacturers to present results to a subset of tests.

# Status of the P25 CAP

- **In May 2009, DHS OIC recognized 8 laboratories that can now perform compliance testing as part of the P25 CAP:**
  - Labs were recognized for Performance and Interoperability testing for products implementing the P25 CAI.
  - SDOCs/STRs are required for CAI purchases using Federal grant money as of November 6, 2009
  - SDOCs/STRs are required for ISSI purchases using Federal grant money as of March 5, 2011
- **In January 2010, the first Supplier's Declaration of Compliance and Summary Test Reports were posted on the DHS Responders Knowledgebase Website – [www.rkb.us](http://www.rkb.us)**
  - To date eight manufacturers have posted their SDOCs and STRs on the publicly available website.

# 700MHz Broadband Demonstration Network

# Why a Demo Network for Public Safety?

- Public Safety has been licensed to use 700MHz spectrum but there are currently no government or independent laboratory facilities in the United States to test and demonstrate the public safety specific LTE implementation requirements
  - PSCR is creating this network to provide manufacturers with a site for early deployment of their systems, an opportunity to evaluate them in a multi-vendor environment, and create integration opportunities for commercial service providers.

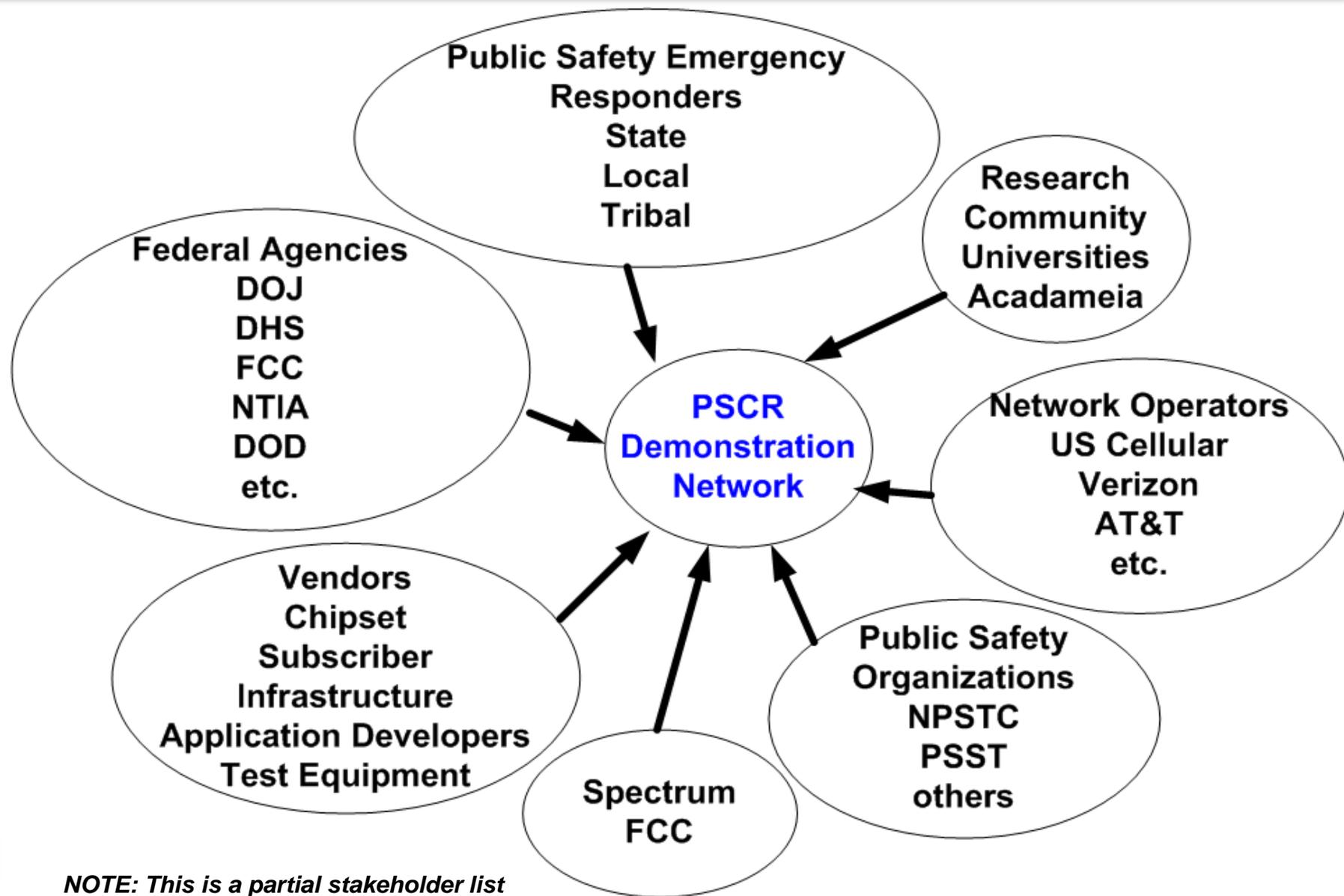
# PSCR Demo Network Project Plan

- Generate interest from broadband vendors to develop a 700 MHz broadband equipment ecosystem
  - Band Class 14 (D Block & Public Safety Block), Long Term Evolution (LTE)
  - Stimulate early development for public safety systems (e.g. Waiver Orders)
  - Support the commercial 3GPP standards process with public safety requirements

# PSCR Demo Network Project Plan (cont.)

- Demonstrate broadband air-interface and core network capabilities
  - Proof of concept, Improve quality for future systems, Create new technology and requirement benchmarks
  - Evaluate broadcast capabilities for wide area, simultaneous data delivery
- Interoperability with existing cellular, broadband and LMR technology
  - Roaming functionality with LTE and non-LTE systems
  - How QoS, billing, priority, pre-emption and applications work when roaming
- Validation of key public safety functionalities and requirements

# Demo Project Stakeholders



*NOTE: This is a partial stakeholder list*

# Working Groups

- Four Working Groups
  - Evaluation Test Working Group
  - Application Demonstration Working Group
  - Network Architecture Working Group
  - Waiver Recipient Working Group

# Demonstration Network Outcomes

- Stakeholders will be able to deploy their equipment in a neutral host network.
- Inform public safety on how this new technology can meet their requirements.
  - They do not have to potentially waste capital expenditures for evaluating a network technology.
- Information gleaned can inform standards bodies.

# Voice over Internet Protocol (VoIP)

# VoIP Outcomes

- **PSCR, with sponsorship from DHS OIC, developed and published the Bridging Systems Interface (BSI) Core Profile with key features that can be implemented quickly.**
  - A collection of existing standards, parameters, and values necessary for VoIP-based devices to connect with one another.
  - Supports group voice communications across multiple-vendors' bridging solutions.
  - Brought together six of the leading VoIP vendors to demonstrate interoperability using the specification.
- **Developed and Published BSI Best Practices Document**
  - Administrative information for contracting officials, chiefs, etc.
  - Technical guidance for system managers, system planners, etc.

# Audio Quality Testing

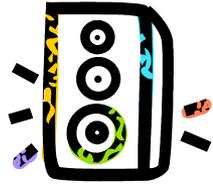
# Audio Quality Testing

- Firefighter reports showed that some background noises created by firefighting equipment can interfere with digital communication.
- PSCR worked with practitioners to develop and implement tests that measure the operation of digital radios, and also tested mitigation techniques for the problems.



# Example of the Audio Quality Issue

**Analog**  
**(no background noise)**



**P25**  
**(no background noise)**



**Analog**  
**(low air alarm)**



**P25**  
**(low air alarm)**



# Audio Quality Project Outcomes

- A technical report was published in June 2008 describing the testing and results.
  - Supplemented by a July 2008 report from the International Association of Fire Chiefs, which recommends operational changes for fire agencies using digital radios.
- Scientifically documenting public safety's audio issues provided the opportunity to make improvements to remedy audio quality problems.

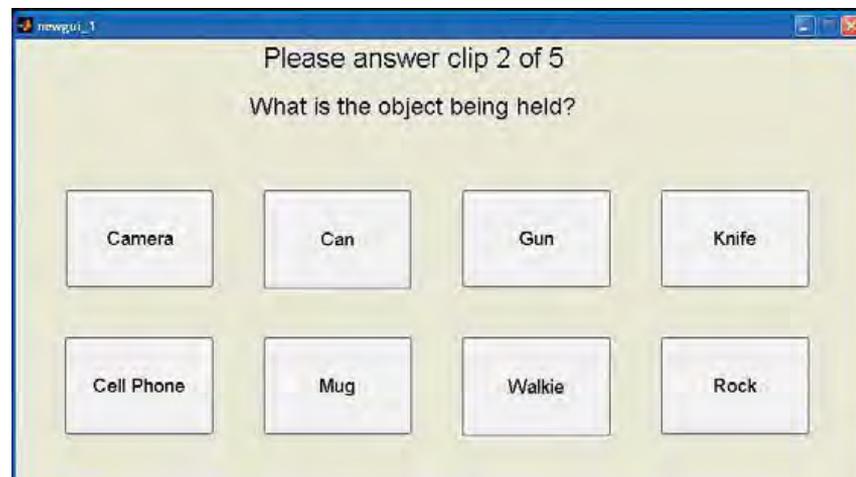
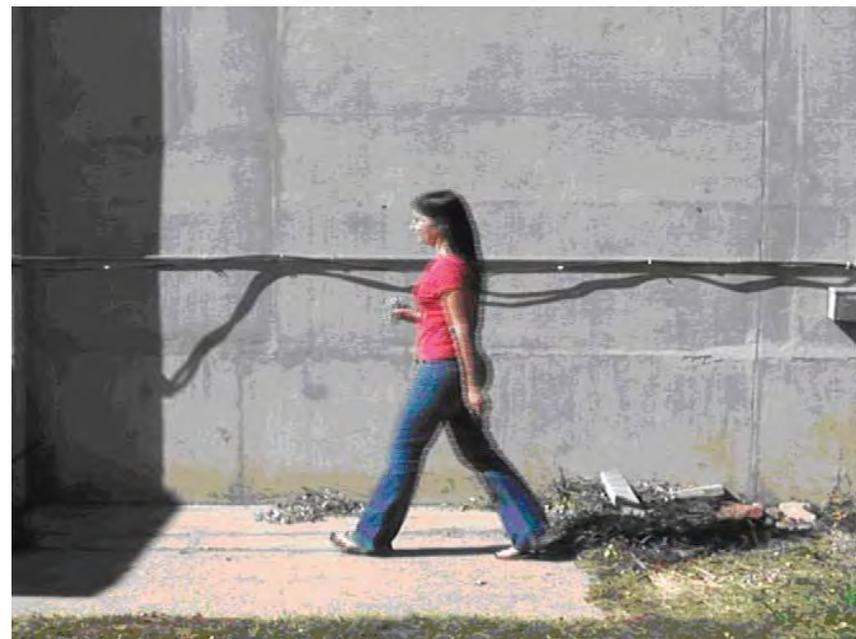
# Current Testing Effort

- Intelligibility Test Underway
  - Measures improvements since 2008 test
    - Improvements include vocoder updates and IAFC Best Practices updates
    - Includes law enforcement background noise
  - 28 of 32 subjects have completed test
    - Disciplines include law enforcement, fire, EMS, and dispatchers
  - Results expected to be presented at October P25 meeting

# Video Quality Testing

# PSCR Video Quality Project

- Develop network performance specifications for public safety video applications
  - Bandwidth
    - Compression
    - Resolution
    - Frame rates
  - Data (packet) loss
  - Latency



# Approach

- Develop subjective testing methods for task-based video
  - ITU-T Recommendation P.912
- Form a working group of stakeholders: Video Quality in Public Safety (VQiPS)
- Create an classification system to group applications into a manageable number of cases
- Conduct experiments to determine network specifications for each group

# VQiPS Working Group

- Provides a central location for organizing video quality specifications (new or existing) for Public Safety (and supporting) applications
- Members:
  - Practitioners
    - Law enforcement, fire, EMS, transportation, etc.
    - Local, state, Federal
  - Government and academic researchers
  - Industry (manufacturers and integrators)

# Current Video Quality Testing Efforts

- Test parameters:
  - Target size
  - Motion in the scene
  - Scene lighting
  - Compression (reduced bandwidth)
- Test subjects so far: 37

# Target Size Large, Medium Motion, Good Lighting 512kbps – 100% recognition



# Target Size Large, Medium Motion, Good Lighting 128kbps – 85% recognition



# Target Size Small, Medium Motion, Good Lighting 512kbps – 78% recognition



# Target Size Small, Medium Motion, Good Lighting 128kbps – 59% recognition



# Contact Information



**PSCR**

<http://www.pscr.gov>

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