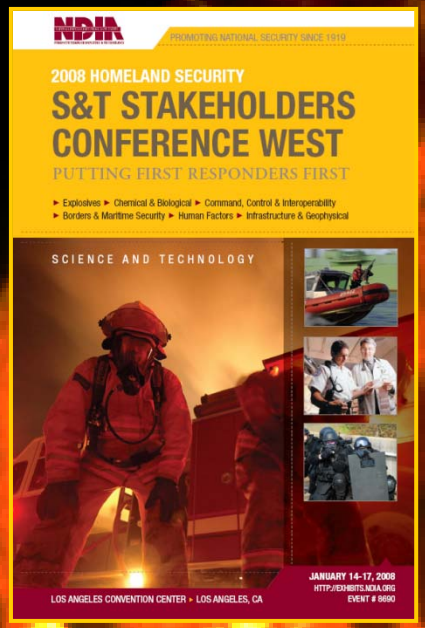

Determining Video Quality Requirements for Public Safety Applications

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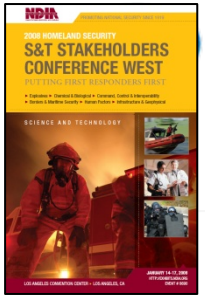
"Putting First Responders First"

Homeland Security
Science & Technology

Outline



- Introduction
- Scope
  - Video applications for Public Safety
  - Parameters of Quality
- Measurement of Quality
- Future work
- Conclusions

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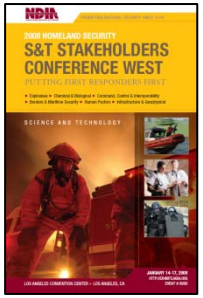
Introduction



- SoR: Statement of Requirements for Public Safety Communications Interoperability
- Volume 1
  - Developed for DHS by SAFECOM, NIST/OLES and NTIA/ITS
  - Contained qualitative requirements for video
  - No quantitative requirements for video
  - Latest version released October 2006.
- Volume 2
  - ITS tasked with determining quantitative requirements for video
  - First version released August 2006

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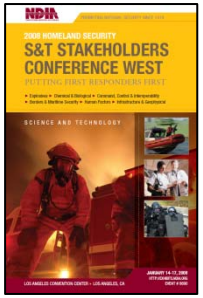
Scope



- SoR Goal: specify network performance parameters to meet these applications' [mission-critical video] quality of service needs.
- To make the project realistic, we must determine
  - Application areas to be covered
  - Parameters of quality to be addressed
  - Measurement system to be used

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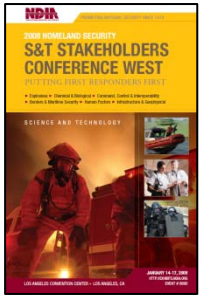
Public Safety Video Applications



- Tactical – remotely directing events
  - SWAT
  - US&R robots (PerMIS)
  - Fire fighting (visible spectrum cameras)
- Live Surveillance – real-time monitoring
  - In-car police cameras (IACP)
  - Commercial (SWGIT)
  - Sporting events
- Forensics – recorded evidence (LEVA)
- Future: Telemedicine, IR cameras, other ??

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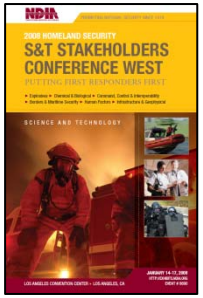
Quality Parameters



What do we mean by “quality?”

- Content
  - Acting, composition, lighting
- Optics
  - Dynamic range, focus, resolution
- Channel: capture and transmit
  - Frame rate, compression, network loss
- Display
  - Pixel aspect ratio, color map

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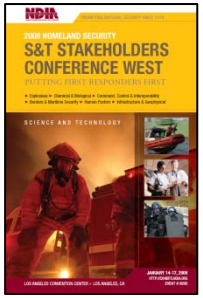
Quality Parameters, con't



What is the intended use for the video?

- Level of discrimination required
  - General elements of the action
  - Class recognition
  - Positive ID (face, object, alpha-numeric)
- Relative size of the targets (object, head) of interest
  - Percentage of the frame occupied
- Relative complexity of the scene
  - How much motion
  - How many objects

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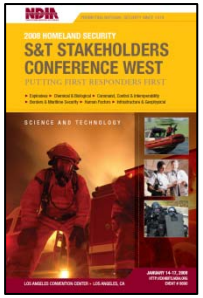
Measuring Quality



- The ITU has published many standards for measuring and modeling video quality
- These methods are based on the application of passive entertainment
  - Randomly selected viewers report perceived quality
- Public Safety video is used to perform recognition tasks
- ITS has developed, and submitted to the ITU, a test method to measure the quality of task-oriented video
- Subjective tests are being performed at ITS
  - Expert viewers perform tasks

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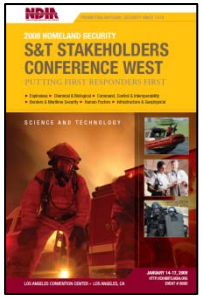
Quality measurement test method



- Viewers are asked to perform tasks:
  - Detect target presence
  - Report target characteristics
  - Target positive ID
- Methods:
  - Multiple choice
  - Alpha-numeric entry
  - Real-time vs. playback controlled
- Video impairments
  - Compression, network errors

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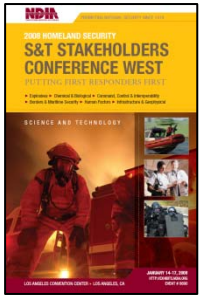
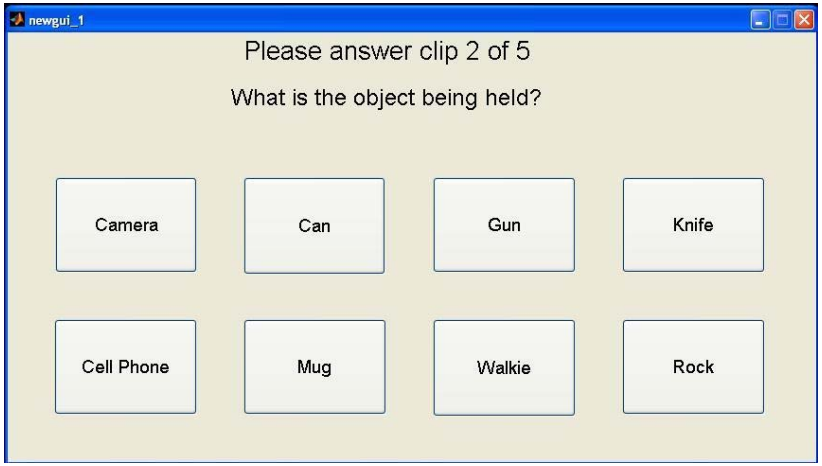
Example





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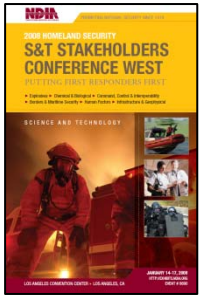
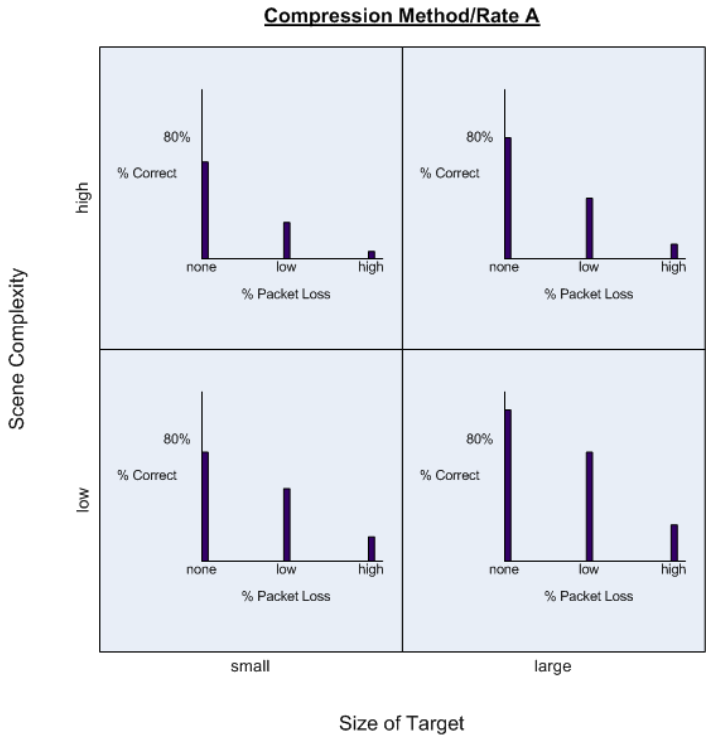
Test Output



- Example with three parameters
  - Scene complexity [low/high]
  - Target size [small/large]
  - Network packet loss rate [none/low/high]
  - One set compression rate



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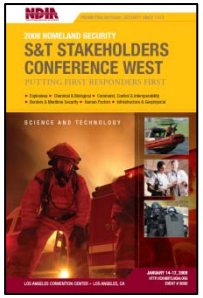
Plan for SoR Volume 2



- Given the application's:
  - Target size
  - Complexity of scene
  - Level of discrimination required
- SoR V2 will provide guidelines for:
  - Compression requirements
  - Network (packet loss) requirements

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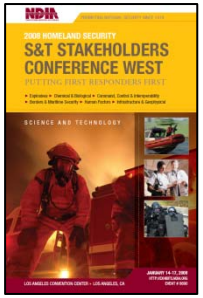
Future Work



- Biometrics
  - Observer facial recognition
  - Automatic facial recognition
- Telemedicine
- Fire
  - IR and night vision
  - Specific testing for “smoke reading”
- Emerging technology
  - Error concealment
  - Compression algorithms

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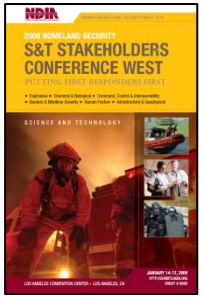
Viewers Needed



- Experts in
  - Forensic video (February ’08)
  - Live surveillance
  - Fire
- Details
  - Free trip to beautiful Boulder, CO
  - Travel paid, but not time
  - Test takes approximately 2 hours
  - More details at www.its.bldrdoc.gov/psvq

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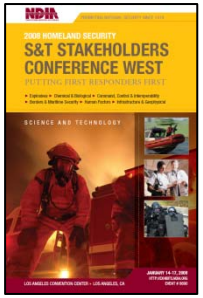
Conclusions



- SoR Volume 2 will assist Public Safety organizations determine their video equipment requirements.
- Goal is to prevent agencies from over- or under-specifying video equipment purchases.
- Test methods and scenes can be provided for equipment evaluation.
- Many organization's efforts can be coordinated (IACP, PerMIS, SWGIT, etc).
- Need first responders for subjective testing.

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