



# PSCR 2020: THE DIGITAL EXPERIENCE

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## ON-DEMAND SESSIONS

**START HERE:  
7-MINUTE PORTFOLIO  
OVERVIEWS**

**USER INTERFACE  
USER EXPERIENCE**

**LOCATION-BASED  
SERVICES**

**SECURITY**

**COMMERCIALIZATION**

**MISSION CRITICAL  
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**RESILIENT  
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## ON-DEMAND SESSIONS

**START HERE:**  
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OVERVIEWS

**USER INTERFACE**  
USER EXPERIENCE

**LOCATION-BASED**  
SERVICES

**SECURITY**

**START HERE:** 7-Minute Portfolio  
Overviews

**DON BRADSHAW**  
**JOHN GAROFOLO**  
**SCOTT LEDGERWOOD**  
**JOHN BELTZ**  
**JOE GRASSO**  
**ROGER BLALOCK**  
NIST PSCR

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ON-DEMAND SESSION](#)

The PSCR Research Portfolio Leaders will provide overview presentations of the projects housed within their portfolios, using just 20 slides that showcase each for only 20 seconds. Their traditional Pecha Kucha style presentations are combined into this 60-minute session to provide viewers with an introduction to all the projects at PSCR and how they are organized within Mission Critical Voice, Public Safety Analytics, User Interface and User Experience, Location-Based Services, Security, and Resilient Systems.



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## ON-DEMAND SESSIONS

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### USER INTERFACE USER EXPERIENCE

**LEGEND**  
●○○ Beginner  
●●○ Intermediate  
●●● Advanced

<p><b>Prototyping 3D User Interfaces for First Responders</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">MORE INFO</a></p>	<p><b>Immersive Ballistic Simulation in Virtual Reality</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">MORE INFO</a></p>	<p><b>7000+ First Responders Have More to Say: Nationwide Usability Survey Results at Your Fingertips</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">MORE INFO</a></p>	<p><b>Building Virtual Reality for Public Safety</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">MORE INFO</a></p>
<p><b>CHARIoT Prize Challenge Discussion</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">MORE INFO</a></p>	<p><b>Cameras That Understand Your Needs</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">MORE INFO</a></p>	<p><b>First Responder Feedback on a VR Emergency Response Scenario and User Interface</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">MORE INFO</a></p>	<p><b>ARTEMIS: Measuring Usability in a Virtual Environment</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">MORE INFO</a></p>





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### USER INTERFACE USER EXPERIENCE

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**Simulating Next-Generation Public Safety User Interfaces in Virtual Reality**

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**Mixed Reality Training and Testing Facility for First Responders (VALOR)**

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**FirstSimVR: Prototyping the Future Using Today's VR**

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●●○ [MORE INFO](#)

**Personalized Wayfinding System Based on Real-Time Cognitive Load Measures**

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**Believability with Actionable Metrics**

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### USER INTERFACE USER EXPERIENCE

**Prototyping 3D User Interfaces for First Responders**  
●●○

**KATE KAPALO** NIST PSCR

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**Immersive Ballistic Simulation in Virtual Reality**  
●●○

**7000+ First Responder Have Usability Survey Results at PSCR 2020**  
●●○

**Building Virtual Reality for Public Safety**  
●●○

**CHARIoT Prize Challenge Discussion**  
●●○

**Measuring Usability in a Virtual Environment**  
●●○

**LEGEND**

- Beginner
- Intermediate
- Advanced

**Prototyping 3D User Interfaces for First Responders**

Due to rapid advances in technology, first responders will eventually have access to building information, sensor data, and fire protection system data in real-time. However, the presentation of this critical information has not been fully evaluated from the human performance perspective. This session will address some of the benefits and challenges of using virtual reality (VR) for prototyping 3D user interfaces. The theoretical background needed to effectively identify public safety end-user needs will be introduced, along with highlights from some of the previous research efforts conducted by both PSCR and the University of Central Florida (UCF). The session will conclude with a brief discussion of current and future research directions within the PSCR UI/UX portfolio.

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### USER INTERFACE USER EXPERIENCE

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Prototyping 3D User Interfaces for First Responders	Immersive Ballistic Simulation in Virtual Reality	7000+ First Responder Have More to Say: Nationwide Usability Survey Results at PSCR 2020	Building Virtual Reality for Public Safety
●●○	●●○	●●○	●●○
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<a href="#">MORE INFO</a>	<a href="#">MORE INFO</a>	<a href="#">MORE INFO</a>	<a href="#">MORE INFO</a>

### Immersive Ballistic Simulation in Virtual Reality

●●○

**CHRIS JOHNSON**  
NIST PSCR

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Virtual Reality Developer Chris Johnson conducts a deep dive analysis into the considerations and challenges of creating an immersive virtual reality AR-15 patrol rifle for NIST PSCR's Haptic Challenge SWAT Scenario, and accurately simulating its ballistic performance characteristics. Discussion will span the fields of both theoretical design and technical implementation.



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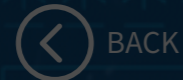
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#### 7000+ First Resonders Have More to Say: Nationwide Usability Survey Results at Your Fingertips

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YEE-YIN CHOONG  
SHANEE DAWKINS  
SANDRA SPICKARD PRETTYMAN  
NIST PSCR

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Come learn more about what 7000+ first responders have to say about current and future Technology! Building on our high-level survey overview in the 2019 Stakeholders Meeting, we now present new analyses and a deeper dive into findings from the NIST nationwide usability survey, covering four major public safety disciplines—Fire, Law Enforcement, EMS, and 911/Dispatch. This broad survey sample has representation from every FEMA Region (including all states and the District of Columbia), different areas (urban, suburban, and rural), and jurisdictions (local, county, state, federal). With survey topics ranging from current to future technology, and from day-to-day usage to major events, we offer an extensive view of the public safety technology landscape. The NIST survey dataset offers a picture of the state of technology across the U.S. that is both timely and indispensable for industry developers, researchers, and first responder organizations alike—and now publicly available via a new web tool!



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Prototyping 3D User Interfaces for First Responders	Immersive Ballistic Simulation in Virtual Reality	7000+ First Responder Have More to Say: Nationwide Usability Survey Results at a Glance	Building Virtual Reality for Public Safety
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<a href="#">MORE INFO</a>	<a href="#">MORE INFO</a>	<a href="#">MORE INFO</a>	<a href="#">MORE INFO</a>

#### Building Virtual Reality for Public Safety

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**JACK LEWIS**  
**CHRIS JOHNSON**  
**JEFF KARHOFF**  
NIST PSCR

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This is a panel session in which the PSCR Virtual Reality team will be discussing how they work with first responders to build realistic virtual reality scenarios. The panel will discuss how they build first responder specific requirements into VR, and they will go over the tools and techniques they use to do so.

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### USER INTERFACE USER EXPERIENCE

**CHARIoT Prize Challenge Discussion**

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**SCOTT LEDGERWOOD** PSCR, **DON HARRISS** PSCR, **SCOTT TURNBALL** US IGNITE/IMPLEMENTER, **PAUL MERRITT** PSCR, **BILL GELLMAN** BLUEFORCE

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**LEGEND**

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The CHARIoT Challenge is tasking developers to create visual interfaces for public safety using personal area networks, smart buildings, and smart city IoT sensor data. The contestants will leverage these sensors and provide actionable alerts to incident command and first responders through augmented reality headsets. During this session, attendees will learn more about the challenge structure, benefits of IoT sensor data and spatial computing, and see a sneak peak of the final event where judges will be donning the final prototypes and responding to simulated wildfire, active shooter, flood, and mass transits accident scenarios.



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### USER INTERFACE USER EXPERIENCE

**Cameras That Understand Your Needs**

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**MARGARET PINSON**  
NIST PSCR

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Escalating video consumption drives the industry to seek more wireless bandwidth and higher visual quality at lower bandwidths. With the varied methods for content generation and distribution, better standalone tools are a must to drive experiences consumers expect. Improved methods to evaluate visual quality will help industry develop products and improve services. The missing component is no-reference (NR) metrics that perform image and video quality assessment. This presentation describes ongoing work within the Video Quality Experts Group (VQEG) to develop open-source NR metrics that meet industry requirements for scope, accuracy, and capability. We will describe industry specifications from discussions at VQEG face-to-face meetings among industry, academic, and government participants. Attendees will be invited to share their unique needs.

**LEGEND**

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- Intermediate
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### USER INTERFACE USER EXPERIENCE

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#### First Responder Feedback on a VR Emergency Response Scenario and User Interface

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CHARIoT Prize Challenge  
**RANDALL SPAIN,**  
**DONIA SLACK,**  
NORTH CAROLINA STATE  
UNIVERSITY



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First responders are seeing a significant increase in the amount and types of data available to them while responding to emergencies. This increase can be partly attributed to an increasingly sensor-rich world. To maximize the value of these data sources, user interfaces must be designed to allow first responders to interact effectively with them and respond in an effective and timely manner, without inducing undue errors or additional mental workload. This is particularly important for presenting firefighters with task-critical information through Heads-Up Displays (HUD). A critical challenge facing designers is ensuring firefighters receive the right information, in the right format, at the right time without imposing significant levels of mental workload or frustration. Moreover, firefighters must be able to use HUD interfaces efficiently and effectively without committing unnecessary errors due to poor design. The objective of this project is to address this issue by examining the effect of intelligent user interfaces on firefighter performance in a fully immersive VR-based emergency response scenario. Intelligent user interfaces leverage state-of-the-art artificial intelligence techniques to improve human-computer interaction. In this session, we will describe the development



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#### First Responder Feedback on a VR Emergency Response Scenario and User Interface

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**RANDALL SPAIN,**  
**DONIA SLACK,**  
NORTH CAROLINA STATE  
UNIVERSITY



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of a VR-based emergency response scenario that serves as a testbed for evaluating the efficacy of intelligent user interfaces for first responders as well as the development of a prototype VR-HUD for presenting firefighters with task critical information at the point of need. We will discuss design changes our team has made to the VR emergency response scenario and HUD based upon feedback collected from our Public Safety Organization (PSO) partners at the Washington Metropolitan Area Transit Authority (WMATA) to guide our human-centered design approach. We will also describe the results of a recent usability evaluation that captured firefighters' feedback and reactions to the VR scenario and prototype intelligent user interface. The session will conclude with lessons learned from our development and testing process and a discussion of our research plans for the fall.



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### USER INTERFACE USER EXPERIENCE

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Session Title	Difficulty	More Info
Prototyping 3D User Interfaces for First Responders	●○○	<a href="#">MORE INFO</a>
Immersive Ballistic Simulation in Virtual Reality	●●○	<a href="#">MORE INFO</a>
7000+ First Resonders Have More to Say: Nationwide Usability Survey Results at a VR Emergency Response Scenario and User Interface	●○○	<a href="#">MORE INFO</a>
Building Virtual Reality for Public Safety	●○○	<a href="#">MORE INFO</a>

#### ARTEMIS: Measuring Usability in a Virtual Environment

ARTEMIS allows first responders to test the usability and effectiveness of new technologies and procedures in virtual reality. Researchers at the Georgia Tech Research Institute are working closely with local police departments to develop a traffic stop scenario (and eventually, other useful scenarios) in virtual reality and to understand how the experience could be enhanced through the use of near-future technology. This session will cover the usability metrics and physiological data that will be used to evaluate new technologies and procedures.

**SARAH FARMER**  
GEORGIA TECH RESEARCH INSTITUTE

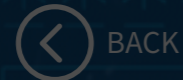
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### USER INTERFACE USER EXPERIENCE

#### Simulating Next-Generation Public Safety User Interfaces in Virtual Reality

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**REGIS KOPPER, JERONIMO GRANDI**, UNC GREENSBORO;  
**ZEKUN CAO, MARK OGREN**, DUKE UNIVERSITY

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We will present the design of next-generation user interfaces for Public Safety Organizations (PSOs) developed as the result of an extensive requirement analysis with the participation of public safety partners. The interfaces are proposed to leverage the futuristic capabilities of augmented reality displays of integrating virtual and real elements into simulated situational awareness scenarios in immersive virtual reality. Furthermore, we will detail the assessment designs created to evaluate the interface elements proposed and conclude by reporting preliminary results gathered from informal observational studies.



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### USER INTERFACE USER EXPERIENCE

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**Mixed Reality Training and Testing Facility for First Responders (VALOR)**

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**JOHN BLACKWELL**  
TRACLABS

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We will discuss the practical utility of the current simulation, the technical progress made during the last two years, experiment designs, and the intended next steps for our research and development. We will provide an immersive tour of the virtual reality firefighter simulation environment, including its relation to real-world objects in the mixed reality training facility, and the capabilities of the core software infrastructure built on VALOR, the Virtual and Augmented Laboratory for Objective Realities. The mixed reality facility is designed for training and testing of first responders as well as for use as a validated virtual testbed for assessing the impact of new technologies on first responders. Mixed reality training offers many of reality's benefits with few of its drawbacks. Its digital nature allows us to prepare for more types of emergency events in less time and provides better opportunities to improve performance through data. As a product deployment testbed, it offers economic efficiencies and rapid iteration opportunities. The ultimate goal of VALOR is to save the lives and resources of first responders and the public they serve.



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### USER INTERFACE USER EXPERIENCE

#### LEGEND

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#### FirstSimVR: Prototyping the Future Using Today's VR



**JASON JERALD,  
JASON HASKINS,  
CHARLES LAIRD**  
NEXTGEN INTERACTIONS



Next-generation first responder tools and their interfaces have the potential to significantly enhance public safety. However, many such tools are still at an early experimental stage and are not yet ready to be used or fully tested. Even when the tools come to fruition, it can be difficult to evaluate and optimize their use in the context for which they will be deployed. To propel tool development, evaluation, and usage, we are leveraging virtual reality (VR) technologies to efficiently test early prototypes of those new tools in virtual environments that simulate the context in which they will be used. Whereas consumer VR systems can support scenarios that are quite visually and aurally realistic, most of today's VR hardware is lacking when it comes to physical touch. This shortfall is especially critical when simulating real-world user interfaces and the real physical world first responders work in. For FirstSimVR, we focus on adding (and evaluating) realistic physical cues to VR interfaces and the environment the system is simulating. For this talk, we will discuss three scenarios we are building: 1) teaching to use a gas monitor device for a hazmat incident, 2) simulating a traffic stop that includes a vehicle search, and 3) a mass casualty situation where data can be entered via an armband interface. We will also discuss the user studies we are designing to evaluate if integrating physicality into VR simulations can lead to performance that more closely matches real world usage.



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### USER INTERFACE USER EXPERIENCE

**Personalized Wayfinding System Based on Real-Time Cognitive Load Measures**

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**ERIC JING DU**  
UNIVERSITY OF FLORIDA

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This session will introduce a cognition-driven, personalized information system for emergency indoor wayfinding. It addresses the emerging yet critical challenge in emergency response: information overload. On the one hand, as modern buildings become more spatially complex and are equipped with new sensing and information systems, firefighters can be exposed to huge volumes of information in the line of duty. On the other hand, these first responders have only limited capacity for information processing. Aimed to solve this conflict, this research employs the latest neuroimaging technologies (brain sensing) to monitor a firefighter's cognitive status in real time, providing the basis to adjust the contents and format of wayfinding information and consequently control the level of the cognitive load. The system also captures and tracks "information personality," i.e. the firefighters' preferences to different types of information. To achieve these goals, the research integrates the latest developments in visualization (e.g., virtual reality), building science, neuroscience, and information technologies. Ultimately, the research paves a path to develop individualized intelligent and adaptive systems for firefighters.

LEGEND

- Beginner
- Intermediate
- Advanced



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### USER INTERFACE USER EXPERIENCE

**Believability with Actionable Metrics**  
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**JOHN DWYER**  
HEALTH SCHOLARS INC.

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MORE INFO

**LEGEND**

- Beginner
- Intermediate
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The presentation will review the progress on creating a VR application for first responders that trains and assesses readiness for Advanced Cardiac Life Support (ACLS). The application is completely voice-driven with the exception of a vitals monitor, allowing learners to act just like they would as a team lead in an actual cardiac event or simulation for certification. We will discuss the effects of believability and immersion in the interface. We will also discuss the app's tracking backend that allows agencies to assess the readiness of their learners.



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### LOCATION-BASED SERVICES

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**Hancock County Public Schools Indoor Mapping**

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**Map901: Building Rich Interior Hazard Maps for First Responders**

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●●○ [i MORE INFO](#)

**Mapping Indoor Environments to Support Navigation Systems for First Responders**

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**Situational Awareness for Emergencies Through Network-Enabled Technologies (SafeT-Net)**

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**Developing a Best Practices Framework for Indoor Mapping, Tracking, & Navigation**

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**Hyper-Reality Helmet for Public Safety**

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**Real-Time First-Responder Tracking and Mapping with Thermal, Inertial and Radar**

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**Ultimate Navigation Chip (uNavChip): Chip-Scale Personal Navigation System**

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### LOCATION-BASED SERVICES



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**A Body-Worn  
Localization System for  
Firefighters**



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#### LEGEND

- Beginner
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Hancock County Public Schools  
**Indoor Mapping**


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HANCOCK COUNTY

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Indoor mapping is the next big frontier for the geospatial field. Lack of adequate indoor maps is a well-documented public safety issue reasserted with each building fire, earthquake, mass shooting, and other tragedies. While technology exists capable of mapping buildings, very few standards and best practices are available to create reliable, affordable, and consistent indoor maps.

The Point Cloud City Hancock County, Mississippi grant project allows public safety and geospatial subject matter experts to work hand in hand with federal oversight to further develop approaches that improve indoor mapping techniques and datasets in the US to make them more common. Because Hancock County is a rural area, any approach used here should be applicable nationwide.





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<p>Hancock County Public Schools Indoor Mapping</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>	<p>Map901: Building Rich Interior Hazard Maps for First Responders</p> <p>●●○</p> <p>LAN WANG EDDIE JACOBS MADELINE CYCHOWSKI CITY OF MEMPHIS</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>	<p>Map901: Building Rich Interior Hazard Maps for First Responders</p> <p>●●○</p> <p>This session will discuss the Map901 project, which is creating detailed annotated 3D interior maps for buildings in the City of Memphis.</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>	<p>Mapping Indoor Environments to Support Navigation Systems for Emergency Responders</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>	<p>Situational Awareness for Emergency Responders through Network-Enabled Technologies (SafeT-Net)</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>
<p>Developing a Best Practices Framework for Indoor Mapping, Tracking &amp; Navigation</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>	<p>Real-Time First-Responder Tracking and Mapping with Thermal, Inertial and Radar</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>	<p>Ultimate Navigation Chip (uNavChip): Chip-Scale Personal Navigation System</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p><a href="#">MORE INFO</a></p>		



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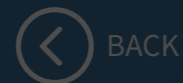
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## ON-DEMAND SESSIONS

### LOCATION-BASED SERVICES




#### LEGEND

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- Intermediate
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#### Mapping Indoor Environments to Support Navigation Systems for First Responders

●○○

**JASON PARENT**  
**PAUL JANUSZEWSKI**  
ENFIELD CONNECTICUT

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

First responder navigation and tracking systems will require accurate maps of indoor environments. To help create a database to support the development and deployment of indoor navigation and tracking systems, we used Paracosm's PX-80 handheld LiDAR to collect imagery and 3D point cloud data for 11 schools, administrative buildings, and industrial buildings in Enfield and Storrs, Connecticut. We developed a manual procedure for mapping features-of-interest that used Paracosm's Retrace and ESRI's ArcGIS software. Retrace provides an immersive view of the image and point cloud data and we used it to identify features and tag their approximate 3D locations. We used ArcGIS to create 3D polygons that define the horizontal and vertical boundaries of each tagged feature. A script was then used to classify the point cloud based on the 3D polygons. The final products include classified and georeferenced 3D point clouds that will be useful for researchers as well as interactive 2D floor plans with embedded videos that will allow first responders to effectively make use of the data during pre-planning, training, and active incidents. The procedure that we developed allowed us to accurately map a variety of features ranging from recessed sprinkler heads and fire alarms to windows and doors. We estimate that the complete process, from collecting data to creating the final products, takes about 20-30 hours for a 175,000 square foot building and requires personnel with little technical skill and training. This project demonstrated that a handheld LiDAR data can be used to efficiently create products to support indoor navigation and tracking systems as well as provide more general support to first responder operations.



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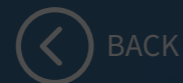


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## ON-DEMAND SESSIONS

### LOCATION-BASED SERVICES




#### LEGEND

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**Situational Awareness for Emergencies Through Network-Enabled Technologies (SafeT-Net)**

●●○

**MOE Z. WIN** MIT

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SafeT-Net will develop new localization algorithms for low-cost devices that can obtain position information using different radio technologies including ultra-wideband and orthogonal frequency-division multiplexing. An important aspect of SafeT-Net is to provide position information using lightweight and inexpensive end-user communication devices with limited hardware capabilities. Specifically, signal processing techniques and statistical inference algorithms are developed to mitigate measurement uncertainty and obtain desirable localization performance. Another important aspect of SafeT-Net is to exploit multipath propagation to improve the localization accuracy. In particular, multipath phenomena are exploited by inferring the indoor propagation environment together with transmitter/receiver positions. The presented methods are promising as demonstrated by simulation and experiment results.





## ON-DEMAND SESSIONS

### LOCATION-BASED SERVICES



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#### LEGEND

- Beginner
- Intermediate
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#### Developing a Best Practices Framework for Indoor Mapping, Tracking, & Navigation

●○○

**PAUL DOHERTY**  
**TOMMY HICKS**  
**PETER HANNA**  
NAPSG

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Join the NIST i-Axis Team in our continued quest to create the first Best Practices Guide for Indoor Mapping, Tracking, and Navigation. Why create a best practices guide? In Public Safety, “early adopters” are the individuals working within agencies who encourage innovation but are looking for tangible examples before making definitive choices. Furthermore, researchers and the private sector need a foundation to build on so that technology can be prototyped and implemented. This session will discuss some early progress and provide you with a platform to contribute candidate best practices for review by the working group. There will also be a short virtual and interactive pre-incident planning and mapping exercise using a mapping “sandbox”. This will help to stimulate discussion around best practices with regards to Indoor Mapping, Tracking, and Navigation; now and into the future.





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### LOCATION-BASED SERVICES

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**Hyper-Reality Helmet for Public Safety**  
●●○  
YANG CAI  
SEAN HACKETT  
FLORIAN ALBER  
CARNEGIE MELLON UNIVERSITY  
[CLICK TO PLAY ON-DEMAND SESSION](#)

Emergent technologies of intelligent sensors and heads-up displays for first responders to perceive, map, and navigate in extreme environments.

[×](#)

**Hancock County Public Schools Indoor Mapping**  
●●○  
[CLICK TO PLAY ON-DEMAND SESSION](#)

**Map901: Building Rich Interior Hazard Maps for First Responders**  
●●○  
[CLICK TO PLAY ON-DEMAND SESSION](#)

**Mapping Indoor Environments to Support Navigation Systems for Emergency Services**  
●●○  
[CLICK TO PLAY ON-DEMAND SESSION](#)

**Situational Awareness for Emergency Services through Network-Enabled Technologies (SafeT-Net)**  
●●○  
[CLICK TO PLAY ON-DEMAND SESSION](#)

**Developing a Best Practices Framework for Indoor Mapping Tracking & Navigation**  
●●○  
[CLICK TO PLAY ON-DEMAND SESSION](#)

**Real-Time First-Responder Tracking and Mapping with Thermal, Inertial and Radar**  
●●○  
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**Ultimate Navigation Chip (uNavChip): Chip-Scale Personal Navigation System**  
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## ON-DEMAND SESSIONS

### LOCATION-BASED SERVICES



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#### LEGEND

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**Real-Time First-Responder Tracking and Mapping with Thermal, Inertial and Radar**

●●○

**DR. PEDRO PORTO BUARQUE DE GUSAMO**  
**DR. JOHAN WAHLSTROM**  
**PROF NIKI TRIGONI**  
**PROF ANDREW MARKHAM,**  
OXFORD

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Accurate and robust tracking and mapping of first responders is key to improved situational awareness, efficiency, and enhanced safety. Conventional positioning techniques e.g. based on GPS, do not work in complex indoor environments. Through the NIST-funded IPSER project, the University of Oxford and its first responder partners have been working towards tackling this problem, using a combination of novel sensor modalities and algorithmic innovations. In particular, we present our multi-modal platform which combines robust sensing modalities (inertial, thermal, and radar) with state-of-the-art deep learning techniques to track and map first responders. A major issue with deep-learning approaches is that they are computationally expensive and thus are not amenable to real-time operation on lower-end mobile devices. We present work in this area to move towards achieving real-time tracking and mapping, presenting results from lab and simulated fire trials.



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## ON-DEMAND SESSIONS

### LOCATION-BASED SERVICES



#### LEGEND

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#### Ultimate Navigation Chip (uNavChip): Chip-Scale Personal Navigation System



**ANDREI M. SHKEL**  
**ZAK KASSAS**  
**SOLMAZ KIA**  
UNIVERSITY OF  
CALIFORNIA IRVINE

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ON-DEMAND SESSION](#)

This brief is on the development of the Ultimate Navigation Chip (uNavChip) concept. Our project develops a Chip-Scale Personal Navigation System to localize emergency responders, assets, and people indoors and in covered outdoor environments, where GPS signals are unusable. We will talk about the Micro-Electro-Mechanical Systems (MEMS) technology that we are developing within this project, groups' latest analytical and modeling results, and in-field test and evaluation. Our technical approach is based on simultaneous integration of Deterministic, Probabilistic, and Cooperative Localization. The Deterministic Navigation is based on foot-mounted sensors and motion models providing zero-velocity updates, constituting a unique, self-contained, and high accuracy dead reckoning capability. Signals of Opportunity are turned into our own "dedicated pseudolites" for position fixing and augmentation. We are exploiting cellular signals (CDMA, LTE, and 5G) to navigate within building infrastructure to an unprecedented level of accuracy (about 2 meters). Cooperative Localization is utilized by a team of mobile agents equipped with the uNavChip, with communication and computational capabilities, jointly processing a relative measurement between any two agents leading to an increase in localization accuracy.



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## ON-DEMAND SESSIONS

### LOCATION-BASED SERVICES



#### LEGEND

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A Body Worn  
Localization System for  
Firefighters



#### A Body-Worn Localization System for Firefighters

●●○

**ANTHONY ROWE**  
CARNEGIE MELLON  
UNIVERSITY

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ON-DEMAND SESSION](#)

In this talk, we will discuss a rapidly deployable infrastructure-free localization system to track firefighters inside of a structure such as a building. Our goal is to provide fire safety chiefs who are responsible for team accountability a live feed on a tablet or computer outside of the facility that can show the position of each firefighter within. Given the hostile nature of burning structures and the time criticality of missions, this requires that a system can track firefighters without any pre-installed internal and limited external infrastructure, and without assuming knowledge of the structure's layout. For a system to be practically adopted at scale, it also needs to be low-cost and extremely simple to configure and deploy. We will focus on four new topics: (1) a scalable UWB ranging system, (2) an Open-Source Range-Only SLAM Platform, (3) a new relative positional tracking system that does not require fixed infrastructure and (4) early integrations with Augmented Reality platforms.



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### SECURITY

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**Expanding the SIM Card  
Use Prize Challenge  
Overview**

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

●●○ [i MORE INFO](#)

**ICAM - Critical Topics and  
New NIST Documents**

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

●●○ [i MORE INFO](#)

**Mobile Fingerprint  
Capture for First  
Responders**

 [CLICK TO PLAY  
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**5G Security - Evolution  
not Revolution**

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●●● [i MORE INFO](#)

**3GPP Standards Status  
Update**

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## ON-DEMAND SESSIONS



### SECURITY


#### LEGEND

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Expanding the SIM Card Use Prize Challenge Overview

●●○

**MIKE BARTOCK** ITL  
**MATT LOURIE** NOK NOK  
**CONOR PATRICK** SOLOKEYS  
**PETER PADD** FORTIFYEDGE  
**SHANE WEEDEN** IBM

 [CLICK TO PLAY ON-DEMAND SESSION](#)

PSCR and a few partnering entities finished a recent PSCR sponsored prize challenge, Expanding the SIM Card Use for Public Safety. The challenge requested solvers' assistance to explore the possibilities and prove the Universal Integrated Circuit Card (UICC), commonly known as the SIM card, can be used as a secure storage container for application credentials. The SIM card is a tamper-resistant hardware storage container and, if it was expanded for storing user credentials, it could enable seamless, secure authentication to public safety applications. In addition to its strong security characteristics, the SIM card offers the following potential usability benefits for public safety: more user-friendly; allow networks to provision credentials over-the-air via a secure channel; and potentially enable device sharing by keeping sensitive information on the removable SIM card. The challenge had three finalists that were awarded prize money for their submissions in October 2019. This session will explain the goals, methodologies, and outcomes of the prize challenge. After a panel discussion of the purpose and benefits of the prize challenge, the winner of the prize challenge will give a demonstration of their winning solution.





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### SECURITY

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Expanding the SIM Card Use Prize Overview

ICAM - Critical Topics and New NIST Documents

●●○

**BILL FISHER**  
NIST PSCR


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More Info

Last year, NIST held its first Cybersecurity for Public Safety and First Responders workshop, with a focus on identity, credential and access management (ICAM) challenges. This year NIST is following up with new guidance on critical topic areas such as identity federation, identity as a service (IDaaS) and biometric authentication technologies. This session will highlight these documents, when and where they apply, and key takeaways and recommendations for the public safety community.





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### SECURITY

#### LEGEND

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**Mobile Fingerprint Capture for First Responders**

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**JEREMY GLENN**  
**JOHN BELTZ**  
NIST PSCR

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 MORE INFO

This panel will discuss the technology gaps and problem statements currently being researched for mobile, high quality fingerprint capture for first responders. This discussion incorporates work performed by NIST's Information Access Division (IAD), represented on the panel by Shahram Orandi. IAD has conducted extensive research and development in the area of fingerprint capture, analysis and image quality. Their experience includes projects with the FBI and various other public safety and government agencies. This session will capture the current status of research and development of fingerprint capture technology and introduce the soon-to-be-launched PSCR prize challenge: Mobile Fingerprint Capture for First Responders Challenge (anticipated launch date: September 2020).





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## ON-DEMAND SESSIONS



### SECURITY

#### LEGEND

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Expanding the SIM Card Use Pre-Shared Keys to Overcome the Challenges of 5G Security - Evolution

ICAM - Critical Topics and New NIST Standards

Mobile Fingerprint

5G Security - Evolution

**5G Security - Evolution not Revolution**

●●●

**JEFF CICHONSKI**  
NIST PSCR

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5G has promised to change the way we communicate with an ambitious slate of capabilities not yet available in the 5G networks deployed today, but rather those still being developed and specified by 3GPP. To help conference attendees fully understand the security posture of 5G networks, Jeff will describe the state of 5G standardization, how researcher-discovered vulnerabilities are addressed in the standards process, and highlight how certain deployment models limit the security capabilities.

This talk will be grounded in 3GPP specifications as well as commercially available technology. While the 5G core network architecture looks radically different than that of LTE, it is comprised of much of the same functionality and depends on aspects of LTE in the 5G deployments available today. A seismic shift in the architecture design is the fact that 5G introduces the notion of a Service Based Architecture (SBA) for the first time in cellular networks. This new design has fundamental impacts on the way new services are created and how

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## ON-DEMAND SESSIONS



### SECURITY

#### LEGEND

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Expanding the SIM Card Use Pre-Shared Keys Overview

ICAM - Critical Topics and New NIST


Mobile Fin...rint

5G Security - Evolution

**5G Security - Evolution not Revolution**

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**JEFF CICHONSKI**  
NIST PSCR

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the individual Network Functions (NF) cooperate – not only is the core network decomposed into smaller functional elements, the communication between these elements is also expected to be more flexible, routed via a common service bus and deployed using virtualization and containerization technologies. Jeff will also discuss the security implications and opportunities around cellular networks finally taking advantage of these modern IT technologies. The cellular networks of tomorrow (5G) are largely based on the cellular networks of today (LTE) and the 5G specifications have been developed to build upon LTE.

This session will highlight the similarities, differences and—most importantly—the interdependencies of the two systems. This session will include an overview of the 5G security architecture, how it addresses LTE security challenges, a dive into security features new to 5G, security opportunities introduced with increased use of commodity internet technologies, and finally a quick look at NIST 5G security activities.



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### SECURITY

#### LEGEND

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Expanding the SIM Card Use Prize Overview

ICAM - Critical Topics and Best Document


Mobile Fingerprint

5G Security - Evolution Revolution

### 3GPP Standards Status Update


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**DEAN PROCHASKA**  
**IHAB GUIRGUIS**  
**BILL JANKY**  
**ESHWAR PITTAMPALLI**  
**MICHAEL DOLAN**  
FIRSTNET

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[MORE INFO](#)

In this session, panelists from the FirstNet Standards Team will review a history of the First Responder Network Authority (FirstNet), their goals on the standards team, and what's been accomplished to date in Releases 12 -15 for 3GPP. The panel will then share what they have planned for Release 16 and 17 for 3GPP.





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**Tech to Protect - Year in Review**

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**PSCR's Follow on Funding Opportunity**

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**Steps You Can Take When Partnering with Public Safety Agencies to Develop and Test Technologies**

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**Making an Impact: Experiences of PSCR's Awardees**

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**For Technology Innovators, What Should You Know About Public Safety Agencies' Procurement Process?**

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**Connecting Innovators to Small Business Resources**

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[Tech to Protect - Year in Review](#) 

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**CRAIG CONNELLY**, PSCR; **MARGARET PINSON**, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION; **BILL SCHRIER**, FIRST RESPONDER NETWORK AUTHORITY; **JASON KAHN**, PSCR; **CHARLES GARNETT**, FIRST RESPONDER NETWORK AUTHORITY; **GARY HOWARTH**, PSCR; **ZACH BRAUN**, FIREHUD; **LAUREN SCLUZAS**, BIO1 SYSTEMS; **AUSTIN S. HANDLE**, APOLLO AI; **LEVIS ADISSI**, AR EXTRICATION ASSIST - AREA

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Launched in April 2019, the Tech to Protect Challenge is over one year old. This session will look back at the progress to date, highlight recent national award winners, and share the next steps for participants moving forward.



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PSCR's Follow on

Funding Opportunity

**PSCR's Follow on Funding Opportunity**

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**SARAH HUGHES  
ELLEN RYAN**

**SCOTT MCNICHOL**  
NIST PSCR

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Steps You Can Take When

Partnering with Public Safety

Making an Impact:

Experience of PSCR's



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For Technology Innovators: What Should You Know About Public Safety Agencies Procurement Process?

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#### Steps You Can Take When Partnering with Public Safety Agencies to Develop and Test Technologies

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**JONATHAN H. LEWIN** FIRST RESPONDER NETWORK AUTHORITY, **LT. CHARLIE FAIR** RETIRED PARAMEDIC, MANAGER EMS IT, **CRAIG CONNELLY** PSCR

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How do successful public private partnerships support the development and testing of innovative communication technologies? What are some examples of successful partnerships from the perspectives of public safety leaders? How are these partnerships structured? What steps can you take if you are looking for a public safety agency partner in your R&D process or go to market strategy? This discussion will focus on each of these questions with the goal of encouraging others who are just starting or planning for future partnerships.



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**Steps You Can Take When Partnering with Public Safety**  
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**For Technology Innovation: What Should You Know About Public Safety Agencies' Procurement Process?**  
●○○

**Connecting Innovators to Small Business Resources**  
●○○

**Making an Impact: Experiences of PSCR's Awardees**

This session seeks to explore the impacts of the PSIAP program on award recipients. They will discuss their experience including how the program affected their organization, expanded their network, and introduced them to public safety. They'll also discuss how PSCR can continue to make an impact for first responders.

**JEREMY GLENN**  
NIST PSCR

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**For Technology Innovators, What Should You Know About Public Safety Agencies' Procurement Process?**

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**JESSICA BALLEW** TEXAS DEPARTMENT OF PUBLIC SAFETY, **JIM MCMILLAN** PUBLIC SAFETY TECHNOLOGY, HARRIS COUNTY, **CRAIG CONNELLY** PSCR

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This panel will explore insights into public safety agencies' procurement process. For example, how do public safety agencies assess product and use-case fit, what information can they share regarding procurement processes? And ultimately what are the steps that enable technology to be deployed and utilized by public safety?

For Technology Innovators, What Should You Know About Public Safety Agencies' Procurement Process?

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### Connecting Innovators to Small Business Resources

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**FRANCES PADILLA** U.S. SMALL BUSINESS ADMINISTRATION, **SHARON KING** SMALL BUSINESS DEVELOPMENT CENTER, **SHARON KING** FEDERAL AND STATE TECHNOLOGY (FAST) PARTNERSHIP PROGRAM, **JIM PUCKETT** IBM SECURITY, **MATTHEW LOURIE** NOKK NOK LABS, **SUZETTE MCLEOD** FIRSTNET, BUILT WITH AT&T, **DAVID STIEREN** NIST MANUFACTURING EXTENSION PARTNERSHIP, **BRIAN HOBSON** FIRST RESPONDER NETWORK AUTHORITY

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**Steps You Can Take When Partnering with Public Safety Agencies to Develop and Test Technologies**

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**Making an Impact: Experiences of PSCR's Awardees**

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**CRAIG CONNELLY**, PSCR; **MARGARET PINSON**, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION; **BILL SCHRIER**, FIRST RESPONDER NETWORK AUTHORITY; **JASON KAHN**, PSCR; **CHARLES GARNETT**, FIRST RESPONDER NETWORK AUTHORITY; **GARY HOWARTH**, PSCR; **ZACH BRAUN**, FIREHUD; **LAUREN SCLUZAS**, BIO1 SYSTEMS; **AUSTIN S. HANDLE**, APOLLO AI; **LEVIS ADISSI**, AR EXTRICATION ASSIST - AREA

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Making an Impact: Experiences of PSCR

Launched in April 2019, the Tech to Protect Challenge is over one year old. This session will look back at the progress to date, highlight recent national award winners, and share the next steps for participants moving forward.





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**PSCR's Follow on Funding Opportunity**

Acknowledging the technology development and life-cycle gap from early-stage research and prototypes to publicly available technology, PSCR has launched a new funding opportunity for entities with a previous award in an effort to further propel forward their research and prototypes and more quickly advance needed improvements in communication technology for first responders.

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SARAH HUGHES  
ELLEN RYAN  
SCOTT MCNICHOL  
NIST PSCR

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#### Steps You Can Take When Partnering with Public Safety Agencies to Develop and Test Technologies

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**JONATHAN H. LEWIN** FIRST RESPONDER NETWORK AUTHORITY, **LT. CHARLIE FAIR** RETIRED PARAMEDIC, MANAGER EMS IT, **CRAIG CONNELLY** PSCR

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How do successful public private partnerships support the development and testing of innovative communication technologies? What are some examples of successful partnerships from the perspectives of public safety leaders? How are these partnerships structured? What steps can you take if you are looking for a public safety agency partner in your R&D process or go to market strategy? This discussion will focus on each of these questions with the goal of encouraging others who are just starting or planning for future partnerships.



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**For Technology Innovation: What Should You Know About Public Safety Agencies' Procurement Process?**  
●○○

**Connecting Innovators to Small Business Resources**  
●○○

#### Making an Impact: Experiences of PSCR's Awardees

This session seeks to explore the impacts of the PSIAP program on award recipients. They will discuss their experience including how the program affected their organization, expanded their network, and introduced them to public safety. They'll also discuss how PSCR can continue to make an impact for first responders.

**JEREMY GLENN**  
NIST PSCR

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**For Technology Innovators, What Should You Know About Public Safety Agencies' Procurement Process?**

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**JESSICA BALLEW** TEXAS DEPARTMENT OF PUBLIC SAFETY, **JIM MCMILLAN** PUBLIC SAFETY TECHNOLOGY, HARRIS COUNTY, **CRAIG CONNELLY** PSCR

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<b>The Evolution of Direct Mode in 3GPP</b>   CLICK TO PLAY ON-DEMAND SESSION  ●●●  MORE INFO	<b>Multicast and Unicast in Serving Public Safety Traffic</b>   CLICK TO PLAY ON-DEMAND SESSION  ●●●  MORE INFO	<b>LMR Data Collection for Traffic Modeling</b>   CLICK TO PLAY ON-DEMAND SESSION  ●●●  MORE INFO	<b>Towards 5G mmWave Wireless Connectivity for First Responders</b>   CLICK TO PLAY ON-DEMAND SESSION  ●●●  MORE INFO

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**Analysis and Simulation of Migration of PTT Services to 4G LTE**

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**QUARC: Implementation of a Real-Time Adjustable Degraded Communications System**

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**Propagation Channel Models & System Performance**

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**An Executable MCX 3GPP Conformance Tester to Ensure Device Compliance**

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**The Testing-as-a-Service Approach: An Enabler of Flexible MCS Certification**

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**Mission Critical Communication UE Certification Test Tool Development: Plan & Progress**

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**Emulating and Evaluating Public Safety Voice Quality in a Carry-On**

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<p><b>MCV Portfolio Strategy</b></p> <p>●○○</p> <p><b>DON BRADSHAW</b> NIST PSCR</p>	<p><b>MCV Quality of Experience Measurement Methods</b></p> <p>●○○</p>	<p><b>LMR to LTE</b></p> <p>This session presents the strategy for the MCV portfolio and how all past, current, and future internal/external efforts tie together to create significant positive results for public safety in:</p> <ul style="list-style-type: none"><li>• Mission Critical Push-to-Talk</li><li>• Device to Device</li><li>• LMR to LTE</li><li>• Quality of Experience of MCV</li></ul>	<p><b>Access Driven Modification</b></p> <p>●○○</p>
<p><b>The Evolution of Direct Mode in 3GPP</b></p> <p>●○○</p> <p> <b>CLICK TO PLAY ON-DEMAND SESSION</b></p>	<p><b>Multicast and Unicast in Serving Public Safety Traffic</b></p> <p>●○○</p> <p> <b>CLICK TO PLAY ON-DEMAND SESSION</b></p>	<p><b>LMR Data Collection for Traffic Modeling</b></p> <p>●○○</p> <p> <b>CLICK TO PLAY ON-DEMAND SESSION</b></p>	<p><b>Towards 5G mmWave Wireless Connectivity for First Responders</b></p> <p>●○○</p> <p> <b>CLICK TO PLAY ON-DEMAND SESSION</b></p>



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#### MCV Quality of Experience Measurement Methods

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**TIM THOMPSON**  
NIST PSCR

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Mission Critical Voice (MCV) QoE measurement methods are being developed by NIST/PSCR to determine levels of key performance indicators (KPI) and to provide fair comparison mechanisms for Push To Talk (PTT) technologies. Mouth-to-ear (M2E) latency and end-to-end access time measurement methods and test results were discussed at previous stakeholder meetings. Building upon that foundation, NIST/PSCR has further developed the measurement method to quantify end-to-end access time of P25 LMR technologies using encryption as well as LTE PTT technologies. The end-to-end access time measurement method and test results will be reviewed. Further work will include determining the probability of access and the probability of retaining communications by performing extensive field testing of PTT technologies. The goals of this further testing will be discussed.





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**LMR to LTE**

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**CHRIS WALTON**  
**JORDAN O'DELL**  
NIST PSCR

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Digital Land Mobile Radio (LMR) is the leading communications technology used by Public Safety (PS) for Push To Talk (PTT) applications. With the widespread deployment and desirable features of nationwide broadband networks, there are significant benefits to be gained by augmenting or potentially replacing current PS communications methods with more modern Long Term Evolution (LTE) communications technologies. Emerging Mission Critical (MC) standards will provide PS with PTT, data, and video capabilities above and beyond what modern LMR is able to provide. The possibility of including MC data and video into a nationwide PS broadband communications network stands to profoundly change the tools available to the PS community. As broadband MCPTT solutions continue to mature, they are starting to be implemented in the PS community. However, market penetration of 3GPP MC products continues to be low due to competition from existing LMR infrastructure and other non-MCPTT “over the top” broadband solutions.





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<p>MCV Portfolio Strategy</p> <p><b>Access Driven Modified Rhyme Test Intelligibility</b></p> <p>●●○</p> <p><b>JADEN PIEPER</b> <b>STEPHEN VORAN</b> NIST PSCR</p> <p> <b>CLICK TO PLAY ON-DEMAND SESSION</b></p> <p>●●●  MORE INFO</p>	<p>MCV Quality of Experience Measure</p> <p>Previous work by NIST/PSCR focused on developing a quality of experience based access time measurement system. This system relies on modified rhyme test (MRT) word intelligibility and focuses on intelligibility when incrementally cutting off portions of the first word of a transmission. This impairment of partially muted words is unique and there was not data that described its impact on intelligibility. This talk will describe the research underway at PSCR to characterize this relationship by performing MRTs focused on this impairment with public safety agents.</p> <p>●●○  MORE INFO</p>	<p>LMR to LTE</p> <p>Multicast and Unicast in Serving Public Safety Traffic</p> <p>●●○  MORE INFO</p>	<p>Access Driven Modified Rhyme Test Intelligibility</p> <p>●●○  MORE INFO</p>
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<p>MCV Portfolio Strategy</p> <h3>The Evolution of Direct Mode in 3GPP</h3> <p>●●●</p> <p><b>RICHARD ROUIL</b> NIST PSCR</p>	<p>MCV Quality of Service Methods</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>LMR to LTE</p> <p>Direct Mode communication remains one of the major hurdles for transitioning from Land Mobile Radio (LMR) to broadband technology. This session will start by providing some background information on 3GPP Long Term Evolution (LTE) direct mode, called Proximity Services, introduced in Release 12 and its enhancements in subsequent releases. The remainder of the talk will describe vehicular-to-anything (V2X) communication being defined in 3GPP New Radio (NR) and the efforts to leverage this new technology in order to enhance direct mode performance and reliability in the context of public safety scenarios.</p>	<p>Access Driven Modification</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>
<p>The Evolution of Direct Mode in 3GPP</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>Multicast and Unicast in Serving Public Safety Traffic</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>LMR Data Channel Traffic Modeling</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>5G mmWave Wireless Connectivity for First Responders</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>



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<p>MCV Portfolio Strategy</p> <h3>Multicast and Unicast in Serving Public Safety Traffic</h3> <p>●●●</p> <p><b>CHUNMEI LIU</b> NIST PSCR</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>	<p>MCV Quality of Service Measurements</p> <p>Given a significant amount of group traffic in public safety incidents, multicast has the potential to outperform unicast in terms of precious spectrum savings and first responders' experience. In this study, and for both unicast and multicast, we explore components along the chain from initial first responders' deployment locations to the resulting network performance and user experience, with considerations on Multiple-Inputs-Multiple-Outputs (MIMO) technologies and public safety incident coverage. We also identify, quantify, and visualize major factors that contribute to the resulting first responders' experience.</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>	<p>LMR to LTE</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>	<p>Access Driven Modification at Intelligent</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>
<p>The Evolution of Direct Mode in 3GPP</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>	<p>Multicast and Unicast in Serving Public Safety Traffic</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>	<p>LMR Data Collection and Traffic Modeling</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>	<p>mmWave Wireless Connectivity for First Responders</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●● <a href="#">MORE INFO</a></p>



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#### LMR Data Collection for Traffic Modeling

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**CHRIS DENNIS**  
**YISHEN SUN**  
NIST PSCR

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More Info

The purpose of the Land Mobile Radio (LMR) Data Collection Project is to create a database of Public safety (PS) LMR usage for traffic/call modeling. The generated models may be used by telecom providers and PS entities for future technology deployments (e.g., LTE and 5G). This session presents the results from a recent Radio Frequency (RF) geolocation sensor system test deployment in Boulder, CO, as well as results from testing away from the Front Range. Current geolocation results, although having substantial error, are still useful in developing the modeling method. Future activities for this project include for participating public safety entities to provide P25 traffic and location data, in addition to sensor system deployments. Additional deployments in other U.S. cities are also being planned.

More Info



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#### Towards 5G mmWave Wireless Connectivity for First Responders



**MARCO MEZZAVILLA**  
NEW YORK UNIVERSITY



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The millimeter-wave (mmWave) bands offer vastly more spectrum than current cellular allocations in the highly congested bands in use today, thus enabling orders of magnitude greater data rates and reduced latency. However, the path towards realizing the full potential of this technology is hindered by a number of open research challenges. The teams at New York University, University of Padova, and Austin Fire Department have jointly developed a research platform aimed at exploring mmWave connectivity in disaster response scenarios. In particular, the work is focused on aerial vehicle (UAV) communications, a key technology for first responders that combat wildfires. The speaker will discuss (1) the open source hardware that was developed during this project, i.e., a mmWave software-defined radio (SDR) platform that can be mounted on UAVs and vehicles to conduct mobile experimental wireless research; and (2) the open source software that has been recently released for use in every wireless lab that is interested in simulating mmWave communications in public safety scenarios.



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#### Analysis and Simulation of Migration of PTT Services to 4G LTE



**SUMIT ROY**  
**THOMAS HENDERSON**  
 UNIVERSITY OF WASHINGTON


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The performance of Mission-Critical Push-To-Talk (MCPTT) in future public safety networks based on LTE and 5G will be a key driver of operational success and safety. MCPTT is being implemented by many vendors and tested at interoperability events such as the ETSI Plugtest events, but large-scale experimentation with real equipment is often limited by factors such as equipment availability and field testing costs. For these reasons, a high-fidelity simulation model of MCPTT for the popular ns-3 discrete-event network simulation framework has been initiated by NIST Wireless Networks Division and further developed in this PSIAP-funded project. We will describe specifically how the off-network MCPTT simulation models from NIST have been extended to model on-network MCPTT operation over a simulated LTE radio access network and core, and how these models can be used in large-scale simulation experiments such as have been authored by NIST. Key performance indicators (KPIs) such as access time latency and mouth-to-ear latency are supported by performance traces from the simulation models, and the models will allow researchers to explore issues such as scheduling policies and robustness to intermittent links in a controlled, reproducible simulation environment. Simulation tests and documentation are also published as part of the open-source software dissemination of the models.



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## ON-DEMAND SESSIONS



BACK

### MISSION CRITICAL VOICE

#### LEGEND


- Beginner
- Intermediate
- Advanced

#### QUARC: Implementation of a Real-Time Adjustable Degraded Communications System

●●○

**ALESSIO MEDDA**

GEORGE TECH RESEARCH  
INSTITUTE

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Georgia Tech Research Institute (GTRI) is developing a framework for the evaluation of mission critical voice (MCV) quality of experience (QoE) for first responders operating in real field scenarios. The research team is developing a suite of software tools for the simulation, recording, and evaluation of LMR and LTE voice communication systems with the ability to concurrently vary four proposed key performance indicators (KPI) and evaluate the quality of experience for active-duty operators and first responders. Moreover, GTRI is developing a dedicated wearable digital communication system with the purpose of collecting data during real operating scenarios by measuring objective and subjective outcomes, recording data in input and output of each communication system and recording the overall scenario. Furthermore, GTRI will leverage outcomes to design, develop, and validate a model for QoE for public safety users. The GTRI ARTEMIS-QUARC project will integrate with the ARTEMIS (usability testbed for first responders), seamlessly enabling a Virtual Test Facility for the collection of real-time, objective data.



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## ON-DEMAND SESSIONS



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### MISSION CRITICAL VOICE

#### LEGEND

- Beginner
- Intermediate
- Advanced

#### Propagation Channel Models & System Performance



**ANDREAS MOLISCH**  
**HUSSEIN HAMMOUD**

UNIVERSITY OF  
SOUTHERN CALIFORNIA

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The next generation of emergency responder systems will be based on LTE, as the use of commercial off-the-shelf components will lead to a dramatic decrease in cost. However, since PSOs (Public Safety Organizations) often need to operate in areas where there is no cellular infrastructure (either by design, or because the infrastructure is nonoperative after a natural disaster), it is essential that DMO (Direct Mode Operation), also known as Device-to-Device (D2D) communication is fully operational and reliable. At the current time, the D2D mode of LTE is still under development, and no proper testing has been done yet.

A key requirement is testing in realistic channels; it is not sufficient to analyze performance with the 3GPP (or similar) channel models, as those are intended to compare different systems, not to evaluate absolute performance and reliability.

The key goal of this project is thus to perform extensive measurement campaigns for D2D channels, in particular concentrating on channels that are most important for PSOs, namely (i) channels for vehicle-to-vehicle (V2V) communications, including convoys, and (ii) indoor-to-outdoor (I2O) channels, where one mobile device is outdoors at street level, and the other indoors, possibly at a higher floor. For those scenarios, existing measurements are missing critical components such as (i) sufficient number of measurements to provide statistical viability, (ii) directional channel characteristics (which are needed to evaluate multi-antenna terminals), and (iii) evolution of channel characteristics when the device moves on a trajectory.



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### MISSION CRITICAL VOICE


#### LEGEND

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**An Executable MCX 3GPP Conformance Tester to Ensure Device Compliance**

●●○

**IAN CARPENTER**  
VALID8

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This presentation will provide an overview of the Valid8 MCX Conformance Tester that can be used to verify MCX Client device compliance to the 3GPP specification standards. This includes a demonstration of Mission Critical Push-to-Talk (MCPTT) test execution and result analysis.





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### MISSION CRITICAL VOICE

#### LEGEND

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#### The Testing-as-a-Service Approach: An Enabler of Flexible MCS Certification

●●○

**FIDEL LIBERAL**  
**TJ KENNEDY (PSTA)**  
**WALT MAGNUSSEN**  
**(TAMU) UNIVERSITY OF THE BASQUE COUNTRY**

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The Mission Critical Services (MCS) Testing-as-a-Service approach aims to fulfill the needs of the mission critical and public safety community in terms of compliance testing. Our goal is to drive innovation for public safety by making compliance with open standards more accessible to all.

Developing and deploying compliance remote testing services will allow not only the industry to prove the 3GPP standards-compliance of their implementation, but will also give the public safety users and operators the confidence to buy compliant products.

Unlike traditional mobile phone testing environments in which both service -software- and hardware are bundled in the device to be tested, assembled, and certified by a single vendor, in the MCS ecosystem most of the times the device manufacturer is not the same as the MCS client provider. Then, instead of expensive testing equipment targeting markets of billions of smartphones, the flexible MCS-TaaS approach enables cost-efficient, regular and frequent testing, re-testing, certification and re-certification of the myriad and increasing combinations of devices, operating systems, middleware and applications in the MCS ecosystem.

Furthermore, the testing service will also be made available through LTE hardware that is capable of evaluating the specific Mission Critical features from LTE including the radio interface elements.



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### MISSION CRITICAL VOICE


#### LEGEND


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#### Mission Critical Communication UE Certification Test Tool Development: Plan & Progress

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**SUDIPTO BISWAS**  
POLARIS NETWORKS

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Session will cover the following points in detail:

- Project Goal
- Scope of Work
- High Level Solution
- Project Schedule
- Dependencies
- Progress
- Next Plans
- Challenges
- Support Required



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### MISSION CRITICAL VOICE

**Emulating and Evaluating Public Safety Voice Quality in a Carry-On**

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**HENNING SCHULZRINNE,**  
COLUMBIA UNIVERSITY

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We describe a programmable land-mobile radio voice emulator that allows experimenters to vary all critical communication parameters, including codec (P.25 and others), delay, PTT delay, packet loss, bit error rate, and voice drop-outs. The system is integrated with an experiment management system so that experiments can be recorded and evaluated.

[LEGEND](#)

- Beginner
- Intermediate
- Advanced

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### PUBLIC SAFETY ANALYTICS

**LEGEND**


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<p><b>Social Media Incident Streams</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">i MORE INFO</a></p>	<p><b>Automated Streams Analytics for Public Safety</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">i MORE INFO</a></p>	<p><b>Speech Analytics for Public Safety</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">i MORE INFO</a></p>	<p><b>IoT Environments: Examining Data Foundations</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○ <a href="#">i MORE INFO</a></p>
<p><b>Connecting the First Responder's Environment</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">i MORE INFO</a></p>	<p><b>Crisis Collaborations: Challenges for Safe Data Sharing with Differential Privacy</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">i MORE INFO</a></p>	<p><b>Towards Cognitive Assistant Systems for Emergency Response</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">i MORE INFO</a></p>	<p><b>SAFE-NET: A Computing Platform for Public Safety Applications</b></p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○ <a href="#">i MORE INFO</a></p>





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### PUBLIC SAFETY ANALYTICS

**LEGEND**


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**User Defined Video Analytics and Integrated Alerting for Public Safety**

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**Real-Time Video Analytics for Situation Awareness**

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**Technical Advances in Body-Worn Camera Video Understanding**


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**Information-Driven Video Communication for Public Safety Networks**

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### PUBLIC SAFETY ANALYTICS

#### LEGEND

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<p>Social Media Incident Streams</p> <h3>Social Media Incident Streams</h3> <p>●○○</p> <p><b>IAN SOBOROFF</b> NIST PSCR</p>	<p>Automated Streams Analytics for Public Safety</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>Speech Analytics for Emergency Response</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>IoT Environments: A Computing Platform for Public Safety Applications</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>
<p>Connecting the First Responder's Environment</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>Crisis Collaboration Challenges for Safe Data Sharing with Differential Privacy</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>Emergency Response</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>	<p>NET: A Computing Platform for Public Safety Applications</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p>



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### PUBLIC SAFETY ANALYTICS


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**Automated Streams Analytics for Public Safety**

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**JOHN GAROFOLO**  
**CRAIG CONNELLY**  
NIST PSCR

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The session will introduce the audience to the new PSCR Automated Streams Analysis for Public Safety (ASAPS) prize challenge program. This unique program brings together research across the PSCR Analytics Portfolio, and provides an opportunity for participants to create prototype real-time emergency detection, analysis, alerting, visualization, and situation awareness applications for emergency operations centers. ASAPS is a multi-phase challenge to apply the state-of-the-art in AI technologies to the many live streams of data that public safety must currently monitor to automatically analyze critically important information about emergencies as they happen. ASAPS is designed to solicit innovative concepts and foster teaming and collaboration. Contestants will design and develop technology solutions to the analytic components needed to create progressively more sophisticated ASAPS system prototypes. The data that will be used to drive the R&D for the contests are collected and synchronized from staged emergency scenes viewed by many CCTV cameras and synthesized dispatch communications, situation logging, 911 calls, social media postings, responder audio and



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<p><b>Automated Streams Analytics for Public Safety</b></p> <p>●●○</p> <p><b>JOHN GAROFOLO</b> <b>CRAIG CONNELLY</b> NIST PSCR</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>textual communications, GPS, and sensor data. The data will be automatically streamed to contestant algorithms within a state-of-the-art integration framework simulating real-time data streaming and communications and providing common APIs to contestant-developed analytic components supporting real-time multi-modal data analysis, information representation, analytic reporting, information visualization, and user interaction. Prizes will be awarded to contestants for various aspects of their prototype solutions.</p>
<p><b>JOHN GAROFOLO</b> <b>CRAIG CONNELLY</b> NIST PSCR</p>	<p>The session will feature speakers including the NIST ASAPS challenge leads John Garofolo and Craig Connelly, Keil Green, CEO of the Lafayette Group who is organizing and implementing the challenges under contract to NIST, and a public safety representative, Julie Stroup, the Public Safety Video Program Manager for the Houston Mayor's Office of Public Safety and Homeland Security. ASAPS will foster ground-breaking multidisciplinary R&amp;D for real-time multi-modal data stream analysis, information fusion, and information delivery to help provide public safety with critical real-time emergency situation information to save lives, property, and infrastructure where every second counts!</p>



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**Speech Analytics for Public Safety**

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**FRED BYERS**  
NIST PSCR

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As emerging first responder communicative assistive technologies become available, the need for testing and improving speech analytic technologies for first responder scenarios becomes increasingly more important. First responder acoustic scenarios can include noisy background sounds and changes in speech. In 2019, researchers, through a NIST speech analytics evaluation project called OpenSAT, applied their speech analytic technologies to audio that contains public safety response background noise that were subjected to participants playing an interactive fire rescue game. The intent was to induce increased vocal effort and occasional expression of urgency by game players in response to the noise. The game players were subjected to background sounds from actual first responder events. Time constraints were also injected to create a sense of urgency. The changes in speech combined with the background sounds create communicative conditions that can be challenging for speech analytic technologies. The first responder simulation through game-playing could represent real communicative



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**Speech Analytics for Public Safety**

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**FRED BYERS**  
NIST PSCR

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conditions for first responders at critical times during an actual emergency. This presentation includes evaluation results from the NIST's inaugural OpenSAT19 Evaluation that will be the baseline for tracking speech analytic technology performance improvements through annual evaluations. The speech analytic technologies that are currently being tracked include automated speech-to-text, speech activity detection, and keyword search. The OpenSAT20 Evaluation is currently in process. DHS sponsored this effort by PSCR to create an audio dataset and to test and evaluate state of the art speech analytic systems with conditions challenging for speech analytics as mentioned above.



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### PUBLIC SAFETY ANALYTICS



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**IoT Environments: Examining Data Foundations**

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**ALISON KAHN**  
NIST PSCR

For 3 years, PSCR and DHS have been working together to evaluate the state of Internet of Things and personal area networks for first responders. In 2020, our scope has widened to look beyond the personal area network and determine the data that the first responder needs from these systems. From there, we will show how these systems can integrate beyond on-the-body sensors into smart buildings. This session aims to explain how we are identifying the data that sensor systems must be able to provide to first responders, and how the first responder community can help inform technology developers to create the products public safety needs.



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







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### PUBLIC SAFETY ANALYTICS

#### LEGEND

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<p>Social Media Incident Streams</p> <h3>Connecting the First Responder's Environment</h3> <p>●●○</p> <p><b>DON HARRISS</b> NIST PSCR</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Automated Streams Analytics for Public Safety</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Speech Analytics for Public Safety</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>IoT Environments: Computing Public Safety Operations</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>
<p>Connecting the First Responder's Environment</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Crisis Collaboration Challenges for Safe Sharing with Different Privacy</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Automated Streams Analytics for Public Safety</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>IoT Environments: Computing Public Safety Operations</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>



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### PUBLIC SAFETY ANALYTICS



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#### LEGEND


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**Crisis Collaborations:  
Challenges for Safe Data  
Sharing with Differential  
Privacy**

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**GARY HOWARTH  
DIANE RIDGEWAY  
CHRISTINE TASK**  
NIST PSCR

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In April 2020, NIST held a Data Privacy workshop designed to explore the interests and needs of advancing fundamental data privacy technology research. The workshop helped NIST PSCR understand current approaches to data privacy risk-management and the need of the Public Safety community. We explored concepts in differential privacy methods and evaluated industry and academic approaches that may soon fill the gap in the de-identification of data. We will share the results of this workshop.



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### PUBLIC SAFETY ANALYTICS




#### LEGEND

- Beginner
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**Towards Cognitive Assistant Systems for Emergency Response**

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**SARAH MASUD PREUM**  
UNIVERSITY OF VIRGINIA

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This project can potentially make a significant impact on improving health outcomes and first responders' safety by promoting evidence-based emergency response decision making. Automated incident monitoring and data collection will benefit first responders by reducing cognitive burden and response time to incidents and focusing on more important tasks. The collected data and analytic results can be shared with the public safety community and other researchers and further used for responders' performance assessment, identifying most critical emergency scenarios and response actions, and designing more effective training modules.





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### PUBLIC SAFETY ANALYTICS


#### LEGEND

- Beginner
- Intermediate
- Advanced


**SAFE-NET: A Computing Platform for Public Safety Applications**

●●○

**KHALED ABDELGHANY**  
**MICHAEL HAHLER**  
**BARBARA MINSKER**  
**MAY YUAN**  
SOUTHERN METHODIST UNIVERSITY

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We present the modeling frameworks and solution methodologies for three problems related to enhancing the dispatching operation of emergency vehicles in urban areas. First, we discuss the problem of emergency routing. Next, we present results related to spatial risk analysis for emergency vehicle routing. Finally, a framework for data fusion for flash flood detection is discussed. The results of applying these methodologies for the Dallas area are presented.





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### PUBLIC SAFETY ANALYTICS



#### LEGEND

- Beginner
- Intermediate
- Advanced

#### User Defined Video Analytics and Integrated Alerting for Public Safety

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JULIE STROUP  
TONY WELDON  
SHISHIR SHAH  
UNIVERSITY OF HOUSTON

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Use of video camera systems has become common across various public safety agencies. While the manual review of captured video can be beneficial, there are a growing number of applications that would benefit from automated analyses of captured video. In the recent past, considerable attempts have been made towards video analytics for monitoring, e.g. analytics for automatic left object (baggage) detection, or line (perimeter) crossing are common today. While more advanced and sophisticated analytics can be designed and developed, the ingestion of resulting information to facilitate communication and timely response from first responders requires the integration of video analytic methods with existing information management and communication systems. Typical video systems leverage a video management system (VMS) to record video from cameras and push event information into a public safety information management system (PSIM). The PSIM is often used as the information management and communication system to define standard operating processes for each event, which in turn facilitates planning and response. In this session, we will discuss our learnings on how video analytics can be enabled for first responders and public safety personnel.



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### PUBLIC SAFETY ANALYTICS



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#### LEGEND

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#### Real-Time Video Analytics for Situation Awareness

The ubiquity of mobile phone cameras allows public safety events to be captured on video right on the spot and be rapidly shared via social media. Our project seeks to develop video analytics and visualization tools based on computer vision and machine learning techniques for public safety events. We will demonstrate multiple systems that illustrate some of the work we have been doing. For example, we've developed a system to assess the damage of houses after a natural disaster from drone videos and a person re-identification system that utilizes multi-modal information including text descriptions and gait recognition. We'll demonstrate how we could identify the suspect of the Boston Bombing across different cameras and times with such systems.

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**ALEXANDER HAUPTMANN**  
**JUNWEI LIANG**  
CARNEGIE MELLON UNIVERSITY

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## ON-DEMAND SESSIONS

### PUBLIC SAFETY ANALYTICS



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#### LEGEND

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#### Technical Advances in Body-Worn Camera Video Understanding



JASON CORSO  
CHENLIANG XO  
TOM YAN  
KYLE MIN  
UNIVERSITY OF MICHIGAN

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

Our project is focusing on developing a new level of analytical capability in body-worn cameras for public safety. BOCA analyzes human activity from body-worn cameras with minimum human effort for data annotation by leveraging available regularity in the data as well as preexisting labeled data from third-person fixed-camera-view scenarios; it adapts ideas from transfer learning and multi-task clustering to overcome the following key challenges to realizing state-of-the-art body-worn camera analytics in public safety. This talk will present our recent finding on transfer learning for activity understanding in body-worn cameras, it will discuss mechanisms for leveraging attention in understanding body-worn cameras and it will discuss the challenge of scene understanding from body-worn cameras.



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## ON-DEMAND SESSIONS

### PUBLIC SAFETY ANALYTICS



BACK

#### LEGEND


- Beginner
- Intermediate
- Advanced


**Information-Driven Video Communication for Public Safety Networks**

This presentation introduces quality assessment models and quality control schemes for image and video analytics in public safety networks.

●●○

**RUI (APRIL) DAI**  
UNIVERSITY OF CINCINNATI

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## ON-DEMAND SESSIONS

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### RESILIENT SYSTEMS

**LEGEND**

- Beginner
- Intermediate
- Advanced

**Resilient Communication Network Platforms Research: A New Direction for Deployable Communications**

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●○○ [MORE INFO](#)

**Innovating on Drone Technology to Support First Responder Missions**

[CLICK TO PLAY ON-DEMAND SESSION](#)

●○○ [MORE INFO](#)

**UAS Test Methods**

[CLICK TO PLAY ON-DEMAND SESSION](#)

●●○ [MORE INFO](#)

**Broadband Wireless Access Technologies for Deployable Systems: Where are they?**

[CLICK TO PLAY ON-DEMAND SESSION](#)

●○○ [MORE INFO](#)

**DistressNet-NG: Resilient Mobile Broadband Communication and Edge Computing**

[CLICK TO PLAY ON-DEMAND SESSION](#)

●●○ [MORE INFO](#)

**ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters**

[CLICK TO PLAY ON-DEMAND SESSION](#)

●●○ [MORE INFO](#)

**Tamperproof Storage and Communication for Adversarial IoT Networks**

[CLICK TO PLAY ON-DEMAND SESSION](#)

●●○ [MORE INFO](#)

**Data on the Edge: Development of the Wildland-Fire Data Logistics Network (WDNL)**

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●●○ [MORE INFO](#)

[→](#)




## ON-DEMAND SESSIONS

### RESILIENT SYSTEMS

LEGEND

- Beginner
- Intermediate
- Advanced

Client-Driven Multipath TCP for Improved Network Performance and Reliability

 [CLICK TO PLAY ON-DEMAND SESSION](#)

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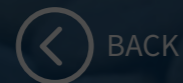
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## ON-DEMAND SESSIONS



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### RESILIENT SYSTEMS

#### LEGEND


- Beginner
- Intermediate
- Advanced

Resilient Communication Network Platforms Research: A New Direction for Deployable Communications
×

**Resilient Communication Network Platforms Research: A New Direction for Deployable Communications**

●○○

**SAM RAY**  
**HIEN NGUYEN**  
NIST PSCR

 [CLICK TO PLAY ON-DEMAND SESSION](#)

PSCR has been researching deployable communications systems for first responders since 2015. In this session, we will present the latest addition to our research portfolio. Sponsored by Department of Homeland Security (DHS) Science and Technology (S&T) Office of Interoperability and Compatibility (OIC), the Resilient Communication Network Platform (RCNP) has the flexibility to host new, leading edge public safety capabilities, as well as the ability to bridge gaps in degraded communications environments. The RCNP will be a “grab and go” modular, flexible system that will consist of equipment deployed as standalone units or integrated into a unique system of systems solution catered to first responder needs.



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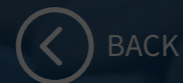


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## ON-DEMAND SESSIONS



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### RESILIENT SYSTEMS


#### LEGEND

- Beginner
- Intermediate
- Advanced


**Innovating on Drone Technology to Support First Responder Missions**

●●○

**TERESE MANELY** PSCR, **HIEN NGUYEN** PSCR, **MAXWELL MAURICE** PSCR, **KAMEL SAIDI** PSCR, **MICHAEL O'SHEA** FEDERAL AVIATION ADMINISTRATION AVIATION SAFETY, **RAYMOND SHEH** GEORGETOWN UNIVERSITY AND NIST ASSOCIAT, **CHRISTOPHER W. STOCKHOWER** VIRGINIA BEACH FIRE DEPARTMENT, **CAPTAIN PHILLIP HALL** NOAA

 [CLICK TO PLAY ON-DEMAND SESSION](#)

Learn about the recently launched UAS2 challenge, where we will publicly announce the stage one winners of the concept paper contest. We will announce up to 20 teams that will be challenged to build a UAS prototype for first responders and compete for prizes. Learn about the survey and research that informed the UAS2 challenge and how the winning UAS prototypes will be tested in an open field in the Finals, using NIST's Public Safety UAS Pilot & Training Procedure.





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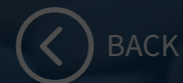
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## ON-DEMAND SESSIONS



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### RESILIENT SYSTEMS

#### LEGEND

- Beginner
- Intermediate
- Advanced

<p>Resilient Communication Network: A New Direction for Deployable Communications</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p> <p><b>KAMEL SAIDI</b> NIST PSCR</p>	<p>Innovating on Drone Technology to Support First Responder Missions</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>	<p>UAS Test Methods</p> <p>Learn about what NIST is doing to help evaluate the performance of small Unmanned Aircraft Systems (UAS) and how this is helping first responders in their missions. We will discuss how tests are being developed, what they apply to, and who is using them and how. We will also discuss how the tests are conducted and the theory behind them.</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>	<p>Broadband Wireless Systems: How to Deploy Them?</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>
<p>DistressNet-NG: Resilient Mobile Broadband Communications at the Edge</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>	<p>ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>	<p>Tamperproof Storage and Communication for Adversarial IoT Networks</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>	<p>Data on the Edge: Development of the Wildland-Fire Data Logistics Network (WDNL)</p> <p>CLICK TO PLAY ON-DEMAND SESSION</p> <p>●●○</p>



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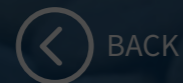


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## ON-DEMAND SESSIONS




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### RESILIENT SYSTEMS

#### LEGEND

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<p>Resilient Communication Network: A New Deployable</p> <p><b>Broadband Wireless Access Technologies for Deployable Systems: Where are they?</b></p> <p>●○○</p> <p><b>MAX MAURICE</b> NIST PSCR</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Innovating on Drone</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>UAS Test Methods</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Broadband Wireless</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>
<p>DistressNet-NG: Resilient Mobile Broadband</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>UAS Test Methods</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Broadband Wireless</p> <p>●○○</p> <p><a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>



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## ON-DEMAND SESSIONS



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### RESILIENT SYSTEMS


#### LEGEND

- Beginner
- Intermediate
- Advanced


**DistressNet-NG: Resilient Mobile Broadband Communication and Edge Computing**

●●○

**DR. RADU STOLERU**  
TEXAS A&M ENGINEERING EXPERIMENT STATION

 [CLICK TO PLAY ON-DEMAND SESSION](#)

In this session, we present how our solution, DistressNet-NG, enhances the resilience of both public safety mission critical systems and services in the face of connectivity challenges. DistressNet-NG provides a scalable and resilient wireless interconnection fabric for first responder communication equipment. A novel mobile edge computing service pushes cloud computing beyond the network edge and onto the user equipment itself. Smartphones carried by first responders are capable of performing analytics on shared data using the computing and storage power of nearby devices, eliminating the need for constant high capacity connections to the Internet. In order to accelerate this process, several high-performance computing nodes that are built using COTS components can be deployed in the area. These devices collaborate to offer LTE-as-a-Service: the functional elements in the backhaul and RAN such as eNodeB, P-GW, S-GW, MME, HSS etc. are autonomously created and destroyed in response to communication demand. A multi-domain routing framework ensures resiliency across the network by optimally leveraging mesh, ad hoc and cellular routing protocols.





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## ON-DEMAND SESSIONS



### RESILIENT SYSTEMS

#### LEGEND

-  Beginner
-  Beginner
-  Intermediate
-  Advanced
-  Advanced

#### ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters

●●○

**DR. K.K. RAMAKRISHNAN**  
**DR. MURAT YUKSEL**  
**DR. HULYA SEFEROGLU**  
**DR. JIACHEN CHEN**

UNIVERSITY OF CALIFORNIA - RIVERSIDE

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Effective communication among first responders during and in the aftermath of a disaster can affect outcomes dramatically. We are building a resilient architecture that allows first responders to communicate even with: (i) damage to infrastructure – civilian and/or specialized communication facilities may be damaged by the disaster, (ii) congested channels – because affected people report something about the disaster, and these messages may be broadcast, (iii) dynamically formed groups – first responder teams may be formed dynamically in response to a disaster and team member addresses (e.g., phone numbers) may not be known to one another, (iv) impediments to communication – because the new command chain to manage the disaster may be different from the original organizational hierarchy, (v) poor interoperability – each sub-team might use different communication facilities, and (vi) security attacks – disaster situations are often vulnerable to attacks, requiring authentication and authorization as well as establishing data integrity and provenance.

We have developed a resilient network architecture that allows efficient communication among first responders during and after a disaster. We support dynamically formed groups for incident response, allowing first responders to securely and conveniently communicate based on roles (names), rather than network addresses. The architecture addresses the needs identified above



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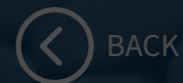
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## ON-DEMAND SESSIONS



### RESILIENT SYSTEMS

#### LEGEND

- Beginner
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- Advanced

#### ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters

●●○

DR. K.K. RAMAKRISHNAN

DR. MURAT YUKSEL

DR. HULYA SEFEROGLU

DR. JIACHEN CHEN

UNIVERSITY OF CALIFORNIA - RIVERSIDE



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for communication in disasters by (i) building resilience into the framework across all the layers, (ii) creating a framework that allows communication by role and identity, rather than addresses, (iii) supporting multiple modalities (data, voice, video) for communication among dynamically formed first responder teams, and (iv) providing robust and resilient communication and computing even when facilities are error- and disruption-prone.

In this session, we will focus on the progress we have made in the last year, which includes 1) scalable namespace propagation across fragmented and disconnected networks; 2) the design and implementation of an approach for first responders to update the current situation on offline maps on their (potentially disconnected devices) and a protocol to ensure delivery and consistency of the data across multiple users; 3) design and implementation of a dynamic routing protocol that can work with heterogeneous device-to-device (D2D) communication links and tolerate disconnections and partitions in the underlying wireless network topology, 4) modeling and analysis of public crowdsourced data to predict the potential impact of disasters on the cellular communication infrastructure, 5) the design of secure coded computation in adverse environments, 6) robust and resilient communication over intermittently connected D2D communication links with infrastructure support, 7) design and implementation of the new ReDiCom modularized architecture, 8) a new map functionality to help first responders communicate and mark based on geo-locations, and 9) text-to-speech capability to further improve the communication efficiency in ReDiCom.



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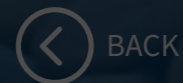
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### RESILIENT SYSTEMS

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<p>Resilient Communication Network A New Direction for Deployable</p> <h3>Tamperproof Storage and Communication for Adversarial IoT Networks</h3> <p>●●○</p> <p><b>ROBERT VAN RENESSE</b> CORNELL UNIVERSITY</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p>	<p>Innovating on Drone Technology to Support Disaster Response Missions</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○</p> <p><a href="#">MORE INFO</a></p>	<p>UAS Test Methods</p> <p>We present the design and evaluation of a new blockchain design for providing IoT devices in a partitionable network with reliable communication and tamperproof provenance-aware storage.</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○</p> <p><a href="#">MORE INFO</a></p>	<p>Broadband Wireless</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●○○</p> <p><a href="#">MORE INFO</a></p>
<p>DistressNet-NG: Resilient Mobile Broadband Communication for Edge Computing</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○</p> <p><a href="#">MORE INFO</a></p>	<p>ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○</p> <p><a href="#">MORE INFO</a></p>	<p>Tamperproof Storage and Communication for Adversarial IoT Networks</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○</p> <p><a href="#">MORE INFO</a></p>	<p>Data on the Edge: Development of the Wildland-Fire Data Logistics Network (WDNL)</p> <p> <a href="#">CLICK TO PLAY ON-DEMAND SESSION</a></p> <p>●●○</p> <p><a href="#">MORE INFO</a></p>



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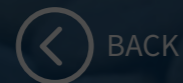


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### RESILIENT SYSTEMS


#### LEGEND

- Beginner
- Intermediate
- Advanced


**Data on the Edge:  
Development of the Wildland-  
Fire Data Logistics Network  
(WDNL)**

●●○ [MORE INFO](#)

**NANCY FRENCH  
MARTIN SWANY  
JEREMY MUSSER  
MICHIGAN TECH**

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

We will review the outcomes of the development of the Wildfire Data Logistics Network concept. Our work includes the development of a prototype data ferry system to deliver large, critical data and information to wildland fire managers and firefighters. The presentation will review the system, ideas for deployment, and future development concepts to improve communications in wildland fire operations.





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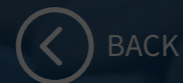


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### RESILIENT SYSTEMS

#### LEGEND

- Beginner
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Client-Driven Multipath  
TCP for  
Network  
and Reliability

#### Client-Driven Multipath TCP for Improved Network Performance and Reliability

●●○

JINSUNG LEE  
UNIVERSITY OF COLORADO

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

This presentation provides a brief overview of multipath TCP, and then introduces our proposed client-driven multipath TCP algorithm consisting of machine learning-based path selection and packet scheduling algorithms in cellular networks of multiple operators to maximize application performance and user experience in challenging network conditions.



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## LIVE SESSIONS

**TUESDAY JULY 28<sup>TH</sup>**  
10:00am MST / 12:00pm EST  
**PSCR PROGRAM  
OVERVIEW**

FEATURING PUBLIC SAFETY KEYNOTE

**TODD EARLY**, TEXAS DEPARTMENT  
OF PUBLIC SAFETY  
**DERECK ORR**, PSCR DIVISION CHIEF

CLAIM YOUR SPOT

**WEDNESDAY JULY 29<sup>TH</sup>**  
10:00am MST / 12:00pm EST  
**FIRESIDE  
CHAT**

WITH FIRSTNET BOARD CHAIRMAN

**DERECK ORR**, PSCR DIVISION CHIEF  
**ED HOROWITZ**, FIRST RESPONDER  
NETWORK AUTHORITY

CLAIM YOUR SPOT

**WEDNESDAY JULY 29<sup>TH</sup>**  
1:00pm MST / 3:00pm EST  
**HAPTIC  
INTERFACES:**

WHAT WE LEARNED BY  
PARTICIPATING IN A  
PSCR PRIZE CHALLENGE

**SARAH HUGHES**, PSCR  
**CAPTAIN TODD HEINL**, WEST METRO  
FIRE DEPARTMENT  
**RYAN FIELDS-SPACK**, FIRSTNET  
BUILT WITH AT&T,  
**FELIX DESOURDY**, HAPLY  
**SEAN HACKETT**, CARNEGIE MELLON  
UNIVERSITY

CLAIM YOUR SPOT

**THURSDAY JULY 30<sup>TH</sup>**  
10:00am MST / 12:00pm EST  
**THIS IS NOT A  
GAME:**

AR/VR FOR GOOD

**STACEY TRUNNELL** (MODERATOR),  
CORNER ALLIANCE  
**ALISON KAHN**, PSCR  
**CAPTAIN KIRK MCKINZIE**,  
CONSUMNES FIRE DEPARTMENT  
**GREG RINALDI**, MAGIC LEAP

CLAIM YOUR SPOT



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## TECH DEMOS

### RESILIENT SYSTEMS

### PUBLIC SAFETY ANALYTICS



TEXAS A&M ENGINEERING  
EXPERIMENT STATION

RESILIENT SYSTEMS



RESILIENT SYSTEMS



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PUBLIC SAFETY ANALYTICS



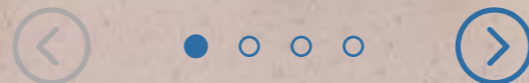
PUBLIC SAFETY ANALYTICS



PUBLIC SAFETY ANALYTICS



PUBLIC SAFETY ANALYTICS



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## TECH DEMOS

PUBLIC SAFETY  
ANALYTICS



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## TECH DEMOS

### LOCATION - BASED SERVICES

### SECURITY



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## TECH DEMOS

### MISSION CRITICAL VOICE



MISSION CRITICAL VOICE



MISSION CRITICAL VOICE



MISSION CRITICAL VOICE



Universidad del Pais Vasco  
Euskal Herriko Unibertsitatea

MISSION CRITICAL VOICE



MISSION CRITICAL VOICE



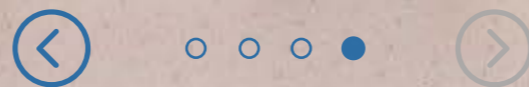
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## MISSION CRITICAL VOICE

### Fully-Digital mmWave Software Defined Radio for Multi-Gbps Wireless Connectivity

MARCO MEZZAVILLA, NEW YORK UNIVERSITY

During this project, we have designed, built, and demonstrated a 4-channel fully-digital Software Defined Radio (SDR) operating in the 57-64 GHz band. The transceiver board is mated with a Xilinx Radio Frequency System-on-Chip (RFSoc) to form the hardware, which is then controlled through a simple MATLAB-based interface. We demonstrate a data link and Transmit/Receive (TX/RX) beamforming on this system.

[▶ VIEW DEMO](#)



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**Georgia Tech** Research  
Institute

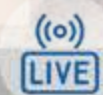
**MISSION CRITICAL VOICE**

## Real-Time Voice Impairment and Evaluation for First Responder Communications

**ALESSIO MEDDA**, GEORGIA TECH RESEARCH INSTITUTE

The Georgia Tech Research Institute will present a demo for the real-time impairment of live voice aimed at first responders' communication systems. This demo will allow users to exercise the main key performance indicators (KPIs) related to Mission Critical Voice (MCV) Quality of Experience (QoE) in communications. These KPIs are Mouth-to-Ear Latency, End-to-End Access Time, Audio Quality and Intelligibility, and Probability of Access and Retention. A cloud-based portal will allow users to upload their voice and independently exercise the four KPIs to impair the voice segment before playing it back. The playback will show users how the KPIs influenced voice quality and intelligibility of the message. Afterwards, the team will demonstrate a communication system based on an ad-hoc network which allows users to experience the effect of the KPIs in real time. Two portable handsets will allow two users to communicate at a distance using this system; a transmitting handset will initiate a communication and the user's voice will be sent to an impairment agent that will intercept communication packets, apply the preset impairments, and send the output to the receiver, all with a minimal and controllable delay. The result is the ability to impair communication in real-time to allow a user experience the effect of common digital communication system degradations on intelligibility and voice quality.

 VIEW DEMO



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**MISSION CRITICAL VOICE**

## A Demonstration of Valid8's Executable MCPTT 3GPP Client Conformance Tester

IAN CARPENTER, VALID8

We will execute mission-critical push-to-talk (MCPTT) conformance tests from 3rd Generation Partnership Project (3GPP) Technical Specifications (TS) 36.579-2 release 14 against a MCPTT Client using the Valid8 MCPTT Client Conformance Tester Tool.

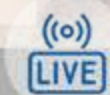
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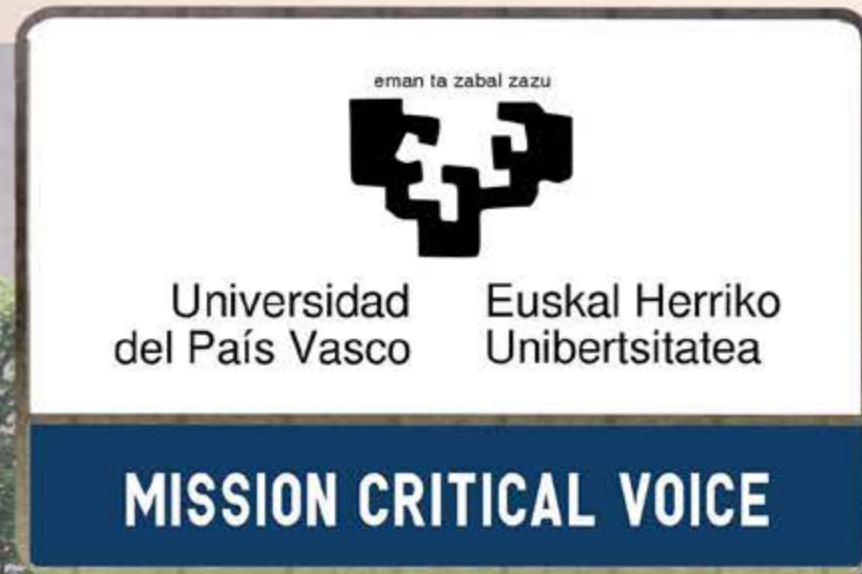
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## MCS Testing as a Service - Introduction and Hands-On

**FIDEL LIBERAL, TJ KENNEDY (PSTA), AND  
WALT MAGNUSSEN (TAMU), UNIVERSITY  
OF THE BASQUE COUNTRY**  
**MICHAEL PROESTLER, GRIDGEARS**

In this session you will learn about the concepts behind mission-critical services (MCS) Testing as a Service and the benefits it brings for manufactures, certification labs and end customers. In addition, you will get an early glimpse of the current development status, showing how different stakeholders can evaluate conformance of their solution to 3rd Generation Partnership Project (3GPP) standards.

 VIEW DEMO



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## MISSION CRITICAL VOICE

### Demonstration of Mission Critical UE Certification Test Tool Under Development

SUDIPTO BISWAS, POLARIS NETWORKS

Polaris Networks is working in a cooperative agreement with PSCR, to develop a Mission Critical User Equipment (UE) Certification Test Tool called Mission Critical Test Platform (MCTP). MCTP will help test agencies and vendors conduct certification testing of Mission Critical User Equipment & Clients. Polaris plans to demonstrate the execution of one Rel-13 MCPTT Test, based on 3rd Generation Partnership Project (3GPP) Test Specifications (TS) 36.579-1 and 36.579-2. Basic Web-Based User Interface for Configuring/ Listing/Executing Tests and Viewing Test Results/Logs will also be demonstrated. MCTP will communicate with devices under test (DUTs) over WiFi/Ethernet.

[▶ VIEW DEMO](#)



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PSCR

MISSION CRITICAL VOICE

## Analog FM Interworking with MCPTT Systems

CHRIS WALTON AND JORDAN O'DELL,  
NIST PSCR

This demonstration explores a low cost method to bridge analog public safety Land mobile radio (LMR) systems into a standards-based Long Term Evolution (LTE) MCPTT system. Design goals included robustness, cost, and the creation of a system that closely conforms to released and future standards. A proof of concept prototype that successfully bridges an analog LMR system with a standards-compliant LTE based MCPTT system was developed and tested.

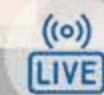
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## MISSION CRITICAL VOICE

### Simulation and Visualization of Public Safety Incidents

**RICHARD ROUIL**, NIST PSCR  
**THOMAS HENDERSON**, UNIVERSITY OF WASHINGTON  
**EVAN BLACK**, NIST WND

The Wireless Network Division (WND) under the Communication Technology Laboratory (CTL) at NIST, in collaboration with the University of Washington, has been developing network simulation models targeting public safety-specific protocols and scenarios. Using several examples of small- and large-scale incidents, we will showcase several of these models including on and off-network Mission Critical Push-to-Talk (MCPTT), Device-to-Device (D2D), UE-to-Network relays using various network deployments.

 VIEW DEMO



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PSCR

## MISSION CRITICAL VOICE

### MCV QoE Access Delay Measurement Demonstration

CHELSEA GREEN AND ZAINAB SOETAN, NIST PSCR

Mission Critical Voice (MCV) QoE measurement methods are being developed by NIST/PSCR to determine levels of key performance indicators (KPI) and to provide fair comparison mechanisms for Push To Talk (PTT) technologies. Mouth-to-ear (M2E) latency and end-to-end access time measurement methods and test results were discussed at previous stakeholder's meeting. Building upon that foundation, NIST/PSCR has further developed the measurement method to quantify end-to-end access time of P25 LMR technologies using encryption as well as LTE PTT technologies. The end-to-end access time measurement method will be demonstrated.

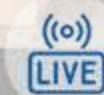
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**TEXAS A&M ENGINEERING  
EXPERIMENT STATION**

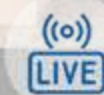
**RESILIENT SYSTEMS**

## Resilient Communication and Edge Computing for FirstNet

DR. RADU STOLERU, TEXAS A&M  
ENGINEERING EXPERIMENT STATION

This demonstration will showcase various edge computing applications (e.g., face detection, face recognition, virtual assistant, etc.) executing on mobile devices and mobile high performance computing nodes (e.g., battery-powered manpack equipped with LTE, WiFi and compute resources).

 VIEW DEMO



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## RESILIENT SYSTEMS

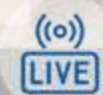
### ReDiCom: Resilient Communications for Dynamic First Responder Teams in Disasters

DR. K. K. RAMAKRISHNAN, DR. MURAT YUKSEL, DR. HULYA SEFEROGLU,  
DR. JIACHEN CHEN, UC RIVERSIDE

Our demo of ReDiCom capabilities combines the research we have completed across the members of our team on this project, including device-to-device communication, message delivery on a graph-based namespace, text messages, push-to-talk, and work offloading. This year, our demo will include several functional enhancements:

- A map function that allows first responders to distribute tasks, mark important task location information, and communicate based on each individual's geo-location. It will use the graph-based namespace for both hierarchies (topic hierarchy and recipient hierarchy) and take advantage of a consensus protocol that seeks to achieve synchronization even with intermittent network connectivity.
- A dynamic routing protocol design and implementation that enables unicast delivery of messages between first responders as well as victims. The protocol uses heterogeneous device to device (D2D) links via Bluetooth and Wi-Fi Direct Application Programming Interfaces (APIs), and can handle disconnections causing partitions and extended delays in the underlying D2D topology.

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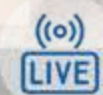
## RESILIENT SYSTEMS

### Demonstration of the WildfireDLN Data Ferry System

MARTIN SWANY, JEREMY MUSSER, MICHIGAN TECH

We will show the functionality of our prototype data ferry system designed to improved delivery of geospatial data during wildland fire incidents. The ferry system consists of a base station and portable ferries that can be deployed as needed to efficiently deliver large data files to locations outside of regularly connected locations. The demo will include a review of the process to upload data based on user-defined policies and deliver the data, including a show-and-tell of a larger ferry (with more data capacity) and a smaller ferry (used where light-weight deployment is needed.)

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## PSCR

### RESILIENT SYSTEMS

## PS Deployables for SA, PTT, Distributed Processing and Resiliency

MAX MAURICE, NIST PSCR

The Deployable systems projects within PSCR will be demonstrating the field capabilities of a mobile broadband system for public safety. The Deployable systems enable broadband connectivity using a completely isolated wireless network. The system is capable of providing broadband services such as video streaming, push-to-talk, and Situational awareness applications.

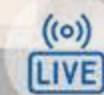
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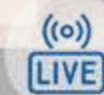
## PUBLIC SAFETY ANALYTICS

### CognitiveEMS: An Intelligent Cognitive Assistant for Emergency Medical Services

ARIF RAHMAN, UNIVERSITY OF VIRGINIA

CognitiveEMS is a decision support system that aims to improve the situational awareness of first responders at the incident scene by real-time analysis of speech data from the responders' communications and observations. With this information, the system provides smart suggestions for the best response actions or interventions to perform based on standard protocol guidelines. We will present our EMS data analytics pipeline for real-time speech recognition, natural language processing, and intervention suggestion, as well as a smart module for interacting with the responders in real-time. The smart interaction module collects critical information about different interventions performed by the responder and their timestamps, provides necessary reminders to the responder, and automatically generates an incident report.

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## PUBLIC SAFETY ANALYTICS

### The Physical Distancing Index for Video Analytics

JASON CORSO, VOXEL 51

Voxel51's new web application deploys cutting-edge computer vision and machine learning technology to detect the density of human and vehicle activity from video feeds. At the heart of this technology is a metric developed by Voxel51 called the Physical Distancing Index (PDI). The PDI, originally developed as a public awareness tool to understand how the coronavirus is changing human activity in real-time around the world, is helping organizations as they plan for reopening and beyond in this new normal.

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## PUBLIC SAFETY ANALYTICS

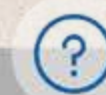
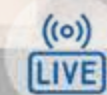
## Quality Assessment and Adjustment for Automatic Image/Video Analytics

ADEMOLA IKUSAN, UNIVERSITY OF CINCINNATI

We will demonstrate two pieces of research results from our project:

- Image Quality Assessment and Adjustment Framework: We will demonstrate how a distorted image can be scored to predict the performance of object detection algorithms and how to repair some of the distortions to improve the performance of object detection algorithms.
- Intermediate Feature Selection for Compact Feature Maps for Computer Vision Tasks: We will demonstrate how deep learning feature maps can be compressed and used for various computer vision tasks to achieve a light-weight architecture with good performance.

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## PUBLIC SAFETY ANALYTICS

### Real-Time Video Analytics for Situation Awareness Demo

JUNWEI LIANG, CARNEGIE MELLON UNIVERSITY

Our project develops video analytics and visualization tools based on computer vision and machine learning techniques for public safety events. We demonstrate multiple systems that illustrate some of the work. For example, 1) we show a system using drone videos to assess the damage to houses after a natural disaster, and 2) we show a person re-identification system that utilizes multi-modal information including verbal descriptions and gait recognition. We demonstrate how this could identify the suspect of the Boston Bombing across different cameras and times. 3) We contribute to traffic safety through vehicle and pedestrian path prediction from arbitrary cameras.

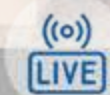
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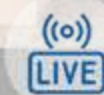
## PUBLIC SAFETY ANALYTICS

### ACE: Framework for Creating, Testing, & Transitioning Analytics to Public Safety

**JIM HORAN**, MULTIMODAL INFORMATION GROUP  
**NICHOLAS BURNETT**, DATA MACHINES

The demo will consist of a camera capturing live video of the demo area and streaming the feed through several object detection analytics. Playback of the video will be displayed on the screen with the results of the object detection analytics (bounding boxes, classifications, and confidence scores) overlaid on top of the video. Participants will be able to interact with the demo to change the compression used to stream the video to the analytics and observe the effect this has on their object detection performance. Detector confidence and other metrics will be recorded and displayed graphically as well.

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## NC STATE UNIVERSITY

### USER INTERFACE USER EXPERIENCE

## Investigating User Experience with VR-Based Intelligent User Interfaces

RANDALL SPAIN, NC STATE

This demonstration provides an overview of a virtual reality (VR)-based emergency response scenario and prototype of an intelligent user interface that allows users to interact with information presented through a VR-based heads-up display (HUD). The VR scenario, which simulates a metro incident, has been developed by gathering requirements and feedback from our partner public safety organization. It includes three missions and additional parameters for evaluating the impact of intelligent user interfaces on performance and user experience. We will demonstrate the VR scenario and showcase how users can interact with the prototype HUD using VR controllers and a speech-based interface.

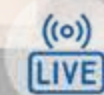
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## Simulating Next-Generation Public Safety User Interfaces in VR Demo

REGIS KOPPER, JERONIMO GRANDI, UNC  
GREENSBORO

ZEKUN CAO, MARK OGREN, DUKE UNIVERSITY

In this demo, we showcase next-generation user interface designs for a traffic stop scenario in the law enforcement context and a burning building scenario in the firefighting context. Our goal is to simulate, in virtual reality, user interface designs that leverage next-generation technology and have the potential to increase the safety and agility practices and procedures of first responders.

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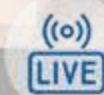
USER INTERFACE USER EXPERIENCE

## Mixed-Reality Firefighting Simulator Built with VALOR: Interactive WebXR Demo

JOHN BLACKWELL, TRACLABS

Demo participants with WebXR capable web browsers will be able to interact with this web-based port of our immersive mixed-reality firefighting simulation. Demo visitors can engage with the 3D experience through a traditional flat screen computer interface or from within a virtual reality headset. A passive recording will also be available for those without a WebXR capable browser. We will demonstrate a variety of elements from the full VALOR simulation, including the apartment environment, live fires, operation of a hose nozzle to suppress fires, and exploration of the space to find and save a baby.

 VIEW DEMO



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## USER INTERFACE USER EXPERIENCE

### FirstSimVR: Tech Demo of our Tracked Lab Space

JASON JERALD, NEXTGEN INTERACTIONS

For this tech demo, we will show our tracked lab space where we build first responder scenarios, give location-based demos, and conduct user studies. We will show physical props as well as videos of some of our first responder experiences.

[▶ VIEW DEMO](#)



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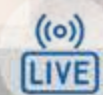
**USER INTERFACE USER EXPERIENCE**

## Real-Time Cognitive Load Analysis System for Firefighters in Indoor Wayfinding

ERIC JING DU, UNIVERSITY OF FLORIDA

Wayfinding in complex buildings brings obvious cognitive challenges to firefighters. Firefighters often need to process and/or memorize a large amount of spatial information in search and rescue tasks, such as building layouts, landmarks, paths, signage, etc. It is important to track the cognitive load status of firefighters to enable effective, early interventions. This demo will showcase a cognitive load tracking and analysis system, Cog-DNA, for firefighters and other emergency responders in cognition-intensive tasks. Cog-DNA is equipped with eye trackers and brain activities monitoring systems. These systems track the gaze scanning patterns, pupillary dilation, and brain oxygen consumption levels every second and translate these neurophysiological signals into cognitive load metrics. Cog-DNA has been tested on 50 firefighters from Bryan, TX. This online demo will be video-based. Results from the system test will also be reported, including the cognitive load patterns of firefighters in different situations of wayfinding.

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**Georgia Tech** Research  
Institute

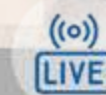
**USER INTERFACE USER EXPERIENCE**

## Walkthrough of ARTEMIS Usability Testing Platform

SARAH FARMER, GEORGIA TECH RESEARCH INSTITUTE

The Georgia Tech Research Institute will present a demo that shows a walkthrough of the Augmented Reality Testing of Equipment in Multiple Immersive Simulations (ARTEMIS). ARTEMIS is intended for use as a virtual reality (VR)-based usability platform for use by first responders. The immersive environment of VR allows first responders to test near-future technologies in a simulated scenario. The demo will present a walkthrough of the evaluator station, including the menu screen in which the evaluator configures the scenario; the scenario playing out in real time; and the view from the evaluator station as the scenario plays out.

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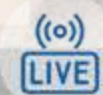
## LOCATION-BASED SERVICES

### Semi-Automated Feature Extraction of Public Safety Features from Indoor Lidar

JOEL LAWHEAD, WAYNE FRANCIS,  
HANCOCK COUNTY

Hancock County mapped 10 schools using indoor lidar, and then created a workflow to mostly automate locating and identifying building features important to first responders.

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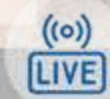
## LOCATION-BASED SERVICES

### Map901 Point Cloud Scanner and Data Demonstration

THOMAS WATSON, CITY OF MEMPHIS

Map901 is a collaboration between University of Memphis and the City of Memphis to build 3D point cloud models of the city's buildings. We will demonstrate our portable Signac scanner for 3D mapping and the annotated point cloud building models produced by our project.

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## LOCATION-BASED SERVICES

## Mapping Indoor Environments with Handheld Lidar and GIS Software

JASON PARENT, ENFIELD CONNECTICUT

Accurate maps of building interiors are essential for the development and deployment of indoor navigation and tracking systems; however, these maps do not exist for many buildings. This demonstration will present an efficient and accurate process that we developed for mapping the interiors and exteriors of buildings. The process uses Paracosm's PX-80 handheld lidar scanner to collect 3D data on the buildings. It also uses Paracosm's Retrace and ESRI's ArcGIS software to both classify features in the lidar point cloud and extract information relevant to first responders. We mapped features ranging in size from recessed sprinkler heads, to fire alarms, to doors and windows. The entire process takes 20-30 hours for a 175,000 square foot building and requires little training and no technical background.

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## LOCATION-BASED SERVICES

### Real-Time Tracking Demo with Thermal, Inertial and Radar Sensors

DR. PEDRO PORTO BUARQUE DE GUSAMO, DR. JOHAN WAHLSTROM, PROF NIKI TRIGONI, PROF ANDREW MARKHAM, UNIVERSITY OF OXFORD

Knowing the position of first responders at an incident site is key to a fast and safe emergency response. However, localization infrastructures such as GPS, Wi-Fi, or floorplans are usually unavailable during critical operations, such as search and rescue inside burning buildings. In this demo, we present various self-contained navigation systems for real-time indoor tracking. We explored the possibility of tracking emergency responders through intelligent sensor fusion and processing of multiple modalities. Through deep learning, we have developed accurate and reliable thermal, inertial, and millimeter-wave radar odometry systems that perform well in low-light and smoky conditions. We present a battery-powered handheld device comprised of a Jetson AGX Xavier developer kit, a thermal camera, a millimeter-wave sensor, and inertial measurement units (IMUs). We also utilize an RGB camera and lidar scanner to reconstruct the ground-truth positions. This demo shows a person performing a search procedure throughout an apartment and coming back to the starting position. The screens presented include the calculated position from sensors combined with the direct outputs of the RGB camera, thermal camera, and the ground-truth position. Excellent accuracy and reliability are demonstrated even in poorly illuminated scenes.

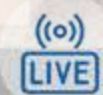
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LOUNGE



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DESK



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## LOCATION-BASED SERVICES

### Hyper-Reality Helmet Technology

YANG CAI, SEAN HACKETT, FLORIAN ALBER,  
CARNEGIE MELLON UNIVERSITY

Hyper-Reality Helmet is a heads-up display system that superimposes the on-demand information onto the objects in an actual scene so that the user can see more in-depth information beyond reality. In contrast to many prevailing augmented reality technologies, our approach focuses on enhancing reality with minimal graphical and textual highlighting without obscuring the user's view. This online demo will show a video of a medical responder using the helmet to screen fever in a crowd both remotely and handsfree.

[▶ VIEW DEMO](#)



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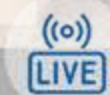
## LOCATION-BASED SERVICES

### RF OFDM Signal Based Distance Ranging in NLOS Channels

DEMBA KOMMA, UNIVERSITY OF MICHIGAN

This demo will show a prototype system for radio frequency (RF)-based ranging and localization in non-line-of-sight (NLOS) channels. The system uses orthogonal frequency division modulation (OFDM) and machine-learning based time-of-arrival (ToA) estimation to achieve tens of centimeter accuracy in NLOS conditions. Novel active signal reflection technique eliminates the need for accurate time synchronization between the anchor and the tag, which often limit the performance of conventional ToA based systems. The proposed system uses much narrower bandwidth than ultra-wideband solutions, thus it is operable covering much wider area (>100m) without compromising the accuracy.

[▶ VIEW DEMO](#)



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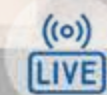
## LOCATION-BASED SERVICES

### Lidar Mapping and LTS Measurement Techniques

JOSEPH GRASSO AND CHARLSEA HANSEN,  
NIST PSCR

The Location-Based Services (LBS) portfolio focuses on indoor mapping, tracking, and navigation. At this demonstration, we will have examples of the technology we have been working with recently. This includes lidar, which can be used to quickly produce high fidelity maps, and several approaches that could be used to measure the accuracy of indoor tracking systems, such as AprilTags, an optimized QR code that can be used to estimate the user's position.

[▶ VIEW DEMO](#)



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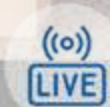
## LOCATION-BASED SERVICES

### Envisioning AR Vision Enhancement in Reduced Visibility Environments

PAUL MERRITT, JOSEPH GRASSO AND  
CHARLSEA HANSEN, NIST PSCR

Tune in to this video of engineers from the UIUX and LBS portfolios to see how they combine the power of lidar building scans with an Augmented Reality headset to produce an enhanced visualization of the structure of a building. This type of visualization demonstrates a concept that could allow police officers to see through walls or firefighters to navigate through smoky environments.

 VIEW DEMO



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**SECURITY**

## Expanded Use of the SIM Card Demo

**MICHAEL BARTOCK, CONOR PATRICK, NIST PSCR**

PSCR and a few partnering entities finished a recent PSCR sponsored prize challenge, the Expanding the SIM Card Use for Public Safety. The challenge requested solvers' assistance to explore the possibilities and prove the Universal Integrated Circuit Card (UICC), commonly known as the SIM card, can be used as a secure storage container for application credentials. This demo will give an overview of how the winning solution for the prize challenge was able to create their solution. Further, the demo will go through the mobile application that was developed for the prize challenge, and perform a registration and authentication with credentials store on the SIM card.

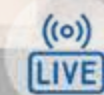
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## OPEN INNOVATION

### TECH TO PROTECT



ENTER ROOM

 MORE INFO

### HAPTIC INTERFACES




CLAIM YOUR SPOT  
ON GO TO WEBINAR

 MORE INFO

### UAS 2.0



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### MOBILE FINGERPRINT CAPTURE



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### CHARIOT



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### ASAPS



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### EXPANDING THE SIM



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### DATA PRIVACY



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## OPEN INNOVATION

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INTERFACES

UAS 2.0

MOBILE  
FINGERPRINT  
CARE

### Tech to Protect

●○○

**CRAIG CONNELLY**  
NIST PSCR



Tech to Protect was a multi-million dollar Open Innovation Prize Challenge that incentivized software developers to collaborate with the public safety community in developing applications customized to the bespoke requirements of first responders. The Challenge consisted of ten contest areas identified in partnership with Public Safety. In May 2020, the top 25 contestants across these areas received awards for their demonstrations. View Tech to Protect video demonstrations in the PSCR 2020 portal, and look out for the twelve contestants that were recognized with additional seed round funding.

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## OPEN INNOVATION

### Haptic Interfaces: What We Learned by Participating in a PSCR Prize Challenge

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**SARAH HUGHES** PSCR, **CAPTAIN TODD HEINL** WEST METRO FIRE DEPARTMENT, **RYAN FIELDS-SPACK** FIRSTNET BUILT WITH AT&T, **FELIX DESOURDY** HAPLY, **SEAN HACKETT** CARNEGIE MELLON UNIVERSITY

 [CLAIM YOUR SPOT](#)  
[ON GO TO WEBINAR](#)

Hear from two past judges and two innovators as they share, from their perspective, about what they learned about innovating for public safety through their participation in the Haptic Interfaces for Public Safety Challenge.



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## OPEN INNOVATION

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FINGERPRINT  
CARE

### Innovating on Drone Technology to Support First Responder Missions

●○○

**TERESE MANELY**  
**HIEN NGUYEN**  
**MAX MAURICE**  
NIST PSCR

 [CLICK TO PLAY  
ON-DEMAND SESSION](#)

Virtual Reality Developer Chris Johnson conducts a deep dive analysis into the considerations and challenges of creating an immersive virtual reality AR-15 patrol rifle for NIST PSCR's Haptic Challenge SWAT Scenario, and accurately simulating its ballistic performance characteristics. Discussion will span the fields of both theoretical design and technical implementation.

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## OPEN INNOVATION

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MOBILE

### Mobile Fingerprint Capture for First Responders

●●○

**JEREMY GLENN**

**JOHN BELTZ**

NIST PSCR

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This panel will discuss the technology gaps and problem statements currently being researched for mobile, high quality fingerprint capture for first responders. This discussion incorporates work performed by NIST's Information Access Division (IAD), represented on the panel by Shahram Orandi. IAD has conducted extensive research and development in the area of fingerprint capture, analysis and image quality. Their experience includes projects with the FBI and various other public safety and government agencies. This session will capture the current status of research and development of fingerprint capture technology and introduce the soon-to-be-launched PSCR prize challenge: Mobile Fingerprint Capture for First Responders Challenge (anticipated launch date: September 2020).



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## OPEN INNOVATION

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INTERFACES

UAS 2.0

MOBILE  
FINGERPRINT  
CAPTURE

### CHARIoT Prize Challenge Discussion

●○○

**SCOTT LEDGERWOOD** PSCR, **DON HARRISS**  
PSCR, **SCOTT TURNBALL** US IGNITE/  
IMPLEMENTER, **PAUL MERRITT** PSCR, **BILL**  
**GELLMAN** BLUEFORCE

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The CHARIoT Challenge is tasking developers to create visual interfaces for public safety using personal area networks, smart buildings, and smart city IoT sensor data. The contestants will leverage these sensors and provide actionable alerts to incident command and first responders through augmented reality headsets. During this session, attendees will learn more about the challenge structure, benefits of IoT sensor data and spatial computing, and see a sneak peak of the final event where judges will be donning the final prototypes and responding to simulated wildfire, active shooter, flood, and mass transits accident scenarios.

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
### Automated Stream Analytics for Public Safety


●●○

**JOHN GAROFOLO**  
**CRAIG CONNELLY**  
NIST PSCR

Virtual Reality Developer Chris Johnson conducts a deep dive analysis into the considerations and challenges of creating an immersive virtual reality AR-15 patrol rifle for NIST PSCR's Haptic Challenge SWAT Scenario, and accurately simulating its ballistic performance characteristics. Discussion will span the fields of both theoretical design and technical implementation.

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MOBILE

### Expanding the SIM Card Use Prize Challenge Overview



**MIKE BARTOCK** ITL  
**MATT LOURIE** NOK NOK  
**CONOR PATRICK** SOLOSIM

 [CLICK TO PLAY  
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PSCR and a few partnering entities finished a recent PSCR sponsored prize challenge, Expanding the SIM Card Use for Public Safety. The challenge requested solvers' assistance to explore the possibilities and prove the Universal Integrated Circuit Card (UICC), commonly known as the SIM card, can be used as a secure storage container for application credentials. The SIM card is a tamper-resistant hardware storage container and, if it was expanded for storing user credentials, it could enable seamless, secure authentication to public safety applications. In addition to its strong security characteristics, the SIM card offers the following potential usability benefits for public safety: more user-friendly; allow networks to provision credentials over-the-air via a secure channel; and potentially enable device sharing by keeping sensitive information on the removable SIM card. The challenge had three finalists that were awarded prize money for their submissions in October 2019. This session will explain the goals, methodologies, and outcomes of the prize challenge. After a panel discussion of the purpose and benefits of the prize challenge, the winner of the prize challenge will give a demonstration of their winning solution.



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## OPEN INNOVATION

### Crisis Collaborations: Challenges for Safe Data Sharing with Differential Privacy



**GARY HOWARTH**  
**DIANE RIDGEWAY**  
**CHRISTINE TASK**  
NIST PSCR

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In April 2020, NIST held a Data Privacy workshop designed to explore the interests and needs of advancing fundamental data privacy technology research. The workshop helped NIST PSCR understand current approaches to data privacy risk-management and the need of the Public Safety community. We explored concepts in differential privacy methods and evaluated industry and academic approaches that may soon fill the gap in the de-identification of data. We will share the results of this workshop.

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## OPEN INNOVATION



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### TECH TO PROTECT

Explore the Top Application Demonstrations from the Tech to Protect Challenge



**CONTEST 001**

360 Degree View: A Mobile Dashboard for Your Network Security



**CONTEST 002**

No Need To Repeat: Delivering Mission Critical Communications



**CONTEST 003**

Looking Under the Hood: Using Augmented Reality to Help Save Trapped Passengers



**CONTEST 004**

Got You Covered: Mapping LTE Capabilities to Save Lives



**CONTEST 005**

Fire Safety in 3D: Incentivizing Homeowners to Create Pre-Incident Plans for Firefighters



**CONTEST 006**

Voice Commands to Virtual Assistants: Hands Free Device Control



**CONTEST 007**

Sensor Integration: Monitoring Emergency Responders' Health



**CONTEST 008**

No Coverage: Placing Deployable Networks in Emergencies



**CONTEST 009**

Making the Case: Proactive Image Protection



**CONTEST 010**

Organizing Chaos: Calming Catastrophe by Tracking Patient Triage



CLICK FOR TECH TO PROTECT YEAR IN REVIEW SESSION



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## OPEN INNOVATION

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### TECH TO PROTECT



#### CONTEST 001

360 Degree View: A Mobile  
Dashboard for Your  
Network Security

Beam Reach

 VIEW DEMO



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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## OPEN INNOVATION

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### TECH TO PROTECT






  
**CONTEST 002**  
No Need To Repeat:  
Delivering Mission Critical  
Communications

**LEGEND**

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient

**MCPTT Application**      **Team Talk**      **Trailblazer**      **Next-Gen MCPTT**      **Critical Access**

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### TECH TO PROTECT



#### CONTEST 003

Looking Under the Hood:  
Using Augmented Reality  
to Help Save Trapped  
Passengers

AR Extrication  
Assist

 VIEW DEMO



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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### TECH TO PROTECT



#### CONTEST 004

Got You Covered:  
Mapping LTE Capabilities  
to Save Lives

Map my LTE

 VIEW DEMO



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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### TECH TO PROTECT



**CONTEST 005**  
Fire Safety in 3D:  
Incentivizing Homeowners  
to Create Pre-Incident  
Plans for Firefighters

Home Pro-Tech

 VIEW DEMO



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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### TECH TO PROTECT



#### CONTEST 006

Voice Commands to  
Virtual Assistants: Hands  
Free Device Control

Apollo A.I.

SIMBA

Zenext

 VIEW DEMO

 VIEW DEMO

 VIEW DEMO



 VIEW SESSION



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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### TECH TO PROTECT



**CONTEST 007**  
Sensor Integration:  
Monitoring Emergency  
Responders' Health

FireHUD

 VIEW DEMO



Harris County Proactive  
Biometric Monitoring

 VIEW DEMO



Heart in Hand

 VIEW DEMO



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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### TECH TO PROTECT



**CONTEST 008**  
No Coverage: Placing  
Deployable Networks in  
Emergencies

Front-Ranger

 VIEW DEMO



#### LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



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### TECH TO PROTECT

  
**CONTEST 009**  
Making the Case:  
Proactive Image  
Protection




Authim      Corroborator      ESafe      HC PIP

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LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
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### TECH TO PROTECT

  
**CONTEST 010**  
Organizing Chaos:  
Calming Catastrophe by  
Tracking Patient Triage

**Bio1 Systems' PhysioCap**      **CritSit Care**      **Modern Triage Management by QuantaSTAT**      **NaT: SALT (Na) Triage (T) Intelligent Assistant**      **vTriage**

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LEGEND

-  Excellent
-  Superior
-  Very Good
-  Good
-  Seed Recipient



## SOCIAL MEDIA

Connect with other PSCR Stakeholders

## MOBILE APP

Directly message another PSCR 2020 participant

## ROUND TABLE

Join a PSCR 2020 feedback discussion



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THROUGHOUT PSCR 2020

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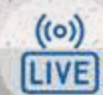
From July 28-30, tune in on Twitter for PSCR 2020 Trivia to test your public safety communications technology knowledge or simply follow along to learn trivia facts about PSCR. Join the conversation at any time by using the #PSCR2020 hashtag on Twitter!



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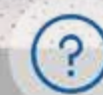
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## MOBILE APP



The 2020 PSCR Digital Experience Mobile Application allows attendees to network with other PSCR stakeholders through a variety of features. Attendees who engage with session content and leverage the following networking capabilities within the app will be eligible to join live networking scheduled later this month:

**1-TO-1 DIRECT MESSAGING**

APPOINTMENTS

GAME

DOWNLOAD INSTRUCTIONS



To send a message to another Digital Experience attendee, click the Attendees icon, select the user you would like to contact, select the “message” button, and begin drafting your message. Please note that only attendees who have created a public profile in the app will be seen as eligible to receive a direct message. You can review your entire message history by clicking the top left corner of the app and selecting “Messages” under the My Items menu.



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GAME

DOWNLOAD INSTRUCTIONS



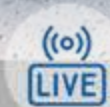
You can also follow the same steps detailed for 1-to-1 messaging to schedule virtual appointments with other attendees. Simply visit the Attendees icon, select a user, and click the “Meeting +” menu option under that user. Users may also schedule appointments with multiple attendees by clicking the top left corner bar icon and selecting “Appointments” under the My Items menu. You can add multiple attendees to each appointment by clicking the “Invitees”



PSCR 2020  
PORTAL



ON-DEMAND  
SESSIONS



LIVE  
SESSIONS



TECH  
DEMOS



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HELP  
DESK

## MOBILE APP



The 2020 PSCR Digital Experience Mobile Application allows attendees to network with other PSCR stakeholders through a variety of features. Attendees who engage with session content and leverage the following networking capabilities within the app will be eligible to join live networking scheduled later this month:

1-TO-1 DIRECT MESSAGING

APPOINTMENTS

**GAME**

DOWNLOAD INSTRUCTIONS



The mobile platform assigns points to achievements completed in the app. For example, a user might receive 500 points upon scheduling his or her first appointment with other attendees. Viewing a session description could earn a user 200 points. Points earned in the mobile game are intended to incentivize stakeholder interaction normally conducted in-person during past PSCR events. Access the user leaderboard by visiting the Game icon.



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To view an HTML version of the app on a desktop or laptop, you may visit <https://crowd.cc/pscr2020>



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## ROUND TABLE



Want to connect with others regarding a specific research topic, finding, or track area? Join a PSCR 2020 round table discussion! These facilitated discussions will take place in real-time using a video-conferencing platform; a PSCR staff researcher will be present in each group.

Space is limited, but you can secure your spot when you interact with live panels, session surveys, social media, and the mobile app. Interact, earn points, get selected! Weigh in from wherever you are with the most engaged PSCR 2020 attendees.

[LEARN MORE AND SIGN UP!](#)



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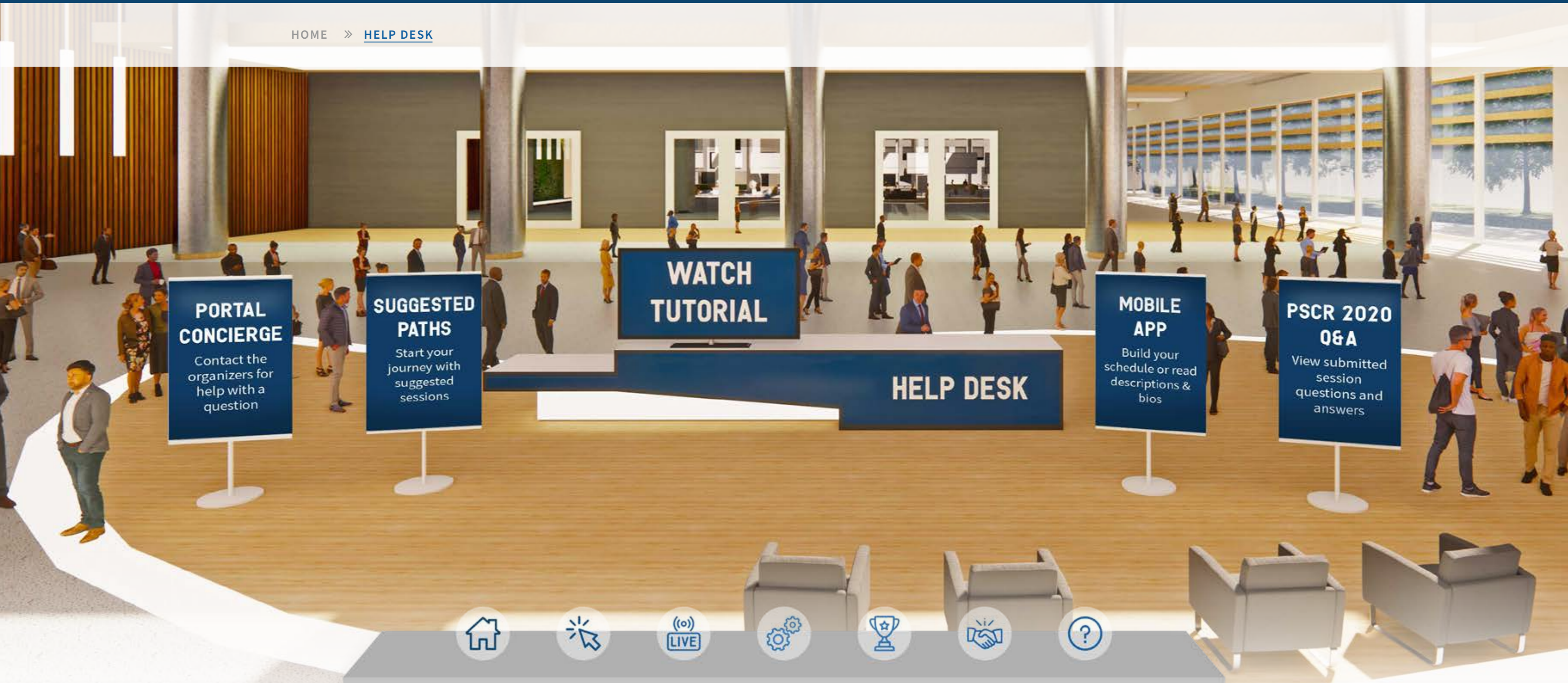
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**PORTAL  
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Contact the  
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help with a  
question

**SUGGESTED  
PATHS**  
Start your  
journey with  
suggested  
sessions

**WATCH  
TUTORIAL**

**HELP DESK**

**MOBILE  
APP**  
Build your  
schedule or read  
descriptions &  
bios

**PSCR 2020  
Q&A**  
View submitted  
session  
questions and  
answers



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## PORTAL CONCIERGE



Do you have questions about where to find something?  
Are you experiencing technical difficulties? Reach out  
to the Portal Concierge with questions or concerns at  
[portalconcierge@corneralliance.com](mailto:portalconcierge@corneralliance.com).

We'll get you an answer within 24 hours.  
This account will be monitored  
through August 28th, 2020.

### PORTAL CONCIERGE

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### WATCH TUTORIAL

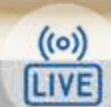
### HELP DESK

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### PSCR 2020 Q&A

View submitted  
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## SUGGESTED PATHS



HOT TOPICS

NEW TO PSCR

NEW & NOTEWORTHY

FUNDING FOCUSED

PUBLIC SAFETY AFFILIATION

### START YOUR PSCR 2020 WITH THESE HOT TOPIC TECHNOLOGY AREAS

#### LIVE Session:

*AR for Good with panelists from PSCR, Magic Leap, and Cosumnes Fire Dept. You've heard about the SXSW panel. Now tune in for the LIVE session.*

 [CLICK TO PLAY LIVE SESSION](#)

#### On-Demand Session:

*IoT Environments: Examining Data Foundations. You're familiar with IoT in relation to your home or health. Learn how PSCR is investigating it in relation to first response.*

 [CLICK TO PLAY ON-DEMAND SESSION](#)

#### On-Demand Session:

*Building VR for Public Safety. Virtual Reality is in our news feeds more than ever. Dive deeper into applications for this technology with an on demand session.*

 [CLICK TO PLAY ON-DEMAND SESSION](#)

#### On-Demand Session:

*5G Security - Evolution not Revolution. Everyone's talking about 5G. Hear what NIST has to say in this on-demand session.*

 [CLICK TO PLAY ON-DEMAND SESSION](#)

#### On-Demand Session:

*Social Media Incident Streams. People report crime and emergencies to social media. Can detection of these reports be automated? Find out in this session.*

 [CLICK TO PLAY ON-DEMAND SESSION](#)



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## SUGGESTED PATHS



HOT TOPICS

**NEW TO PSCR**

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PUBLIC SAFETY AFFILIATION

NEW TO PSCR? START WITH AN OVERVIEW THEN FAST FORWARD TO TRACKS & RESULTS

**LIVE Session:**  
PSCR 2020 Program Overview, Opening Remarks, and Public Safety Keynote.  
Get oriented with a **LIVE Session kickoff.**

 [CLICK TO PLAY LIVE SESSION](#)

**On-Demand Session:**  
Portfolio Overviews Pecha Kucha.  
**Discover which tracks speak to you by viewing this on-demand session.**

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**On-Demand Session:**  
Making an Impact: Experiences of PSCR's Awardees.  
**Fast forward to learn about program impacts.**

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**Webinar:** *Using Prize Challenges to Drive Innovation.*  
**Learn how PSCR stimulates R&D with a recorded webinar.**

 [CLICK TO PLAY WEBINAR](#)

**Social Media:** *Twitter Trivia Party.*  
**Learn more PSCR facts and history when you follow NIST on social media.**

 [FOLLOW @NISTPUBLICSAFET](#)

**PORTAL CONCIERGE**  
Contact the organizers for help with a question

**PSCR 2020 Q&A**  
View submitted session questions and answers



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STAKEHOLDER MEETING REGULAR? JUMP RIGHT TO WHAT'S NEW THIS YEAR.

**On-Demand Session:** PSCR Impacts Panel. You heard Derek promise this report last year. Learn about the PSCR program impacts in the on-demand session.

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**On-Demand Session:** Access Driven Modified Rhyme Test Intelligibility. Learn about an impact from the largest PSCR portfolio in the on-demand session.

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**Technology Demo:** Envisioning AR Vision Enhancement in Reduced Visibility Environments. See research lanes LBS and UI/UX cross, experience the technology demo.

 [CLICK TO PLAY TECH DEMO](#)

Check out the first-ever virtual, **PSCR 2020 Roundtables.** Talk with others about the research.

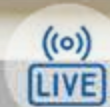
 [LEARN MORE & SIGN UP](#)

**On-Demand Session:** Connecting Innovators to Small Business Resources. You never knew all your options. Discover them here.

 [CLICK TO PLAY ON-DEMAND SESSION](#)

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LOOKING TO GET INVOLVED? START WITH THESE FUNDING-FOCUSED SESSIONS. THEY MIGHT JUST LEAD TO YOUR NEXT ENDEAVOR.

**LIVE Session:** *What We Learned from Participating in a PSCR Prize Challenge - Haptic Interfaces.*  
**Hear the results from the challenge you influenced in 2019.**

 [CLICK TO PLAY LIVE SESSION](#)

**On-Demand Session:** *Automated Stream Analytics for Public Safety (ASAPS).*  
**Catch up and jump in on this multi-million dollar challenge.**

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**Watch On-Demand Session:** *First Responders and Drones*  
**Get ready for round two.**

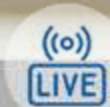
 [CLICK TO PLAY ON-DEMAND SESSION](#)

*Message PSCR 2020 participant using the **mobile app!***  
**Meet a potential partner or simply connect with someone new.**

 [DOWNLOAD MOBILE APP](#)

**On-Demand Session:** *PSCR's Follow-On Funding Opportunity.*  
**Been there, done that? Consider what's next.**

 [CLICK TO PLAY ON-DEMAND SESSION](#)



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**PUBLIC SAFETY AFFILIATION**

ARE YOU PUBLIC SAFETY PERSONNEL? WE THINK THIS CONTENT WILL PIQUE YOUR INTEREST. THANK YOU FOR ALL YOU DO.

**On-Demand Session:** 7000+ First Responders Have More To Say - Nationwide Usability Survey Results at your Fingertips.  
**You took the survey; now, hear the results!**

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**On-Demand Session:** Immersive Ballistic Simulation in Virtual Reality Officers.  
**See our efforts to match your realistic experience.**

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**Technology Demos** from the Tech to Protect Winning Solutions.  
**See them here now, maybe later in stores near you.**

 [CLICK TO EXPLORE TECH DEMOS](#)

**On-Demand Session:** Mobile Fingerprint Capture for Public Safety.  
**ATTN: First Responders: Hear from your own about their experience.**

 [CLICK TO PLAY ON-DEMAND SESSION](#)

**PSCR 2020 Mobile App.** Connect with public safety around the world, message the researchers dedicated to your mission.

 [DOWNLOAD MOBILE APP](#)

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## MOBILE APP



OVERVIEW

DOWNLOAD INSTRUCTIONS

PSCR has published a mobile application intended to supplement information included in the 2020 Digital Experience. The app features an interactive agenda, networking opportunities, speaker bios, technical demonstration descriptions, and other PSCR project background materials that will help attendees enhance their conference experience. Follow the instructions below to download the CrowdCompass mobile application. You may contact Marc Leh ([mleh@corneralliance.com](mailto:mleh@corneralliance.com)) with any questions or troubleshooting items.



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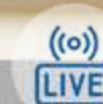


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## PSCR 2020 Q&A



Year after year, audience questions prove to be valuable interactions for attendees and researchers alike. We encourage you to ask questions about PSCR 2020 content. Use the link provided at the bottom of each on-demand session or technology demonstration page to submit your question(s).

Then, visit [this page](#) to learn the answers provided by the researchers themselves.

PSCR will be answering your questions on a rolling basis. If you don't see your question yet, be sure to check back later.

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### SUGGESTED PATHS

Start your journey with suggested sessions

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Build your schedule or read descriptions & bios

### PSCR 2020 Q&A

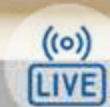
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