Video Quality in Public Safety Workshop Report

February 16-18, 2011
Boulder Marriott Hotel
Boulder, Colorado

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If you are interested in participating in VQiPS workshops or contributing to this work, please contact VQIPS_Working_Group@sra.com

VQiPS Vision:
The Video Quality in Public Safety Working Group seeks to empower people with the tools and information needed to purchase and employ the right video technology to support public safety, physical security, and the homeland security enterprise operations.

VQiPS Mission:
The Video Quality in Public Safety Working Group will research, develop, and compile information necessary for people purchasing video technology to meet the needs of public safety, physical security, and the homeland security enterprise

Updated: October 2010

I. Introduction

In partnership with the U.S. Department of Homeland Security (DHS) Office for Interoperability and Compatibility, the U.S. Department of Commerce's Public Safety Communications Research program (PSCR) hosted the fourth Video Quality in Public Safety (VQiPS) Workshop. Held February 16-18, 2011, this Workshop provided VQiPS Working Group members with the opportunity to share key information and best practices about video quality in various operational environments. United by the common goal of improving video quality for public safety, participants represented a diverse range of public safety agencies and practitioners, homeland security operations, and critical infrastructure communities across the Nation. Appendix A contains a list of participants.

Workshop Summary

The Workshop's purpose and outcomes, listed below, provided participants with a shared understanding of both panel and session expectations. Appendix B provides the high-level agenda for the Workshop.

Workshop Purpose:

- To convene public safety, industry, and academic and research professionals to share progress regarding DHS' VQiPS initiative and exchange best practices and lessons learned for video applications in public safety environments
- To provide input into key VQiPS project components

Workshop Outcomes:

- Awareness of the VQiPS Working Group's progress since the last Workshop
- Insights into best practices, lessons learned, and major challenges surrounding video quality in a variety of public safety applications
- Upgrades to the VQiPS User Guide Web site
- Commitments from volunteers to support VQiPS's cause and spread the word about the initiative's efforts

The unique breadth of perspectives shared during the panel presentations helped to shed light on the wide use of video technologies and applications in various operational systems. Panelists were grouped into three categories: (1) first responders, (2) operations centers, and (3) critical infrastructure and transportation. Figures 2, 3, and 4 show the meeting participants during some of the panel presentations and plenary discussions. The VQiPS Leadership Team sought the most qualified panelists who use video in their daily operations and were able to share best practices for different video applications. The diversity of participants enabled them to build bridges with each other regarding the ways video can be used in different situational environments. While video applications seemed disparate, many commonalities existed in video tasks, as many practitioners sought to accomplish similar objectives from observing video.

Participants provided feedback to a draft version of a Web tool that complements the VQiPS Video Quality User Guide document (which was publicly released in July 2010). The Web tool will enable users to make more informed decisions when selecting video systems and components. Participants had an opportunity to use the Web tool and provide feedback to the design team, ensuring a stakeholder-driven approach that will meet user needs.

Figure 1. Ceremony recognizing the most outstanding contributors of the VQiPS Working Group (above from left to right: Don Zoufal, John Contestabile, Kevin McGinnis, Steve Surfaro, Cuong Luu)

II. Working Group Team Updates

In previous meetings, the VQiPS Working Group organized and tasked five smaller, independent teams, which include the Leadership Team, Standards Team, Performance Requirements Team, Outreach and Marketing Team, and End User Team. The status of these teams is summarized below:

- **Leadership Team**
  - This team has coordinated and facilitated team calls and meetings, elicited feedback on Working Group activities, and ensured that all participants have received an equal opportunity to voice comments. This team will continue to monitor each of the teams' progress and provide periodic updates to the Working Group as necessary. Figure 1 shows some members of the Leadership Team who were recognized as outstanding contributors of the VQiPS Working Group.

- **Standards Team**
  - This team has worked on identifying and cataloging information for a standards matrix. The standards team defined their work into the following framework: Standards Template; References, Glossary; Introduction (Use Class and Use

Cases); Video Quality Measurement Standard by Manufacturers; Video Quality Measurement Standard by Research Team; and Video Quality Test Specification – Self Compliance. The team will continue to appropriately map standards, specifications, and guidelines to the use cases and components of the video system, which will be compiled into a "Video Quality in Public Safety Handbook".

- **Performance Requirements Team**
  - This team has conducted object recognition research and engaged first responders as they review video clips and provided feedback pertaining to the use of video quality in daily operations. This team will continue to conduct object recognition research and visual acuity research, as well as set performance specifications for various components of the video system. In addition, the team will also coordinate with other groups that are conducting similar video system research.

- **Outreach and Marketing Team**
  - This team has defined and created an outreach and marketing strategy for the VQiPS project. In order to implement this outreach engagement strategy, the team will focus on publicizing the VQiPS work products and deliverables. The team will continue to accomplish the following: identify upcoming conferences that can be an appropriate forum for the VQiPS efforts to be highlighted, nominate representatives from organizations to present on VQiPS, and identify other individuals who would aptly promote the VQiPS mission.

- **End User Team**
  - This team has worked closely with PSCR during the creation of the Volume I Web tool to ensure usability and relevancy to practitioners. The team will continue to review, as appropriate, any VQiPS Working Group products (e.g., Web sites or documents). The team will also continue to coordinate with the Working Group to anticipate upcoming products that should undergo review from the end user community.

Figure 2: Rubén Madrigal of the City of Chicago Office of Emergency Management and Communications (OEMC) explains their video camera system.

III. Summary of Knowledge Sharing Sessions

Over the course of the two-day Workshop, participants broke into three subgroups based according to their expertise and discipline (e.g., first responders, operations centers, and standards and research). Each subgroup rotated through three different knowledge sharing sessions (A through C). These sessions are listed below:

- **Session A**: VQiPS Ambassador Recruiting: How you can help spread the word about the VQiPS Project
- **Session B**: Understanding and Upgrading the VQiPS Web Tool
- **Session C**: Incorporating Our Collective Experiences

The following is a brief summary of each subgroup's working session report-out:

Session A - VQiPS Ambassador Recruiting: How you can help spread the word about the VQiPS Project

- 26 participants offered to help spread the word about VQiPS by volunteering as speakers or writers.
- 18 additional people were identified as potentially interested parties to whom the VQiPS project could contact.
- 61 conferences and their attendees were identified, as well as potential opportunities to present the VQiPS project.

Session B - Understanding and Upgrading the VQiPS Web Tool

- Participants provided feedback about the VQiPS Web tool:
  - Participants expressed that some Web pages often load too slowly, especially the pages that feature auto-play videos. Instead, participants suggested the implementation of photo representation with the option to view videos, instead of embedding auto-play into these pages.
  - Participants expressed that they had lost track of their location within the framework of the Web tool. They suggested breaking down the timeline header into sub-headings as a way to enable users to follow along.
- Participants viewed video clips and provided feedback about what is important for users to be able to see. Although several of the video clips matched many of the users' typical situations, participants still expressed a desire for more realistic video footage (e.g., night or blurry footage) that could reflect the quality of video used in their daily operations. They viewed clips that covered the following settings:
  - Fires
  - Warehouses
  - Wildfires
  - Emergency Medical Services
  - Forensics (i.e., Bank robbery)
  - Shoplifting
  - Sidewalk/Foot traffic

Figure 3: Meeting participants during the VQiPS Background Session

> *"Communications between practitioners and manufacturers is often unclear, making it difficult for public safety agencies to get the best equipment for their particular requirements, which is why VQiPS is extremely helpful."*
>
> *-Gina Riggs, Kiamichi Technology Center*

Session C - Incorporating Our Collective Experiences

- **VQiPS is important because it is ….**
  - Building a set of common standards for all of public safety. Currently, there is a lack of standards (for public safety and public deployment) and a lack of education. Without video quality standards, government will likely overspend on video and underuse it.
  - Partnering with different agencies across various disciplines to create alignment around video quality, enabling standardization. VQiPS serves as a think tank by providing a networking forum of end users and developers/vendors of video systems.
  - Defining video quality standards in a world where video is the future. Just three years ago, video comprised 5-10 percent of internet usage. Some estimates project that by 2012, 50 percent of internet usage will be for video. Video is growing exponentially and VQiPS helps to define use cases and manage deployment, including promoting interoperability of video camera systems.
  - Providing a valuable resource to smaller agencies that otherwise would not have access to or availability of resources. These same smaller agencies are often using Federal grant funds to acquire video and sometimes purchase the wrong systems or operate video systems ineffectively. Non-technical people are often making decisions about video technology, and it is important to remember that those people need VQiPS resources, like the VQiPS Web tool to make the right decisions for their needs.
  - Establishing a shared lexicon, creating a repository of resources, and raising the baseline of knowledge about video quality.
  - Developing a framework for end users to define their requirements for video systems. Because VQiPS ensured that the User Guide received a thorough peer-

review and involved the end users, it is more defensible, adds credibility to the effort, and demonstrates broad subject matter expert input. It is also user-friendly because it is not highly technical.

- **We have learned this lesson about video/video quality….**
  - Nominate a central organizing force, otherwise there will be chaos. Careful planning is very important.
  - Ask questions and share experiences with others; don't recreate the wheel.
  - Research and learn from existing Memorandum of Understanding, known as MOU.
  - Know that Concept of Operations, known as CONOPS, play a fundamental role in the system design.
  - Standardize use cases across disciplines.
  - Set reasonable quality expectations.
  - Involve end users in the design of video systems. The end users' experiences will influence success or failure.
  - Hire ethical professionals to cover knowledge gaps.
  - Define user needs in advance of specifying/purchasing. Users must think about the results one wants the video to perform.
  - Establish standards within your system and apply "systems engineering" at the outset.
  - Consider or anticipate life cycle management as an important factor when determining a specification.
  - Know that organized retail crime can be defeated by identifying repeat offenders on video.
  - Know that face and plate recognition is important for police and law enforcement.

- **We recommend this best practice….**
  - Quantify video quality for each use case will lead to better use of funding.
  - Try before your buy! Ensure that an industry representative demonstrates exactly how the video technology works.
  - Understand that there is no "one-size fits all" model and that the definition of "quality" depends on the user.
  - Make video more useable for investigations.
  - Implement good database management and storage.
  - Work with a standards body.
  - Create a uniting force to work on a video procurement project.
  - Include technical specifications within your Request for Proposal.
  - Articulate the three major video components clearly:
    - Capture
    - Transport
    - Delay

> *"It's important to know what you want from a camera before you purchase it…make sure the camera meets your needs."*
>
> *-Ben Chlapek, Central Jackson County Fire Protection District*

- Standardize video installation and operations.
- Consider legal issues (e.g., local, state, Federal) and know that legal issues differ depending on the agency.

- **The big challenges to be addressed in the future are….**

Technological Advancements

- Advancement of automatic system facial recognition analytics.
- Computational photography.
- High-dynamic range video.
- Mobile video applications: user looking and user searching.
- Sensing technology: integration with other electronic surveillance.
- Video over Broadband: live video streams over broadband will require a significant amount of network bandwidth.
- Widespread acceptance of managed video hosting services and public safety applications in the cloud.
- New modalities like Hyperspectral and Polarimetric video, Light Detection And Ranging (LIDAR) video.
- Wide area mega-pixel video with digital sub-streams.
- 3D CCTV.
- Next Generation 911.
- Peer-to-peer video networks.
- Adaptation to change and ability to keep up pace with technology (Moore's Law)

Figure 4: Meeting Participants during a Plenary Session

Governance and Interoperability

- Combination of audio and visual quality.
- Distribution and management of video.
- Increased video sharing among disciplines and jurisdictions.
- Challenge of video interoperability.
- Wireless interoperability between private and public Long Term Evolution (LTE). LTE is a new high performance air interface for cellular mobile communication systems.
- Need for common codecs.
- Issue of video transportation.
- Consistency of system designers/quality.
- Hard disk drives, or HDDs, and solid-state drives, or SSDS, located at or in-camera for primary storage.
- Integration with access control systems.

Standards

- Interoperable video standards between public (e.g., city) and private (e.g., banks) entities.
- Standards for video telephony quality.
- Managing the standards development process: What happens when users do not adhere to standards? How do we manage competing standards?
- Testing procedures and standards for third party *or* self-certification*s*
- Compliance Acceptance Program.

Maintaining the VQiPS Project

- Maintenance of the VQiPS Web site/Web tool.
- Coordination with similar video quality and research efforts.
- Exploration of critical funding opportunities

Educating the End User

- Engagement of diverse stakeholders in the project to ensure buy-in.
- Education and training of:
  - End Users
  - Administrators (e.g., chiefs, buyers, etc.).
  - Vendors
- Creation of forums for information exchange, such as:
  - How to identify good and bad vendors/integrators.
  - How to identify the "right" questions to ask during the video requirements phase and video purchasing phase
  - How to find resources for grant writing.
- Acceptance of cameras by the public, including overcoming privacy concerns.
- Acceptance of cameras in the workforce, including familiarity with how to use cameras.
- Articulation of the documentation and broadcast of video as it relates to risk reduction for the public, specifically citing case law where video played a specific role in reducing risk.

IV. Next Steps

The VQiPS Working Group teams left the Workshop having made the commitment to work on the following activities:

- Release an enhanced Video Quality User Guide
- Conduct and release a report on research related to the use classes for positive identification
- Compile relevant video quality standards and guidelines into a "Video Quality in Public Safety Handbook"
- Present the VQiPS initiative at upcoming conferences and events
- Reach out to new practitioners to increase the diversity of Working Group members
- Create opportunities for practitioners to review documents and provide feedback about tools and resources

Working Group teams will submit monthly updates to the VQiPS Leadership Team reporting on their progress towards their goals.

In order to ensure project progress and explore future work surrounding video quality for public safety, additional in-person workshops will be scheduled. These workshops will allow participants to present the status of the team efforts and to receive additional input from other Working Group members.

Additional information about VQiPS can be found at:

- **SAFECOM Web site:** http://www.safecomprogram.gov/SAFECOM/currentprojects/videoquality/videoquality.htm
- **Public Safety Video Quality Web site:** http://www.pscr.gov/projects/video_quality/video_about.php

Appendix A - Represented Organizations

First Responders (Police and Law Enforcement, Fire and Rescue, Emergency Medical Technicians and Paramedics)

1. Beverly Hills (CA) Police Department
2. Boise (ID) Fire Department
3. Central Jackson County (MO) Fire Protection District
4. Cincinnati (OH) Police Department
5. Clovis (CA) Police Department
6. District of Columbia Fire & EMS Department
7. Fairfax County (VA) Fire and Rescue Department
8. Fairfax County (VA) Police Department
9. Houston (TX) Police Department
10. Jefferson County (CO) Sheriff's Office
11. Kiamichi Technology Center (OK)
12. Lakewood (CO) Police Department
13. Los Angeles (CA) County Sheriff
14. Maine EMS, Eastern Maine Medical Center
15. Michigan State Police – FAVU
16. Monroe Township (NJ) Fire District Three & Jersey City Fire Department
17. National Association of State EMS Officials (NASEMSO)
18. Ohio State Highway Patrol
19. Port Authority of NY & NJ (PANYNJ)

Operations Centers (State and Local Emergency Operations Centers, Traffic Operation Centers, Fusion Centers, Homeland Security Centers, Transportation, Ports, Highways, Airports, Rail [Light and Heavy], Physical Security)

1. City of Chicago, Office of Emergency Management and Communications
2. Denver Police Crime Lab
3. District of Columbia Homeland Security & Emergency Management Agency
4. Faith Group, LLC
5. French Homeland Security Ministry
6. Georgetown University, Facilities & Safety Control Systems
7. Iowa Department of Public Safety Division of Criminal Investigation
8. Los Angeles World Airports (LAWA)
9. Multi-Agency Radio Communication System (MARCS)
10. The Naval Surface Warfare Center Panama City Division (NSWC PCD)
11. Systems Development.Integration, LLC (SDI)
12. Department of Homeland Security, Transportation Security Administration (TSA)

Standards Development Organizations, Research, Government Agencies, Academia

1. AGH University of Science and Technology, Krakow
2. Department of Homeland Security, Office for Emergency Communications (OEC)
3. Department of Homeland Security, Office for Interoperability and Compatibility (OIC)
4. Johns Hopkins University/Applied Physics Laboratory
5. Motion Imagery Standards Board (MISB)
6. NASA
7. Department of Commerce, Public Safety Communications Research Program (PSCR)
8. Security Industry Association (SIA)
9. Texas A&M, Academy for Advanced Telecommunication and Learning Technology
10. Underwriters Laboratories (UL)
11. University of Arkansas Little Rock
12. University of Colorado Denver, National Center for Media Forensics
13. University of Geneva

Manufacturers

1. Axis Communications
2. Alcatel-Lucent
3. Cardinal Peak
4. L-3 Communications Mobile-Vision
5. Motorola
6. Motorola Solutions
7. Net Research
8. Televate, LLC
9. Verizon Wireless

Appendix B – Agenda

Wednesday February 16th – DAY 1

8:30 - 9:30AM *Registration*

9:30 - 11:30AM *Welcome and Opening Remarks*

- VQiPS Background and Progress Report

11:30 - 11:45AM ***~Break~***

11:45AM - 1:00PM ***~Luncheon Address~***

- Jonathan Lewin, Managing Deputy Director, Public Safety Information Technology; City of Chicago, Office of Emergency Management and Communications
- Rubén E Madrigal, Deputy Director, Internal Secure Communication Network; City of Chicago, Office of Emergency Management and Communications

1:00 - 1:30PM ***~Networking and Email Break~***

1:30 - 3:30PM *Panel Presentation: Video Quality from Operations Center Perspective*

Moderator: Don Zoufal, Systems Development Integration (SDI)

- Joshua Jack – Chief Information Officer/Acting Statewide Interoperability Coordinator (SWIC), District of Columbia Homeland Security & Emergency Management Agency – *"District of Columbia & National Capital Region CCTV Interoperability Efforts"*
- Heather N. Whitton – Regional LPR Program Manager, Cincinnati Police Department – *"Regional Success in License Plate Recognition (LPR)"*
- Don Zoufal – Safety and Security Industry Executive, System Development Integration, LLC – "*Advanced Video Technology Supporting Situational Awareness*"

3:30 - 3:45PM ***~Break~***

3:45 - 4:45PM *Knowledge Sharing Sessions*

- *Participants will be broken into three groups (Red, Blue, Green)*

- *All three groups will rotate through the Knowledge Sharing Sessions over the course of the Workshop to ensure that participants can contribute to all sessions.*

Knowledge Sharing Breakout Session 'A': VQiPS Ambassador Recruiting: How you can help spread the word about the VQiPS Project	**Knowledge Sharing Breakout Session 'B': Understanding and Upgrading the VQiPS Web Tool**	**Knowledge Sharing Breakout Session 'C': Incorporating Our Collective Experiences**
Red Group	***Blue Group***	***Green Group***

4:45 - 5:00PM *Summary and Preview*

5:00PM *Adjourn*

Thursday February 17th – DAY 2

9:00 - 9:15AM *Review and Reflections from Day 1*

9:15 - 11:15AM *Panel Presentation: Video Quality from First Responder Perspective*

Moderator: Steve Surfaro, Axis Communications

- Pret Bjorn, RN, BS – Trauma Program Manager, Eastern Maine Medical Center/Chair, Maine EMS Trauma Advisory Committee - "*Trauma Telemedicine: "The 130,000,000 square-foot Emergency Room""*
- Robert Keyes – Police Captain (Retired), City of Clovis, California – "*City of Clovis Police Department, Video Policing*"
- Mark Lucas – Master Technician, Technical Rescue Operations Team, Fairfax County Fire and Rescue Department- "*Video Use in Urban Search and Rescue*"
- Jim Cooper, CPP – Technical Surveillance Unit, Port Authority of New York and New Jersey (PANYNJ) – "*Perception vs. Design: Reality of Video Quality to Law Enforcement*"

11:15 - 11:30AM ***~Break~***

11:30AM - 12:30PM *Knowledge Sharing Sessions*

- *Participants will be broken into three groups (Red, Blue, Green)*
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Green Group	***Red Group***	***Blue Group***

12:30 - 1:30PM ***~Networking and Lunch Break ~***

1:30 - 3:30PM *Panel Presentation: Video Quality from the Transportation and Critical Infrastructure Perspective*

Moderator: Paul Koebbe, Faith Group, LLC

- David M. Cardenas – Chief of Operations, Los Angeles World Airports - "*Eyes of an Airport*"
- James A. Prokop, PSP - Deputy Program Manager, Advanced Surveillance Program, Transportation Security Administration - "*Video Quality*"
- Thomas Comerford – CEO, Strategic System Technologies, Inc. – "*Security Operation Centers*"

3:30 - 3:45PM ***~Break~***

3:45 - 4:45PM *Knowledge Sharing Sessions*

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Blue Group	***Green Group***	***Red Group***

4:45 - 5:00PM *Knowledge Sharing Sessions Summary*

5:00 - 5:30PM *Next Steps and Adjourn*

Friday February 18th – DAY 3

9:00 AM – 3:00 PM *Technical Standards Meeting*

The overall goals of the VQiPS effort are:

1. Development of a guide to help public safety agencies:
    a. Assess their video user needs.
    b. Match those needs to technical specifications and standards that can be inserted into a procurement document.
2. Development of a set of application-independent use classes.
3. Development of a glossary of common terms.
4. Creation of an inventory of existing standards and specifications that address video system components.
5. Development of a common library of test video clips that represent the use classes.

In support of these goals, the meeting tasks for the research/development section are:

1. Finalize a template for presenting video equipment specifications based on Use Class (called "profiles").
2. Review existing standards and specifications and determine where they fit into the profiles.
3. Review work (or tests) that still needs to be done to determine new specifications.
4. Discuss the methods used to determine these specifications.
5. Agree on a standardization process for the profiles.