PSCR 2022

ATTENDEE PACKET

Jump To

Agenda	Session Descriptions	Session Speakers

NIST

PSCR

Time	Sessions
7:30–8:30am	**Arrive and check-in**
8:30–9:15am	**Welcome/Keynote** Location: California ABC
9:15–10:00am	**PSCR 2022 Program Overview** Location: California ABC
10:00–10:15am	**Break**
10:15–11:15am	**Mobile Fingerprinting Innovation Technology (mFIT) Prize Challenge Winners Announcement** Location: California ABC
11:15–12:45pm	**Lunch** *Please note that lunch will not be provided*

Legend:

- Analytics
- Location-Based Services
- Mission Critical Voice
- User Interface/ User Experience
- Resilient Systems
- Security
- Emergency Communications
- Commercialization
- Wildland Urban Interface
- Ⓒ Campfire Session
- Ⓕ Fireside Chat
- Ⓟ Panel Discussion

Legend for Tech Demos

- ① Attendees in Group 1
- ② Attendees in Group 2

Attendee group is indicated on badge

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☐+ **speakers for each session!**

12:45–1:30pm

Mission Critical Voice Test Equipment Panel Ⓟ Location: California AB	**Voice Communications in WUI Response: Gaps & Opportunities** Ⓒ Location: Garden Terrace 1	**What's New in UAS Operations for Public Safety** Ⓒ Location: Garden Terrace 2	**What's Next for the LBS Portfolio?** Ⓒ Location: Garden Terrace 3

1:40–2:25pm

Advancing Tech Together: Peak Response's Partnership with the San Francisco Fire Department Ⓕ Location: California AB	**Situational Awareness Technology in WUI Response: Gaps & Opportunities** Ⓒ Location: Garden Terrace 1	**What's Next for the UI/UX Portfolio?** Ⓒ Location: Garden Terrace 2	**NG 9-1-1 and Emergency Response** Ⓒ Location: Garden Terrace 3

2:35–3:20pm

Public Safety Research for Immersive Simulations and Measurements Ⓟ Location: California AB	**Alerting Technology in WUI Response: Gaps & Opportunities** Ⓒ Location: Garden Terrace 1	**What's Next for the MCV Portfolio?** Ⓒ Location: Garden Terrace 2	**The Emerging Future of AI and Analytics in Situation Awareness and Emergency Communications** Ⓒ Location: Garden Terrace 3

3:30–5:00pm

Technology Demonstrations ① Location: San Diego Ballroom	**Technology Demonstrations** ② Locations: Plaza, Imperial Boardroom	**FRST Challenge Poster Session** ② Location: Sierra, Santa Fe	**PSCR Van** ② Location: Outside of the Westin lobby

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Time	Sessions
8:30-8:45am	**Day 2 Welcome** Location: California ABC
8:45-9:45am	**PULSE Accelerator: Public Safety Technology Feedback Pitch** Location: California ABC
9:45-10:30am	**From Hypothesis to Reality: FirstNet Today** Location: California ABC
10:30-10:45am	Break

10:45-11:30am

Technology Demonstrations ② Location: San Diego Ballroom	Technology Demonstrations ① Locations: Plaza, Imperial Boardroom	FRST Challenge Poster Session ① Location: Sierra, Santa Fe	PSCR Van ① Location: Outside of the Westin lobby

11:30-1:00pm Lunch *Please note that lunch will not be provided*

1:00-1:45pm

INsider Knowledge: i-Axis Trivia Location: California AB	From Reality to Dreams: FirstNet Tomorrow © Location: Garden Terrace 2	Voice Communications in WUI Response: Gaps & Opportunities © Location: Garden Terrace 1	A Discussion on Current and Future Public Safety ICAM © Location: Garden Terrace 3

1:55-2:40pm

Augmented Reality for Public Safety Ⓕ Location: California AB	Situational Awareness Technology in WUI Response: Gaps & Opportunities © Location: Garden Terrace 1	MCV On-demand Session Q&A Location: Garden Terrace 2	Resilient Systems On-demand Session Q&A Location: Garden Terrace 3

2:50-3:35pm

Mission Critical Voice Quality of Experience Panel Ⓟ Location: California AB	Alerting Technology in WUI Response: Gaps & Opportunities © Location: Garden Terrace 1	UI/UX On-demand Session Q&A Location: Garden Terrace 2	Security On-demand Session Q&A Location: Garden Terrace 3

3:45-5:00pm

Technology Demonstrations ② Location: San Diego Ballroom	Technology Demonstrations ① Locations: Plaza, Imperial Boardroom	FRST Challenge Poster Session ① Location: Sierra, Santa Fe	PSCR Van ① Location: Outside of the Westin lobby

Legend:

■ Analytics	■ Resilient Systems	■ Wildland Urban Interface
■ Location-Based Services	■ Security	© Campfire Session
■ Mission Critical Voice	■ Emergency Communications	Ⓕ Fireside Chat
■ User Interface/ User Experience	■ Commercialization	Ⓟ Panel Discussion

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Time	Session
8:30-8:45am	**Day 3 Welcome** Location: California ABC
8:45-9:45am	**Merging Next Generation Technology for Incident Command Dashboards** Location: California ABC
9:45-10:00am	**Break**
10:00-11:00am	**International Public Safety Panel** Location: California ABC
11:00-12:30pm	**Lunch** *Please note that lunch will not be provided*

Legend:

- ■ Analytics
- ■ Location-Based Services
- ■ Mission Critical Voice
- ■ User Interface/ User Experience
- ■ Resilient Systems
- ■ Security
- ■ Emergency Communications
- ■ Commercialization
- ■ Wildland Urban Interface
- Ⓒ Campfire Session
- Ⓕ Fireside Chat
- Ⓟ Panel Discussion

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Time				
12:30-1:15pm	**Public Safety Communicating Their Needs and Collaborating with Innovators** Ⓟ Location: California AB	**Next Generation WUI Response: A Summary of R&D Gaps and Enabling Technologies** Ⓒ Location: California C	**LBS On-demand Session Q&A** Location: Garden Terrace 1	**Analytics On-demand Session Q&A** Location: Garden Terrace 3
1:25-3:30pm	**Technology Demonstrations** Location: San Diego Ballroom	**Technology Demonstrations** Locations: Plaza, Imperial Boardroom	**FRST Challenge Poster Session** Location: Sierra, Santa Fe	**PSCR Van** Location: Outside of the Westin lobby

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SESSION DESCRIPTIONS

Plenary Sessions	Breakout Sessions	On-Demand Sessions	Tech Demos

= Open Innovation Session

PLENARY SESSIONS

Keynote

Speaker(s): Richard Carrizzo

To kick-off the 2022 Public Safety Broadband Stakeholder Meeting, Richard Carrizzo, Vice Chair for the First Responder Network Authority (FirstNet) Board, will deliver the keynote address. During his keynote, Chief Carrizzo will reflect on his 39 years of experience in the fire and emergency service, as well as his involvement with public safety communications. He will provide updates on behalf of FirstNet and discuss the collaboration between FirstNet and PSCR and the future of emergency communications for public safety.

PSCR 2022 Program Overview

Speaker(s): Dereck Orr

Join Public Safety Communications Research (PSCR) Division Chief Dereck Orr as he discusses what PSCR set out to do with the $300M directed to PSCR in the Middle Class Job Creation Act of 2012, accomplishments our researchers and stakeholders have had over the past decade, and the impacts of these public safety communications technology advancements. Learn more about the growth of PSCR, and the future of our research and development efforts.

Mobile Fingerprinting Innovation Technology (mFIT) Prize Challenge Winners Announcement

Speaker(s): John Beltz, Bill Maheu, Jonathan Lewin, Dereck Orr

PSCR will be announcing the winners of the Mobile Fingerprint Innovative Technology (mFIT) Prize Challenge (Phase 2). We challenged contestants to help advance mobile fingerprint capturing technology by developing or improving existing applications on mobile devices, such as smartphones or tablets that access the existing device sensors to capture high-quality digital fingerprint images. These images can later be interpreted by existing fingerprint management systems. Come learn more about this innovative technology and celebrate with the prize challenge winners.

PULSE Accelerator: Public Safety Technology Feedback Pitch

Speaker(s): Sarah Hughes, Maciej Stachura, Lauren Shluzas Reggie Ash, Michael Marino, Rod Goossen, Kyle Bishop

PSCR and its two implementer partners launched the Pulse Accelerator to help emerging technology companies accelerate growth and development that supports the public safety and first responder sectors. Five businesses from the three rounds of the accelerator are joining us live to pitch their technology. You'll hear feedback from the panel of public safety and communication technology experts, but don't forget to share your own feedback with the businesses in the PSCR 2022 Conference App.

main menu

From Hypothesis to Reality: FirstNet Today

Speaker(s): Jeff Bratcher, Jeremy Zollo

Join the FirstNet Authority's Chief Technical Officer, Jeff Bratcher, and the Chief Market Engagement Officer, Jeremy Zollo, to reflect on how FirstNet, the nationwide public safety broadband network, has transformed public safety communications. See how, in just 10 short years, many of the revolutionary concepts that PSCR scientists were studying at the inception of the FirstNet program have come to life in the reality of our first responders. Learn about how we've evolved over such a short period of time to innovate, field, and operationalize key network, device, and applications differentiators, enabling capabilities critical to the success of public safety operations – including Mission Critical Services, Z-Axis, High Powered User Equipment (HPUE), and the Compact Rapid Deployable (CRD).

Merging Next Gen Tech for Incident Command Dashboards

Speaker(s): Sarah Hughes, Thomas Watson, Dr. Shishir Shah, Scott Ledgerwood, Dr. Jennifer Harder, Chief Sterling Folden

2022 has brought several emergency and disaster scenarios around the world. Hear from one incident commander about their recent experience and how they hope communication technology can advance for future incident command. You'll hear from two external PSCR-funded collaborators about how their R&D technology could be part of the solution, along with NIST PSCR and the First Responder Network Authority about the user interfaces. And, did we mention we're launching the InCommanD Challenge with $1Million in prizes?

International Public Safety Panel

Speaker(s): Jason Kahn, Geoff Spring, Sirilal Mallawa-Arachchi, Joe Fournier, Guillaume Lambert

In the USA, there has been a lot of progress in the last several years to provide broadband service for public safety organizations and personnel. Despite the number of first responders, the market is still seen as small. To better expand the options and the functionality of the overall technology, broadband for public safety must have a global customer base. PSCR has invited representatives from around the globe to see how other countries are building broadband service for public safety.

BREAKOUT SESSIONS

A Discussion on Current and Future Public Safety ICAM

Speaker(s): John Beltz

PSCR has been researching Public Safety Identity Credential & Management (ICAM) solutions in partnership with the NCCoE for six years. Bill Fisher provided a recorded session that outlines the important work the security team has accomplished and what the team has planned for the next eighteen months. Despite PSCR's research efforts, and those of dozens of organizations that advocate for ICAM enhancement, there are many challenges when it comes to implementation. This campfire session will be an informal discussion to learn about current ICAM implementations in public safety agencies in relation to PSCR's research, and how to address the barriers to adoption of more robust and secure solutions. Join this session to hear stakeholders' opinions on these challenges and share your own; this discussion is intended to be non-technical in an attempt to hear the user's perspective.

Advancing Tech Together: Peak Response's Partnership with the San Francisco Fire Department 🎗

Speakers(s): Sarah Hughes, Francis Li, Niels Tangherlini

Peak Response has evolved their technology through several PSCR programs – the Tech to Protect Challenge, the PULSE virtual business accelerator, and a grant funding opportunity. Still, in addition to their support from PSCR, they've advanced their technology

each step of the way with the San Francisco Fire Department. During this fireside chat, hear from the Chief Technology Officer and their public safety partner about their journey to advance the technology.

Alerting Technology in WUI Response: Gaps & Opportunities

Speaker(s): Marc Leh

Wildfire suppression costs consistently exceed $1 billion per year and these incidents are becoming longer, costlier, and more complicated as they increasingly affect urban population centers. WUI responders require new, more effective alerting technologies to sense and predict wildfire risk, proactively communicate hazard intelligence to impacted communities, and optimize the evacuation routing and mitigation resources to people and property. This session will invite first responders to describe technical challenges inherent to alerting the public to wildfire incidents and what technologies would make this process more effective. Participants will be asked to brainstorm what situational awareness information is most appropriate for sharing with the public, how technology can more effectively alert the public to WUI risk and what to do during a wildfire incident, and what technologies could facilitate more efficient two-way information sharing between public citizens and public safety to enhance WUI response.

Analytics On-demand Session Q&A

Speaker(s): Gary Howarth

Come join a Q&A session moderated by Gary Howarth. Gary will also be joined by other Analytics on-demand session speakers, so be sure to check out the Analytics on-demand sessions from both PSCR staff and external researchers in the mobile app prior to attending the Q&A session. Don't have time to watch sessions in advance but are interested in Analytics topics? Please still join us to be a part of the conversation!

Augmented Reality for Public Safety

Speaker(s): Scott Ledgerwood, Jad Meouchy, Yang Cai

Join a fireside chat with Scott Ledgerwood, Jad Meouchy from BadVR, and Yang Cai from Carnegie Mellon University to learn about Augmented Reality (AR) developments supported through the 2020 PSIAP-AR funding opportunity. The group will reflect on the current state of the AR industry, requirements they've heard from public safety, and showcase some of their latest content and hardware.

From Reality to Dreams: FirstNet Tomorrow

Speaker(s): Brian Hobson, Dr. Jennifer Harder, Michael Varney

The FirstNet Authority Roadmap Development team will facilitate a discussion with attendees to learn more about how public safety believes FirstNet, the nationwide public safety broadband network, should be enhanced and evolved in the coming years through collaboration, innovation, and investment. Key topic areas may include network coverage, location services, information exchange, mission critical services, and user interfaces/user experience. They will also discuss a new and innovative partnership between the FirstNet Authority and PSCR in Boulder, Colorado – the Public Safety Immersive Test Center – which will offer innovation opportunities with industry and academia in the areas of User Interface/User Experience and Location-based Services.

INsider Knowledge: i-Axis Trivia

Speaker(s): Kevin Kay, Peter Hanna, Chris Rogers

Join the i-Axis Team and test your knowledge on all things indoors. Question areas include indoor mapping, tracking, and navigation best practices, challenges, and other public safety-related topics. A personal device with internet access is required to participate in the live polls.

Location-based Services On-demand Session Q&A

Speaker(s): Joe Grasso to lead, other LBS session speakers to join

Come join a Q&A session moderated by the Location-Based Services Portfolio Lead Joe Grasso. Joe will also be joined by other LBS on-demand session speakers, so be sure to check out the LBS on-demand sessions from both PSCR staff and external researchers in the mobile app prior to attending the Q&A session. Don't have time to watch sessions in advance but are interested in LBS topics? Please still join us to be a part of the conversation!

Mission Critical Voice On-demand Session Q&A

Speaker(s): Sam Ray

Come join a Q&A session moderated by the Mission Critical Voice Portfolio Lead Sam Ray. Sam will also be joined by other MCV on-demand session speakers, so be sure to check out the MCV on-demand sessions from both PSCR staff and external researchers in the mobile app prior to attending the Q&A session. Don't have time to watch sessions in advance but interested in MCV topics? Please still join us to be a part of the conversation!

Mission Critical Voice Quality of Experience Panel

Speaker(s): Alison Kahn, Robin Grier, Dan Rubenstein, Alessio Medda, Barry Leitch

PSCR's Mission Critical Voice (MCV) Quality of Experience (QoE) program has turned the subjective quality of a first responder's voice communications into a suite of measurable metrics. These session panelists are some of the early adopters of the MCV QoE test hardware and software platforms. This panel session will discuss how they have been able to use the MCV QoE equipment, interesting insights that they have gained from working with the equipment, and how measuring QoE can be useful to the first responder experience and beyond.

Mission Critical Voice Test Equipment Panel

Speaker(s): Jason Kahn, Fidel Liberal, Ian Carpenter, Vince Nguyen

The 3GPP started work on specifying Mission Critical Services in 2014 with the description of MCPTT. In late 2015 – early 2016, for 3GPP Release 13, the core specifications were first published for MCPTT, and additions and modifications have been continuing ever since. In 2016, the 3GPP started to create standardized test cases for MCPTT. MCVideo and MCData were added along the way for both core specifications and standardized test cases. Now that Mission Critical Services test cases have been written in 3GPP, what happens next? How are the test cases executed? An important piece of the overall wireless telecom device ecosystem was missing until recently – the test equipment to execute the standardized test cases.

Related content: Keysight Technologies Demo

Next Generation WUI Response: A Summary of R&D Gaps and Enabling Technologies

Speaker(s): Marc Leh

Public safety personnel involved in wildfire response are invited to share their perspective on the technology gaps, requirements, and future vision for WUI technology scenarios discussed during breakout sessions facilitated on Days 1-2 of the Stakeholder Meeting. This session will also ask public safety stakeholders from industry, academia, and government to share their questions, lessons learned, and other takeaways from participating in this week's WUI technology brainstorming sessions.

NG 9-1-1 and Emergency Response

Speaker(s): Jeff Cohen, Dereck Orr

This campfire-style session will engage attendees in discussion about Next Generation 9-1-1 (NG 9-1-1) with a focus on the

opportunities for responders in the field to exchange new forms of data with 9-1-1 professionals. Jeff Cohen, Chief Counsel and Director of Government Relations at Association of Public-Safety Communications Officials (APCO) International, will set the stage with an overview of the vision for NG 9-1-1 before prompting participants to offer what kind of information sharing would most benefit first responders arriving on scene, the role of the NG 9-1-1 center to triage incident data, how NG 9-1-1 centers will interoperate with FirstNet, and related security considerations.

Public Safety Research for Immersive Simulations and Measurements 🎀

Speaker(s): Scott Ledgerwood, Joe Grasso, Travis Hull, Kim Coleman, John Blackwell, Solmaz Kia

PRISM: Public Safety Research for Immersive Simulations and Measurements is a collaboration between PSCR and the First Responder Network Authority (FRNA). It includes a customized facility within the FRNA office in Boulder, Colorado, equipped with a high-speed optical tracking system to support work in user experience, indoor localization, situational awareness, and other areas important to public safety.

Learn more about PRISM during this panel discussion composed of experts in indoor localization and large-scale extended reality (XR) research and development. During the discussion, hear an overview of the facility, how it has been used to date, and its future potential. Also learn about opportunities for industry, academia, and public safety to collaborate in this space.

Public Safety Communicating Their Needs and Collaborating with Innovators

Speaker(s): Sarah Hughes, Scott Barthelmass, Red Grasso, Charles Guddemi

One of the critical components of the PULSE Accelerator is the collaboration businesses have with public safety members and the feedback they receive. Hear from three public safety officials about their experience communicating their public safety problems and communications technology needs, and helping validate technology with innovators. Fellow public safety members, be forewarned; these panelists aim to convince you that YOU, in collaboration with innovators, are the key to advancing communications technology for public safety.

Resilient Systems On-demand Session Q&A

Speakers: Roger Blalock

Come join a Q&A session moderated by the Resilient Systems Portfolio Lead Roger Blalock. Roger will also be joined by other Resilient Systems on-demand session speakers, so be sure to check out the Resilient Systems on-demand sessions from both PSCR staff and external researchers in the mobile app prior to attending the Q&A session. Don't have time to watch sessions in advance but interested in Resilient Systems topics? Please still join us to be a part of the conversation!

Security On-demand Session Q&A

Speaker(s): John Beltz

Come join a Q&A session moderated by the Security Portfolio Lead John Beltz. Be sure to check out the Public Safety Identity, Credential & Access Management (ICAM) Update on-demand session in the mobile app prior to attending the Q&A session. Don't have time to watch the session in advance but interested in Security related topics? Please still join us to be a part of the conversation!

Situational Awareness Technology in WUI Response: Gaps & Opportunities

Speaker(s): Marc Leh

Wildland urban firefighters face extremely challenging environmental conditions and dynamic risk factors during response. As a result, this discipline would benefit greatly from enhanced situational awareness technologies designed to unique WUI requirements while combating increasingly frequent and destructive wildland urban fire incidents.This session will evaluate emerging, non-voice

technologies across PSCR's portfolio and develop a wish list of technical capabilities that would edify wildland urban firefighter situational awareness today and 10+ years into the future. This breakout session will open with WUI responders describing WUI operational challenges and their ideal situational awareness technology future state before inviting participants to brainstorm emerging technology requirements and capabilities that the R&D community could pursue to help make this ideal future state a reality.

The Emerging Future of AI and Analytics for Public Safety

Speaker(s): Gary Howarth

This campfire session will engage attendees in discussion about the future of R&D in Analytics and Artificial Intelligence (AI) for public safety. Gary Howarth will provide a brief overview on how PSCR defines AI and the types of public safety analytics projects conducted over the last six years before prompting participants to share what they perceive as AI and analytics wins and challenges, ongoing technology gaps, current public safety adoptions, priorities for the future, and how they see themselves getting involved.

UI/UX On-demand Session Q&A

Speaker(s): Scott Ledgerwood

Come join a Q&A session moderated by the User Interface/User Experience Portfolio Lead Scott Ledgerwood. Scott will also be joined by other UI/UX on-demand session speakers, so be sure to check out the UI/UX on-demand sessions from both PSCR staff and external researchers in the mobile app prior to attending the Q&A session. Don't have time to watch sessions in advance but interested in UI/UX topics? Please still join us to be a part of the conversation!

Voice Communications in WUI Response: Gaps & Opportunities

Speaker(s): Marc Leh

Description: Public safety continues to face technical challenges preventing effective voice communications during wildland urban fire response. Whether due to challenging propagation environments, disparate frequency bands and devices being used across multiple responding jurisdictions, or damaged or nonexistent network infrastructure on-scene; wildland-urban firefighters too often cannot reliably transmit voice signals through current radio technology. This breakout session will ask first responders to describe the voice communication challenges they have faced during recent WUI incidents and the short-term voice capabilities required to respond more effectively. After learning from frontline WUI experience, participants will brainstorm additional technology gaps, operational requirements, and R&D activities that could enhance near-term WUI voice communications.

What's New in UAS Operations for Public Safety 🎗

Speaker(s): Terese Manley, Roger Blalock, Travis Balthazor, Kurt Carraway

Join this campfire session to share ideas about current and future use cases for operating unmanned aerial systems (UAS) in public safety operations. Hear about the success of other UAS Programs, learn how to start a new UAS program, and share best practices with other first responders. Whether you have a UAS program today or want to get one started, we will have experts share their operational experience, FAA certification requirements, and NIST's UAS Open Test Lane standards.

What's Next for the LBS Portfolio?

Speaker(s): Joe Grasso

This campfire session will engage attendees in discussion about the future of R&D in Location-Based Services (LBS). Joe Grasso, the LBS Portfolio Lead at PSCR, will provide a brief overview on the types of projects currently comprising this research portfolio before prompting participants to share what they perceive as LBS wins and challenges, ongoing technology gaps, current public safety adoptions, priorities for the future, and how they see themselves getting involved.

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Legend:

TECHNICAL LEVEL:
1 = Beginner
2 = Intermediate
3 = Advanced

What's Next for the MCV Portfolio?

Speaker(s): Sam Ray

This campfire session will engage attendees in discussion about the future of R&D in the Mission Critical Voice (MCV) portfolio. Sam Ray, the MCV Portfolio Lead at PSCR, will provide a brief overview on the types of projects currently comprising this research portfolio as well as the projects concocted over the last six years before prompting participants to share what they perceive as MCV wins and challenges, ongoing technology gaps, current public safety adoptions, priorities for the future, and how they see themselves getting involved.

What's Next for the UI/UX Portfolio?

Speaker(s): Scott Ledgerwood

This campfire-style breakout session will engage attendees in discussion about the future of R&D in User Interface and User Experience (UIUX). Scott Ledgerwood, the UIUX Portfolio Lead at PSCR, will provide a brief overview on the roadmap that led PSCR to their current research to date in this portfolio before prompting participants to share what they perceive as UIUX priorities, successful technology adoptions, ongoing gaps, future research needs, and how they see themselves getting involved.

ON-DEMAND SESSIONS

Analytics

Automated Streams Analytics for Public Safety (ASAPS) Research Resources

Speaker(s): John Garofolo, Gary Howarth, Jim Golden

TECHNICAL LEVEL: 1.5

This session describes the challenges in public safety of monitoring an increasing number of streaming data sources to detect emergencies as they happen and maintain situational awareness with regards to emergencies. The ASAPS challenge space aims to define a set of conceptual challenge problems and a framework to support critical R&D in real-time artificial intelligence (AI) analytics for emergency awareness. The ASAPS Resources project provides data and tools to support research and performance measurement in these challenging problems. This session describes the ASAPS challenge space, data that has been created to support ASAPS-focused research, and how to access the data. The session is intended for both AI researchers and public safety stakeholders.

Challenges and Opportunities for Enabling Use of Video Analytics in Public Safety

Speaker(s): Shishir Shah

TECHNICAL LEVEL: 1

This session showcases a developed platform for customized design and deployment of video analytics to enable several public safety use-case scenarios.

Real-Time Video Analytics for Situation Awareness

Speaker(s): Alex Hauptmann, Xiaoyu Zhu

TECHNICAL LEVEL: 2

This session presents a set of video analytics tools for processing video in the context of public safety. These include systems for Activity Recognition, Gunshot Detection, Gun-type Identification, Shooter Localization, Crowd Counting, Crowd Density Measurement, Traffic Monitoring, and Disaster Damage Assessment, Traffic Monitoring, using video from surveillance cameras, unmanned aerial

vehicle (UAV) video, cell phone recordings, or news footage. For each tool, researchers broadly explain the underlying technology and show examples of use.

Synthetic Data: Uses and Limitations, a Practical Discussion

Speaker(s): Gary Howarth, Christine Task

TECHNICAL LEVEL: 2

Large datasets containing personally identifiable information (PII) are valuable resources for research and policy in public safety, finance, and many other fields. NIST, PSCR Prize Challenges have shown high-performance data synthesizers can allow dataset sharing while protecting individual privacy. The primary goal of this session is to introduce the quality metrics for synthetic data, as well as its uses and limitations. This session also presents resources for creating and evaluating synthetic data.

The ACE Analytics Framework and How You Can Leverage It All the Way to the Edge

Speaker(s): Jim Golden

TECHNICAL LEVEL: 2

This session describes the Analytics Container Environment (ACE) and explains how it can be used to facilitate real-time situation analysis in public safety videos. Jim Golden demonstrates how ACE can be used to easily test a variety of Public Safety analytics on multiple video sources simultaneously and explores new features in ACE, such as multi-node distribution and edge computing. Also, be sure to check out the ACE demo at PSCR 2022.

Working with Social Media in Emergencies

Speaker(s): Ian Soboroff, Cody Buntain, Richard McCreadie

TECHNICAL LEVEL: 2

Social media is an important communication platform during emergency and public safety events, but one that is uniquely challenging for responders and safety personnel to use effectively. This session begins with the Text Retrieval Conference (TREC) Social Media Incident Streams (SMIS) track, an effort to create annotated data for systems to learn to filter and route Twitter data during emergencies. Next, the session presents an overview of Crisis Informatics, the technical field concerned with bridging the gap between data and responders. Lastly, the session provides a preview of TREC CrisisFACTS which will develop datasets for automatically generating timelines of critical facts during an emergency.

Cross-Cutting

PSCR 2022 Pecha Kucha Portfolios Overview

Speaker(s): Scott Ledgerwood, John Beltz, John Garofolo, Roger Blalock, Joe Grasso, Sam Ray, Jason Kahn, Kerianne Gibney

TECHNICAL LEVEL: 1

This video features the National Institute of Standards and Technology (NIST) Public Safety Communications Research (PSCR) Division's Portfolio Leads as they provide an overview of the projects housed within their PSCR portfolio, and which sessions attendees can attend at PSCR 2022 in San Diego, California June 7-9, 2022.

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Location-Based Services

Accurate, Robust and Ubiquitous Localisation on Edge for Emergency Responders

Speaker(s): Zhuangzhuang Dai

TECHNICAL LEVEL: 1.5

Robust and accurate location-based services are vital for emergency responders. However, emergency response scenarios are often challenged by hazards such as fire, smoke, and absence of existing infrastructure. The University of Oxford proposes novel indoor positioning solutions using emerging sensors, such as thermal cameras and radar, which exhibit great resilience under different conditions. The team investigates multi-modality sensor fusion approaches to optimized positioning accuracy and robustness and has also developed a wearable prototype consisting of an edge computer and a LoRa module to perform real-time positioning calculation and wireless communication.

Automatic Alignment of Mixed-resolution 3D Point Cloud Data

Speaker(s): Thomas Watson

TECHNICAL LEVEL: 2

Different types of 3D sensors capture data with various resolutions, ranges, and noise characteristics. It is often desired to merge these different types of data together into a coherent scene. The goal is to evaluate the performance of these algorithms on data with different characteristics. The University of Memphis uses the Redwood dataset, which has high-resolution scans using a stationary LiDAR scanner. First, the team develops a method to emulate the capture of these environments as viewed by different types of sensors. Next, they take fragments of these captures and merge them together using several automatic algorithms. Finally, they evaluate how the results compare with the original scenes.

Developing a Best Practices Framework for Indoor Mapping, Tracking, and Navigation

Speaker(s): Kevin Kay

TECHNICAL LEVEL: 1.5

Join the i-Axis Team and explore updates to the Best Practices Guide to Indoor Mapping, Tracking, and Navigation Version 2. This guide was created to help accelerate the adoption of emerging technologies by public safety professionals and was informed by the Location-Based Services First Responder Working Group. This session discusses significant changes in Version 2, the Game Plan infographics, and provides a deep dive into the results of the Indoor Mapping, Tracking, and Navigation Gap Areas survey. NAPSG also reviews a project wrap-up and discusses the biggest gaps and priorities around the i-Axis.

First Responder Smart Tracking (FRST) Challenge: Indoors 3D Tracking 🎗

Speaker(s): Sonny Kirkley, David Wild, Haley Molchan, Jason Pennington, Kirk McKinzie

TECHNICAL LEVEL: 1

The First Responder Smart Tracking (FRST) Challenge is a prize challenge focused on smart, accurate, indoor 3D location tracking of first responders. Funded through a cooperative agreement with NIST PSCR, the competition seeks to foster the development of technologies that track first responders indoors with a goal of one-meter accuracy. Successful solutions will be robust in authentic first responder scenarios and affordable and scalable for first responder organizations. $5.6 million in prizes will be awarded across the five phases of the competition, culminating in two live field tests and demonstrations.

Indoor Localization System Evaluation Facility (ILSEF)

Speaker(s): Charlsea Hansen, Joe Grasso

TECHNICAL LEVEL: 2

The Location-Based Services (LBS) portfolio focuses on indoor mapping, tracking, and navigation. At past conferences, the LBS team has shared their progress in researching and testing ground truth systems. This year, the team discusses the current project in this arena: the development of an Indoor Localization System Evaluation Facility (ILSEF), an environment equipped with ground truth technologies to quantify the accuracy of an indoor localization system. The session covers what the LBS team has accomplished so far, as well as future plans for the ILSEF.

Ultimate Navigation Chip (uNavChip)

Speaker(s): Andrei M. Shkel, Zak Kassas, Solmaz Kia

TECHNICAL LEVEL: 2

This session discusses the development of the Ultimate Navigation Chip (uNavChip) concept. This project involves a Chip-Scale Personal Navigation System to localize emergency responders, assets, and people indoors and in covered outdoor environments, where GPS signals are unusable. The technical approach is based on the simultaneous integration of Deterministic, Probabilistic, and Cooperative Localization approaches. UC Irvine researchers discuss the Micro-Electro-Mechanical Systems (MEMS) technology being developed as part of this project, the groups' latest analytical and modeling results, hardware prototypes, and in-field tests and evaluations.

Ultimate Personal-Indoor-Navigator for Emergency Responders (uPIN-4-ER)

Speaker(s): Andrei M. Shkel

TECHNICAL LEVEL: 1.5

The MicroSystems Laboratory at University of California, Irvine (UCI) partnered with the Orange County Fire Authority (OCFA) to demonstrate a wearable firefighter tracking technology. The proposed tracking technology would allow first responders to locate team members in burning buildings and on fire grounds more accurately. The proposed Ultimate Personal Indoor Navigator (uPIN) is built around the state-of-the-art Micro-Electro-Mechanical Systems (MEMS) and MEMS-based Inertial Measurement Units (IMUs) technologies. In UC Irvine's implementation, the inertial measurements are augmented by fusion of information from aiding sensors and zero-velocity-update (ZUPT) algorithm.

Utilizing Point Clouds for Public Safety

Speaker(s): Alexander Dimopoulos

TECHNICAL LEVEL: 2

Annotated 3D point cloud maps hold the potential to help first responders navigate through complex scenarios more safely and efficiently. These maps are created through a combination of sensors, including lidar, which generates a point cloud containing highly accurate spatial information. Point Cloud City, a NIST funded project, has produced 3D maps and formatted these point clouds with labels that enable machine learning (ML) to be applied, which could highlight objects and features of importance for first responders. The work aims to develop ML models fit to these datasets in order to augment future map annotation and to create a foundation for other researchers and organizations to utilize these resources.

Mission Critical Voice

5G NR-LTE Coexistence: Opportunities, Challenges, and Solutions

Speaker(s): David Griffith, Sneihil Gopal

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Legend:

TECHNICAL LEVEL:
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TECHNICAL LEVEL: 3

5G New Radio (NR) promises to support new public safety communications services, but many network operators will continue to use existing LTE cellular infrastructure while migrating to NR. Therefore, LTE and NR systems will coexist for the foreseeable future. This talk addresses the issue of coexistence between LTE and NR in public safety communications. PSCR researchers discuss the work of the 3rd Generation Partnership Project (3GPP) on coexistence, identify the gaps in its ongoing work, and discuss the major coexistence use cases that have been identified. They introduce a novel resource allocation scheme that is applicable to the coexistence scenarios under study, which can help PSCR stakeholders to identify the coexistence solution that is best suited for their applications.

A Platform for Experimental Research in Critical Voice Communications

Speaker(s): Henning Schulzrinne, Daniel Rubenstein, Charles Jennings, Christian Regenhard, John Jay

TECHNICAL LEVEL: 1.5

The project, part of the Mission Critical Voice portfolio, established links between public safety Land Mobile Radio (LMR), Quality of Service (QoS), and Quality of Experience (QoE). In practice, QoS varies widely across the nation and across different technologies and geographic settings. Using the Department of Homeland Security's Enhanced Dynamic Geospatial Environment (EDGE), a virtual first responder sandbox, the team simulated realistic first responder activities while relying on simulated LMR transmissions between a "dispatcher" and experimental subjects–both laypersons and first responders. Measurements were taken of various measures of task completion in conjunction with variations in radio QoS.

AI3 Prize Challenge Competition

Speaker(s): Walt Magnussen, Jian Tao, Nick Maynard

TECHNICAL LEVEL: 2

This project, led by the Texas A&M University Internet2 Technology Evaluation Center (ITEC), will establish a public safety IoT sandbox to collect sensor data from various devices at the Texas Engineering Extension Service (TEEX) Disaster City Facility. TEEX trained over 204,000 first responders at this and other facilities in 2019. The sensor data will be collected over a private LTE network. Once collected, the data will be made available to competitors for a prize challenge that is to be led by U.S. Ignite. The Challenge intends to allow competitors to use Artificial Intelligence to classify the data and make it available to first responders.

Comparing LMR and LTE Deployments For Voice Applications

Speaker(s): Yishen Sun, Wesley Garey, Jordan O'Dell

TECHNICAL LEVEL: 2

Long Term Evolution (LTE) has the potential to provide lower latencies, increased capacity, and high-speed broadband data services for public safety agencies when compared to its widely adopted Land Mobile Radio (LMR) counterpart. However, it is still unclear whether or not LTE can provide similar or improved user experience compared to LMR. This session discusses the development of a method that compares the Quality of Experience (QoE) of an LMR deployment with an LTE deployment by evaluating speech intelligibility using drive test data and simulation.

Creating a Shared Public Safety Radio Data Set

Speaker(s): Walt Magnussen, Jian Tao

TECHNICAL LEVEL: 2

The public safety industry will move from Land Mobile Radio (LMR) hosted voice to LTE hosted voice video and data. The difference between mission critical services and over-the-top applications is the manner in which RF resources are allocated to the prioritized service applications and the network loading impact that it will have. To understand this impact, the Internet2 Technology Evaluation

Center (ITEC) will create an LMR dataset collected from 10 public safety agencies across the United States. The ITEC will collect LMR traffic data from each site over a 10 day period that is anticipated to have heavy LMR traffic usage (e.g., 4th of July week in Washington, D.C.). LMR statistics will be collected from LMR Cores with metadata such as LMR and LTE site locations added.

D2D Range Using New Radio

Speaker(s): Chunmei Liu

TECHNICAL LEVEL: 2

Keeping first responders connected is crucial in public safety incidents. This session explores how 5G New Radio sidelink can support device-to-device (D2D) communication and evaluate its communication range. We introduce a New Radio sidelink link-level simulator and use it for D2D range data collection and analysis. We study major factors and their impacts on D2D range, as well as tradeoffs between D2D range and other performance measures.

Embracing Standards Compliance Culture in Mission Critical Communications

Speaker(s): Fidel Liberal

TECHNICAL LEVEL: 1.5

Years ago, the public safety community decided to evolve broadband by adopting 3GPP standards, leaving behind a history of niche technologies and interoperability issues. That paradigm shift cannot be simplified to cherry-picking parts of some technical specifications, but demands a bet for truly multi-vendor, open, and interoperable eco-systems to the same degree that currently enables you to switch on your cell phone anywhere in the world and just talk. To guarantee such a level of interoperability, the 3GPP itself defined comprehensive protocol conformance testing and certification mechanisms. The resulting standards compliance culture needs to be embraced not only by vendors, but by the users and the operators in order to achieve it.

Mission Critical Communication (MCX): Testing User Equipment for Protocol Conformance

Speaker(s): Sudipto Biswas

TECHNICAL LEVEL: 1.5

This session provides a brief introduction to Mission Critical Communication (MCX) technology, an overview of the role of user equipment (mobile phones). Polaris Networks also describes the importance of protocol conformance testing of user equipment and provides an introduction to the MCTP test tool including testing over LTE-Uu and IP connectivity; manual and automated testing; debugging features; test reports; test tool validation; and collaboration opportunities.

Mission Critical Voice Quality of Experience: Outreach and Implementation

Speaker(s): Alison Kahn, Cara O'Malley

TECHNICAL LEVEL: 1

This session expands upon the Mission Critical Voice (MCV) Quality of Experience (QoE): System Overview session and discusses how the MCV QoE platform provides measurement results, including test display, interface, and impacts on our external stakeholders. The session demonstrates how PSCR's engineers have evolved the data processing procedure and test outputs to provide accurate and repeatable quality of experience results for our internal research and our external stakeholders. Finally, the PSCR MCV team discusses future outcomes for the MCV QoE project.

Mission Critical Voice Quality of Experience: System Overview

Speaker(s): Chelsea Greene, William Magrogan, Peter Fink

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TECHNICAL LEVEL: 1

This session introduces the audience to the Mission Critical Voice (MCV) Quality of Experience (QoE) test system developed by PSCR. It provides an overview of the project since its inception, details the QoE measurements and their definitions, and looks into the evolution of the hardware and software interface created to test and evaluate these measurements.

Propagation Channel Models & System Performance

Speaker(s): Andreas Molisch, Hussein Hammoud

TECHNICAL LEVEL: 2

A key requirement for public safety product development is testing in realistic channels; it is not sufficient to analyze performance with the 3GPP (or similar) channel models, as those are not intended to evaluate absolute performance and reliability. Thus, USC intends to perform extensive measurement campaigns for device-to-device (D2D) channels by concentrating on channels that are most important for Public Safety Organizations (PSOs). 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.

QUARC: Quality Under Adjustable Realistic Conditions for Communication Systems

Speaker(s): Kevin Berman

TECHNICAL LEVEL: 2

This session discusses Georgia Tech Research Institute's (GTRI) research into a state of the art push-to-talk radio communication system that can adjust five different key performance indicators (KPIs) of VoIP communication systems in real-time. The session includes a description of hardware and software pieces to allow the communication system to precisely impair the audio according to the five KPIs set by the user. GTRI researchers discuss results and analysis of tests done with first responders during training exercises to realize how these KPIs affect mission critical voice and the ability of the first responder to complete their mission.

Transforming Public Safety Interworking Requirements into Commercial Solutions

Speaker(s): Robin Grier

TECHNICAL LEVEL: 2

Public safety communications are undergoing a huge transformation resulting from the deployment of LTE networks specific to critical communications, including FirstNet. The transition from Legacy Land Mobile Radio (LMR) to Mission Critical Push-to-Talk (MCPTT) over LTE will involve a significant migration. Therefore, there is a need for these two systems to communicate with each other – otherwise known as Interworking – during this transition and beyond. The Department of Homeland Security (DHS) Science & Technology Directorate (S&T) funded a research and development effort to create a solution for LMR LTE Interworking, and the Department of Commerce's (DOC) PSCR has funded commercialization efforts for this technology. This session reviews progress to date, demonstrating how DHS and the DOC are working together to solve a critical problem for public safety.

Resilient Systems

PSCR UAS Program: Optimizing Drones for Public Safety

Speaker(s): Terese Manley, Roger Blalock

TECHNICAL LEVEL: 1

Discover how PSCR's UAS Program contributes to UAS technology advances for public safety. Learn about PSCR's focus on deployables

and the program's impact. With Congressional, partner, industry, and academic support, this session discusses how PSCR's prize challenges have influenced public safety needs. Specifically, you will hear about PSCR's UAS challenge goals, evaluation methods, results and impacts as participant prototypes help increase flight times and improve design tradeoffs for flight, payload and energy sources. This session provides an overview of the UAS 3.0 Triple Challenge, where three competitions seek innovation in UAS cybersecurity, image detection and GPS-denied communications. The session concludes by looking to the future and highlighting the newly launched UAS 4.0 Challenge.

ReDiCom: Resilient Communications for Dynamic Responder Teams in Disasters

Speaker(s): Dr. K. K. Ramakrishnan, Dr. Murat Yuksel, Dr. Hulya Seferoglu

TECHNICAL LEVEL: 2

This session presents the resilient dissemination of social media information and multi-party computation in disasters. To deliver emergency information to the appropriate first responders during disasters, the team maps textual and social media information to a namespace, enabling name-based pub/sub delivery, using NLP-based classification, exploiting a number of online machine learning capabilities to perform real-time mapping. Multi-party computation (MPC) is promising for privacy-preserving machine learning algorithms at edge networks. Coded-MPC (CMPC) uses coded computation to improve MPC performance regarding the required number of workers for computations. The team proposes Adaptive Gap Entangled polynomial (AGE) codes optimized for MPC.

UAS 3.3: Shields Up! – A Cyber-Focused Drone Challenge

Speaker(s): Michael Ogata

TECHNICAL LEVEL: 2

UAS 3.3: Shields Up! is the first cybersecurity-focused UAS prize challenge organized by PSCR. Unmanned aerial systems (UAS) technology is becoming an important tool in the public safety arsenal. This session describes the competition and what contestants were challenged to build. It also features breakdowns of each of the winning submissions.

Wildfire Data Logistics Network (WildfireDLN): A Demonstration of Resilient Data Sharing

Speaker(s): Nancy French, Martin Swany

TECHNICAL LEVEL: 2

This project provides a demonstration of a new hardware and software system that can improve access to complex data for wildland fire incident command firefighting in remote front-line locations, which includes maps and other geospatial data useful for informed decision-making. Researchers discuss the results of field testing of the system done in conjunction with the Colorado Center of Excellence for Aerial Firefighting and the Corona Fire Department.

Security

Public Safety Identity, Credential & Access Management (ICAM) Update

Speaker(s): Bill Fisher

TECHNICAL LEVEL: 2

For five years now, the PSCR security team has focused on helping the public safety and first responder community implement identity, credential, and access management (ICAM) technologies supporting the continued goal of secure information sharing. View this season to hear a recap of this impactful work, a discussion of the current state of public safety ICAM, and the challenges still facing this community.

Natural Authentication Methods for AR Devices

Speaker(s): Joel Scharlat

TECHNICAL LEVEL: 1

This session provides an update on the progress of our research looking into developing natural authentication methods for first responders, specifically law enforcement officers, researching and developing natural authentication methods for augmented reality (AR) devices. This session walks through Cyber Bytes' process, findings to date, and next steps as we determine if we can use 'you' as the authentication method.

User Interface / User Experience

Applied Research and Development of an Immersive Platform for Ops Training

Speaker(s): Jad Meouchy

TECHNICAL LEVEL: 1.5

This session explores and explains applied research in augmented reality (AR)-based user interfaces conducted over the last year. First, BadVR reviews the current state of AR equipment capabilities, strengths, and weaknesses and then documents the interview process and findings from 15+ in-person meetings and demos conducted with public safety partners across the country. Following that, BadVR shows images of implemented adaptations based on police, fire, and EMS feedback, and a roadmap for the next year of bringing a relevant product to market. Finally, a "sandbox" demonstration app will be officially released that attendees can try on their own headset at home/office, or by visiting a demo booth at the conference.

AR/VR is Ready, but Are We? Human Readiness to Immersive Tech in Public Safety

Speaker(s): Ranjana Mehta, Jason Moats, Saurabh Biswas, Srinivas Ranganathan, Kevin Sofen, Shalin Jyotishi, Scott Ledgerwood

TECHNICAL LEVEL: 1

During this session, panelists discuss the opportunities and challenges associated with the acceptance and adoption of immersive training systems in public safety – from individual levels (i.e., users) to technology developers and decision-makers or regulatory bodies. Augmented reality (AR) and virtual reality (VR) have shown immense potential to enhance the training and performance of first responders, and there have been significant strides in technology development. However, our user-centered efforts have repeatedly raised discussions on acceptance and adoption barriers to such training tools. This panel discusses the elements of diffusion of innovation that the community can consider for moving the needle forward in effective and sustainable use of such immersive technologies.

AR/VR Onboarding

Speaker(s): Matt Whitlock

TECHNICAL LEVEL: 1

The use of virtual reality (VR) enables a wide range of multimodal interactions, including hand gestures, eye gaze, voice-based, and controller-based interaction. This can make it challenging to familiarize new users with how to interact with VR applications. PSCR will evaluate how different aspects of XR onboarding affect how quickly users are able to familiarize themselves with a new UI and how well users are able to perform after receiving the onboarding guidance. PSCR's user study manipulates the presentation of guidance and the criteria for completing the onboarding session for varying XR user interfaces (UIs). This research provides insight for researchers evaluating novel XR UIs on how to properly onboard users.

Augmented Reality Control with a Handsfree Activated Neural Gesture Engagement Library (ARCHANGEL)

Speaker(s): Megan Blackwell

TECHNICAL LEVEL: 1

Several applications have been suggested in which technology such as augmented reality or drones could assist public safety organizations. Pison has developed a wrist-based sensor that enables gesture-control technology. During this session, Pison demonstrates its gesture-based interface and describes example applications.

Building Large Scale XR

Speaker(s): Jack Lewis

TECHNICAL LEVEL: 2

This session provides an in-depth overview of the new large-scale extended reality (XR) experience center developed in collaboration with FirstNet, a Public Safety Research for Immersive Simulations and Measurements. This talk covers the initial project planning, infrastructure buildout, and scenario development. It also discusses the various technologies and design methodologies used to develop first responder virtual reality (VR) scenarios for research and training within the new immersive facility.

Cognition-Driven Wayfinding System for Search and Rescue: AR Applications

Speaker(s): Eric Jing Du

TECHNICAL LEVEL: 1.5

This session introduces an adaptive wayfinding system based on the real-time measurement of cognitive load. Neural activities of first responders are tracked with eye trackers and Functional near-infrared spectroscopy (fNIRS), a noninvasive optical imaging technique that measures blood flows in different areas of the brain. A machine learning model is used to predict the cognitive load levels of the first responders. Then, based on the real-time reading of cognitive load, the wayfinding user interface is dynamically and automatically adjusted to control the risk of cognitive overload. This method has been validated in several user test studies and is being transferred to an Augmented Reality (AR) platform.

Context-Aware Augmented Reality for Cognitive Assistance in EMS

Speaker(s): Homa Alemzadeh

TECHNICAL LEVEL: 2

This session presents the University of Virginia's progress towards developing a context-aware augmented reality (AR) cognitive assistant system for cooperative situational awareness in medical emergencies. The system integrates AR and smartwatch devices with data analytics algorithms for a real-time context inference based on multimodal sensor data (audio, video, wearables) to provide just-in-time context-dependent feedback to responders. This session reviews preliminary results on applying the state-of-the-art algorithms for real-time pose recognition, hand tracking, and object detection based on video data and machine learning algorithms for assessing the quality of responders' activities based on smartwatch data during a Cardiopulmonary Resuscitation (CPR) procedure in a cardiac arrest scenario.

Creating a Test Bed for Evaluating Augmented Reality Pump Panel Training

Speaker(s): Laura Haak Marcial

TECHNICAL LEVEL: 1.5

Fire apparatus driver/operators (D/Os) must act quickly and decisively to operate the truck's pump panel and help their team successfully extinguish a blaze. While D/Os undergo standardized instruction and evaluation in preparation for this responsibility, true

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proficiency is often built outside of didactic instruction. Augmented reality (AR)-enhanced training may help close the learning gap. Through sponsorship from the National Institute of Standards and Technology (NIST), RTI International (RTI) has begun to develop a series of AR-based training modules for D/O trainees to build practical mastery of fire apparatus pump panel operations.

Development of Incident Response Intelligence Solution ⬥

Speaker(s): Radhakishan Shetty, Ryan Poltermann, David Van Ballegooijenn

TECHNICAL LEVEL: 1

Augmented Reality (AR) allows for the unique opportunity to expand incident command capabilities. This presentation discusses experiences in both the U.S. government's prize challenges (NIST PSCR CHARIoT), as well as JANUS' approach to operational deployment. The team highlights the distinct advantages that AR provides, what it's best suited for, and applications where it will have difficulty being successful. Then, JANUS Research Group provides a review of unique factors such as user ergonomics and control, sharing the knowledge that the AR interface provides, and accumulating data feeds. With this information, the audience should be equipped with the approach that best suits their agency.

EasyVizAR: Edge-supported, Assistive Augmented Reality for Indoor First Responder Scenarios

Speaker(s): Suman Banerjee, UW-Madison, Lance Hartung

TECHNICAL LEVEL: 1.5

First responders routinely make split-second decisions under stressful conditions. Easy access to information can alter the outcome in scenarios ranging from fire and medical rescue, to combative persons. This project explores innovative applications for augmented reality (AR) systems paired with edge computing that enables information sharing and high throughput visual data analysis. Several key information needs emerged in discussions with public safety partners: (1) improved indoor localization and mapping, (2) mechanisms to share visual information with team members, and (3) improved detection and identification of objects and people. This session shares updates and lessons learned in the ongoing first year of the project.

Extended Reality (XR) Research Design

Speaker(s): Julia Chelen, Scott Ledgerwood

TECHNICAL LEVEL: 1.5

This session provides an overview of empirical extended reality (XR) research methods and involves a discussion of why XR is uniquely helpful for studying a range of human processes, particularly in public safety contexts.

Extended Reality (XR) Research in a Pandemic

Speaker(s): Scott Ledgerwood, Julia Chelen

TECHNICAL LEVEL: 1.5

This session provides an overview of extended reality (XR) design considerations and approaches for conducting User Interface/User Experience research in constrained settings.

Extreme Reality Telemetry Interface

Speaker(s): Yang Cai

TECHNICAL LEVEL: 2

Extreme Reality (EXR) is a type of extended augmented reality (AR) that incorporates telemetry interfaces that can be operated in live or simulated extreme environments. In this study, we explore a few architectures of EXR, including real-time multimodal first-person view

video streaming from the thermal, stereo, and panoramic sources, and incorporate live Internet of Things (IoT) data into EXR models on an AR headset. This technology can be applied to real-time operations and simulation training for incident command posts (ICP) and first responders with head-up display (HUD) helmets in extreme environments such as flood, fire, smoke, and shootings.

HazVR: Hazardous Material Training with Virtual Reality

Speaker(s): Jason Jerald, Jason Haskins, JJ Farantatos

TECHNICAL LEVEL: 1

HazVR is a hazmat training module to be used in classroom settings. The goal of the project is to provide experiential training, resulting in increased preparedness and reduced risks for hazmat workers and those they serve. HazVR enables hazmat workers to safely practice using a simulated air monitor and support decision-making within the context of dangerous incidents that are otherwise very difficult and expensive to practice outside of actual incidents. This will enable hazmat workers to quickly and safely gain crucial experience that otherwise takes years to acquire due to the most dangerous incidents being rare.

Image Quality for First Responders

Speaker(s): Margaret H Pinson

TECHNICAL LEVEL: 2.5

This session provides a six-year overview of PSCR research to improve image quality for public safety. The team began in 2017 by talking with first responders about how they use cameras and the quality problems that hinder these tasks. Most of this session describes the research conducted into no reference (NR) metrics that will help cameras adjust their settings to better match first responder needs. The slides show technical details that hint at the complexity of this research, but those research details will be reviewed at a high-level so that the session can be appreciated by a wider audience.

Next-Generation User Interfaces in Public Safety: Accomplishments and Outlook

Speaker(s): Regis Kopper

TECHNICAL LEVEL: 1.5

This session presents an overview of the results from the University of North Carolina - Greensboro's PSIAP-UI project, which culminated with the deployment of next-generation user interfaces (UIs) for Police, Firefighting, and EMS scenarios. Researchers discuss the research and application outcomes of the project where virtual reality (VR) is used as a simulation platform for augmented technologies, and introduce their recently-funded TABA demonstration project. Here, UNC-Greensboro describes ongoing efforts to add the simulation of a traffic stop as a training alternative for a police department in NC, then discuss a plan to assess the benefits of the simulation as a training tool and the potential integration of next-generation UIs into future traffic stop protocols.

Peak Response 2.0: From MCIs to Daily Dispatched Runs 🎗

Speaker(s): Francis Li

TECHNICAL LEVEL: 1

Peak Response is a prize-winning tool for real-time patient documentation and first responder coordination. This session describes the evolution of the tool from a system for managing Mass Casualty Incidents (MCIs), the original prize challenge scope, to one that can be used for capturing the very first observations on scene during any dispatched run. In doing so, we address documentation gaps experienced by Peak Response's development partner, the San Francisco Fire Department, and enhance the value proposition of the tool as we explore bringing it to market. Furthermore, Integrating the tool into daily practice helps ensure immediate familiarity, comfort, and competence with the user interface from the moment an MCI begins.

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Virtual and Augmented Reality for First Responder Training and Operations

Speaker(s): David Kortenkamp

TECHNICAL LEVEL: 1

The VALOR project is developing Virtual and Augmented Reality testbeds for first responder training and operations. The testbeds include a full mixed reality training simulation for firefighters that incorporated standard fire fighting tools in a large-scale, virtual environment. Results from a recent user study conducted in that testbed and focused on identifying the most salient features required for an immersive experience will be presented. A second testbed is in development using Augmented Reality and the Microsoft HoloLens2 to train firefighters in pumper truck operations. This testbed extends work done to train NASA astronauts for International Space Station operations. A second user study is underway in that testbed.

Voices of First Responders: Five-Year Journey

Speaker(s): Yee-Yin Choong, Kerrianne Buchanan

TECHNICAL LEVEL: 1

It has been an exciting five-year journey conducting this mixed-methods study listening, analyzing, and amplifying the voices of first responders. This presentation shares new findings from the last round of data analyses: (1) inferential statistics contrasting differences such as rural vs. urban/suburban first responders and frontline responders vs. chief/management; (2) meta inferences from Phase one and Phase two integration. The session also summarizes key takeaways from this five-year research journey and provides actionable guidance and future directions.

What is Mobile Edge Computing?

Speaker(s): Paul Merritt

TECHNICAL LEVEL: 1.5

This session provides a basic understanding of Edge Computing, Multi-Access Edge Computing, and Mobile Edge Computing by discussing the history, advantages, disadvantages, applications, and implications of this new and growing technology.

XR Training for Public Safety: Lessons Learned from Industry and Academia

Speaker(s): Scott Ledgerwood, Jason Moats, John Dwyer, Robert Putfark

TECHNICAL LEVEL: 1

This moderated session discusses the lessons learned from developing and deploying extended reality (XR) training content with public safety. Learn from industry, academia, and public safety how they approached research and development for triage, advanced cardiac life support (ACLS), and even exo-skeleton assisted tasks. An overview of the NSF C-ACCEL LEARNER Platform and Health Scholar's ACLS training are provided, followed by a Q&A with the panel. Questions range from translating traditional training content to virtual reality, how to determine success, and working with standards and accreditation organizations for buy-in on this new platform.

TECH DEMOS

PSCR Staff

Analytics

ACE - A Public Safety Focused Toolkit to Test and Integrate Analytics Demonstrating Multi-stream Distributed Video Analytics and Edge Computing

Speaker(s): Jim Golden

This technical demonstration shows how the Analytics Container Environment (ACE) might be used be used to evaluate analytics technologies in public safety. It will demonstrate new features being added into ACE this year, for example, scaling ACE by distributing workloads over disparate networks using an edge device and applying analytics to multiple interrelated replay streams using the ASAPS public safety dataset.

Location-Based Services

Lidar Scans for Public Safety

Speaker(s): Alex Dimopoulos, Joe Grasso

At this demo table, conference attendees have the opportunity to use a mobile lidar scanning system to create point clouds of areas within the Westin Conference Center. PSCR staff will be present to discuss how point clouds are being used in projects such as the Augmented Reality Tracking Visualization project, and how labeled Point Clouds from the Point Cloud City projects are being used for the Future of Pre-Incident planning.

Mission Critical Voice

Comparing LMR and LTE Deployments for Voice Application

Speaker(s): Jordan O'Dell, Jonathan Cook, Sam Ray, Justin Sadinski

The PSCR mission critical voice (MCV) project team will use the PSCR Test Van with installed equipment to demonstrate techniques for measurement of LTE/broadband systems, measurement of P25 radio carriers, and development of test/simulation infrastructure for P25 mission critical push-to-talk (MCPTT). Additionally, the team will incorporate real-time and/or recorded video for demonstrations and will be available to discuss current testing capabilities and lessons learned.

Evaluation of New Radio D2D capabilities

Speaker(s): Chunmei Liu

This demo highlights the key features of 3GPP New Radio Sidelink channel that enable device-to-device communication in support of various services like vehicular (V2X) communication and proximity services (ProSe). Results from simulation scenarios are used to demonstrate the tradeoffs between different configuration options on capacity and coverage.

Quality of Experience Measurement System

Speaker(s): Alison Kahn, Cara O'Malley, Peter Fink

This demonstration presents PSCR's Mission Critical Voice Quality of Experience (MCV QoE) measurement system hardware and software functionality. This system enables developers, researchers, and other interested parties to quantify a first responder's voice communication experience on various hardware and software applications used in the field. The demonstration will include test setup and execution of the QoE measurements using the hardware platform, as well as data collection and analysis using the upgraded graphical user interface (GUI).

Open Innovation

Prize Competitions & Commercialization: Leveraging Industry and Academia to Advance Public Safety Research 🎀

Speaker(s): Stephanie Layman, Joanne Krumel

Stop by the Open Innovation Team's table to view posters and video highlights from PSCR's past prize competitions and innovators' progress towards commercializing their solutions to help first responders.

Learn how to get involved in upcoming competitions – as a public safety SME, a judge, or a competitor!

Share your perspective with PSCR's prize competition managers – we want to hear from innovators and first responders on how to enhance our research!

Resilient Systems

UAS 3.3 Shield Up! Winners: Solution Demonstrations 🎀

Speaker(s): Terese Manley, Roger Blalock

Ever stop to think about what might happen if an Unmanned Aircraft Systems (UAS) becomes the target of a cybersecurity attack?

As the use of UAS technology increases and improves communications for the public safety sector, so may the risks of UAS becoming cybersecurity targets. The third challenge in PSCR's 2021 First Responder UAS Triple Challenge, UAS 3.3: Shields Up! Securing Public Safety UAS Navigation and Control asked cybersecurity innovators to use their ingenuity and expertise to solve threats and vulnerabilities associated with UAS open-source software. Come check out the UAS 3.3: Shields Up! Demo table to explore challenge winners' innovative cybersecurity solutions!

Security

Mobile Fingerprint Capture Technologies: Prototypes from the mFIT Prize Challenge 🎀

Speaker(s): John Beltz, Gary Howarth

The mFIT Prize Challenge encouraged the public to develop and to test mobile platforms to aid first responder acquisition of fingerprints in the field. Come visit the demo table to use prototypes submitted to the competition.

User Interface/User Experience

Augmented Reality Tracking Visualization

Speaker(s): Jordan Smart, Paul Merritt, Joe Grasso, Charlsea Hansen

At this demo, attendees can test out Augmented Reality Tracking Visualization (ARTV): a new augmented reality project being developed collaboratively by the LBS and UI/UX portfolios. While wearing a Magic Leap headset, users will be able to view a lidar scan of the conference area with an overlay of real-time tracking information being sent from tracking devices to the headset. LBS and UI/UX staff will be on hand to discuss the project and how similar technology could be used by first responders in the future to enhance their tracking and navigation capabilities.

Image Quality Survey: Impact of Camera Noise on First Responders

Speaker(s): Margaret Pinson

First responders frequently operate cameras in low-light environments with inadequate lighting. This results in images and videos with high levels of camera noise. Image processing algorithms confuse this unwanted noise with desired detail. The goal of this demo is

for first responders to rate the quality of images and videos with noise impairments, to quantify the impact of this noise on real time response, evidence, etc. The resulting dataset will be shared as open data, to help researchers and product developers to understand and address first responder needs.

UI/UX Extended Reality (XR) Research

Speaker(s): Matt Whitlock, Jack Lewis, Julia Chelen, Jeff Karhoff

This demo showcases various projects under the User Interface/User Experience (UI/UX) Extended Reality (XR) for Improved UIs. Oculus Quest and/or Vive Focus 3 demos for SWAT and XR Onboarding projects are available. A tablet and monitor for showcasing MQTT data broker, WebXR CHARIOT app, and Nav HUDs from a warehouse scenario are also available for review. Stakeholders will have the opportunity to try the different experiences and engage with the UIUX developers and researchers.

Award Recipients

Analytics

Customizable Video Analytics

Speaker(s): Shishir Shah

During this demo, the University of Houston showcases our platform for customizable video analytics and demonstrates how it can be used to design automated video analytics for different public safety use-case scenarios. Additionally, our demo displays how these solutions can facilitate detection of events of interest and alerting.

Video Analytics Tools for Public Safety

Speaker(s): Alexander Hauptmann, Xiaoyu Zhu

This demo presents a set of video analytics tools for processing video in the context of public safety. These include systems for Activity Recognition, Gunshot Detection, Guntype Identification, Shooter Localization, Crowd Counting, Crowd Density Measurement, Traffic Monitoring, and Disaster Damage Assessment using video from surveillance cameras, unmanned aerial vehicle (UAV) video, cell phone recordings or news footage. We will broadly explain the underlying technology for each tool and show examples of use cases.

Cross-Cutting

PSIAP-2022 Poster Session

Speaker(s): PSIAP-2022 awardees

Come meet the awardees from PSCR's last major funding opportunity, the Public Safety Innovation Accelerator Program 2022 (PSIAP-2022)! The award recipients will have posters to showcase their different projects and discuss their plans for future implementation.

Location Based Services

Foot-mounted System for self-contained Localization and Navigation

Speaker(s): Andrei M. Shkel

Demonstration of "Lab-on-Shoe" and "Sugar Cube" foot-mounted platforms. The attendees will witness the system in action performing GPS-free self-contained indoor navigation.

FRST Challenge Indoor Tracking Technologies Poster Session 🎗

Speaker(s): Sonny Kirkley

The First Responder Smart Tracking (FRST) Challenge is a prize challenge focused on smart, accurate, indoor 3D location tracking of first responders. This poster session will feature indoor location tracking technologies under development by several competitors who are advancing through the competition.

Mission Critical Voice

Hands on Conformance Testing: How to Evaluate That a MCPTT UE is 3GPP Compliant

Speaker(s): Fidel Liberal, Michael Proestler

This demo demonstrates how the mission critical services (MCS) testing as a service (TaaSting) platform enables easy and cost-efficient evaluation of mission critical push-to-talk (MCPTT) compliance, fully supporting the whole process defined by 3GPP. Therefore visitors, including end-users (first responders), MCS vendors and operators will have a hands-on experience of what the process entails and how they can integrate it in their integration and acceptance labs and/or their internal development processes.

Furthermore, the on-site extension allows the evaluation of the radio interface, including the required mission critical LTE signaling.

Keysight UXM5G: Basestation Emulation for MCPTT

Speaker(s): Vince Nguyen, Alden Kane

Learn about Keysight's unparalleled UXM5G base station emulator. UXM5G is a top-notch solution for conformance, acceptance, functional, and radio frequency (RF) testing of 5G devices. In this demo, we will go through Keysight's unique set of Mission Critical Push-to-Talk test cases, developed in collaboration with NIST PSCR.

LMR Data Collection to Support Research in Support of LMR to LTE Transition

Speaker(s): Walt Magnussen, Jian Tao

The public safety industry will move from Land Mobile Radio (LMR) hosted voice to LTE hosted voice video and data. The difference between mission critical services and over-the-top applications is how radio frequency (RF) resources are allocated to the prioritized services applications and the network loading impact that it will have. To understand this, the Internet2 Technology Evaluation Center (ITEC) will create an LMR dataset collected from 10 public safety agencies across the United States.

The ITEC will discuss work with 10 agencies that have been identified to collect all LMR traffic data over a 10 day period which anticipate heavy LMR traffic usage (for example, 4th of July in Washington, D.C.).

LMR LTE Interworking

Speaker(s): Robin Grier

This is a demonstration of voice communications between legacy Land Mobile Radio subscriber units and Smartphones with mission critical push-to-talk applications on LTE networks, such as FirstNet.

QoS-Tunable handset-to-handset testbed

Speaker(s): Jan Janak

The QoS-Tunable handset-to-handset testbed can emulate a variety of channel conditions to permit experimentation and measure the effectiveness of communication by first responders as a function of the quality of the channel. The testbed can operate either with a single user (using speech-to-text or listening to a synthetic voice), or between two users at remote locations.

QUARC: Quality Under Adjustable Realistic Conditions for Communication Systems

Speaker(s): Kevin Berman

This demo showcases GTRI's state of the art push-to-talk radio communication system. It demonstrates the ability to adjust five different key performance indicators (KPIs) in VoIP communication systems and how they affect the quality of experience for mission-critical voice for first responders. The demo includes more than three radios and an impairment server so that users can adjust radio communication key performance indicators (KPIs) in real time and hear their effect, and also presents GTRI's latest v3.0 hardware and enclosure.

Resilient Systems

DistressNet-NG: A Resilient Broadband and Edge Computing Framework for FirstNet

Speaker(s): Radu Stoleru

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. Mobile devices 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.

Wildfire Data Logistics Network (WDLN)

Speaker(s): Nancy French, Martin Swany

This demo has a fully functional wildfire data logistics (WDLN) system that will show the entire data transfer process from origination of the file, to the ferry system, and finally, to the end ATAK user.

User Interface/User Experience

An Augmented Reality-Enhanced Fire Pump Operator Training Tool

Speaker(s): Laura Haak Marcial

RTI International will demonstrate an initial version of an augmented reality (AR)-enhanced tool for the HoloLens, designed to support basic training on the use of the pump panel interface. This initial design will test the learner's ability to recall basic facts and concepts deemed important to pump panel operations. Definitions will overlay corresponding pump components, and interactions will change based on the mode (explore or challenge) a learner selects.

ARTEMIS: Using Virtual Reality to Test Augmented Reality

Speaker(s): Nicole Kosoris

This session presents the ARTEMIS (Augmented Reality Testing of Equipment in Multiple Immersive Simulations) system. ARTEMIS

gives us a way to test out potential FirstNet enabled technologies for first responders. We enable groups such as police officers, fire fighters, or EMTs to test ideas virtually without needing to first develop complex physical equipment. In our current work, police officers can test out virtual display elements for heads-up displays. The ARTEMIS system lets us quickly discover pain points in implementing emerging technologies.

Beyond CHARIoT: A Live Demo of AR Ops Center Interfaces for Public Safety ⚜

Speaker(s): Jad Meouchy

This live, interactive demonstration allows attendees to step into an augmented reality (AR) operations center "sandbox" and respond to different emergency scenarios. Attendees will be able to arrange and rearrange data visualization components, enable different configurations of heads-up displays (HUDs), and control displays of mapping layers including weather. As the experience is inherently multi-user, attendees will be encouraged to join two at a time and collaborate throughout the scenario. An experienced proctor will be present as well to explain the different elements and demonstrate critical features.

Cognition-Driven Adaptive Wayfinding System: Application of AR and Robot Dog

Speaker(s): Eric Jing Du, Joe Gabbard

This demo shows the use of a robot dog, augmented reality headsets, and neural activities measurement technologies in simulated wayfinding tasks. Special effects, such as "seeing through walls" and automated adjustment of wayfinding user interface based on the real-time measures of cognitive load levels will be demonstrated as well.

Edge-supported Augmented Reality for Visual Collaboration

Speaker(s): Suman Banjeree

First responders routinely make split-second decisions under stressful conditions. Easy access to information can alter the outcome in scenarios ranging from fire and medical rescue to combative persons. We will demonstrate prototype augmented reality (AR) applications designed for indoor scenarios that leverage sensors in AR headsets for indoor localization and mapping, as well as an edge computing platform for data exchange and processing. We will show how visual information can be shared between team members and displayed unobtrusively in an AR view for such tasks as viewing team members or objective locations on a map and recording the location of equipment or safety hazards.

Emergency Response Information System (ERIS) ⚜

Speaker(s): Yohan Baillot

Emergency Response Information system (ERIS) is a multi-user Augmented Reality (AR) platform that leverages real-time data from external IoT sensors streamed from an MQ Telemetry Transport (MQTT) server and user input to display relevant information, using iconography to annotate the natural world and a topographic map of the surrounding environment. The system communicates real-time information visually, quickly, and efficiently to first responders in the field.

HazVR: Hazardous Material Training with Virtual Reality

Speaker(s): Jason Jerald, Connor Shipway, Charles Laird, Charlie Fair, JJ Farantatos

HazVR is a hazmat training module to be used in classroom settings. The goal of the project is to provide experiential training, resulting in increased preparedness and reduced risks for hazmat workers and those they serve. HazVR enables hazmat workers to safely practice using a simulated air monitor and support decision making within the context of dangerous incidents that are otherwise very difficult and expensive to practice outside of actual incidents. The training model will allow hazmat workers to quickly and safely gain

crucial experience that otherwise takes years to acquire due to the most dangerous incidents being rare.

Hyper-Reality Helmet for First Responders

Speaker(s): Yang Cai

Carnegie Mellon University has developed a prototype of the holographic heads-up display (HUD) on a helmet, called "Hyper-Reality Helmet." The term "hyper" means it provides more real-time information than ordinary augmented reality (AR) systems. This demo shows the real-time thermal imaging overlay, remote fever detection, and video streaming from a drone.

Incident Response Intelligence Solution 🎗

Speaker(s): Radhakishan Shetty, Ryan Poltermann, David Van Ballegooijen

This is a demonstration of the CHARIoT Challenge's Augmented Reality for Public Safety Situational Awareness interface and open data for public safety. Team JANUS's solution set out to enable end users to intuitively interact with and manipulate the virtual objects through their Incident Response Augmentation Headset (IRAH) platform. This demonstration will show how they integrated public safety partner input to shape their designs and ensure interfaces best meet the needs of first responders.

Peak Response 2.0: Real-time patient documentation and MCI coordination

Speaker(s): Francis Li

Peak Response 2.0 is the latest iteration of the prize-winning mass casualty incident (MCI) coordination app – now designed to support capturing the very first observations on scene of any dispatched run. Attendees will be able to explore and experience the Peak Response interface, including its voice-to-text capture capabilities, with a hands-on demonstration of patient documentation during everyday dispatched runs, as well as the seamless transition to MCI scene coordination and management.

RespondAR: Integrating IoT with Augmented Reality 🎗

Speaker(s): Jason Jerald, Connor Shipway, Charles Laird, Charlie Fair, JJ Farantatos

First responders have significant challenges that are quite unique compared to other professions. We believe augmented reality (AR), when used appropriately for the right use cases, has the potential to significantly enhance first responder operations during critical incidents. Our goal for this project was to prototype AR interfaces in order to demonstrate how emerging technologies might be best utilized by first responders with future technology. The purpose of this demo is to create a conversational starting point for what capabilities and benefits augmented reality might be able to support in future public safety operations.

Simulating Next-Generation Public Safety User Interfaces in Virtual Reality

Speaker(s): Regis Kopper, Dalton Costa

Imagine, in the not-so-distant future, a world where first responders are equipped with sensors and advanced displays integrated within their gear. Police officers are alerted about risk escalation even before they can reach out to their dash computer; firefighters immediately see the location of all teammates in a burning building; paramedics are immediately aware of medical risks from a critical patient. While these technologies are not yet available in the real world, the audience will experience them first-hand through virtual reality (VR) simulations in this demo. Attendees can try on VR headsets and be transported to scenarios in police, firefighting, and EMS that simulate realistic situations with the aid of advanced next-generation technology.

VR-Based Emergency Response Scenario and Prototype Intelligent User Interface

Speaker(s): Randall Spain, Will Parente

This demonstration provides an overview of a virtual reality (VR)-based emergency response scenario and prototype 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, was developed by gathering requirements and feedback from our partner public safety organization. It includes three missions and additional parameters for evaluating the impact of information display and interaction modalities on mission performance and user experience. We will demonstrate the VR scenario and showcase how users can interact with the prototype HUD.

Commercialization

The R2 Network; Addressing Disaster Response & Resiliency Challenges

Speaker(s): Bryce Stirton

The Economic Development Administration (EDA), in collaboration with NIST and FirstNet, created the Accelerate R2 Network Challenge to help address the nation's most pressing disaster response and resiliency (R2) challenges with innovative technologies. A public-private partnership between RapidSOS, Responder Corp, Orleans Parish Communication District, and Western Fire Chiefs Association was awarded the R2 Network Challenge grant in 2021. Now, the partners are working together to build and scale a national, free-to-use, and self-sustaining Response & Resiliency Network that brings stakeholders together for a common goal: to support innovators and agencies in empowering first responders with the tools and technologies they need to stay safe and protect our communities.

The R2 Network consists of a three-part approach:

- R2 Learn: Resources to educate entrepreneurs and public safety departments on the unique challenges and opportunities of the public safety markets.
- R2 Portal: An online solution innovators and departments can use to source, vet, and commercialize or deploy new technology.
- R2 Connect: Programming and events to create strategic exchange and enable the community to share, learn, and adopt best practices and new technology.

At this demo, attendees will learn about the benefits of joining the R2 Network and how the R2 Network is driving change within the industry by working to close critical gaps between innovators and First Responders.

SESSION SPEAKERS

Homa Alemzadeh

Homa Alemzadeh is an Assistant Professor in the Department of Electrical and Computer Engineering (ECE) with a courtesy appointment in the Department of Computer Science (CS) at the University of Virginia. She is also affiliated with the Link Lab, a multi-disciplinary center for research and education in Cyber-Physical Systems (CPS). Before joining UVA, she was a research staff member at the IBM T. J. Watson Research Center. Her research interests are at the intersection of computer systems dependability and data science, particularly data-driven design and validation of resilient CPS with applications to medical devices, surgical robots, and autonomous systems. Homa received her Ph.D. in Electrical and Computer Engineering from the University of Illinois at Urbana-Champaign. She is the recipient of the 2022 NSF CAREER Award and 2017 William C. Carter Ph.D. Dissertation Award in Dependability from the IEEE TC and IFIP Working Group 10.4 on Dependable Computing and Fault Tolerance.

Reggie Ash

Reggie Ash is a retired U.S. Air Force Colonel, having served over 24 years as a cyber officer. He commanded Communications Squadrons at Travis Air Force Base (AFB), California and Bagram Airfield, Afghanistan. He served at the U.S. State Department as the Senior Military Advisor for European and Eurasian Affairs. In his final assignment, Ash commanded the 21st Mission Support Group, leading the six squadrons that manage Peterson AFB and support Cheyenne Mountain Air Force Station, North American Aerospace Defense Command (NORAD), U.S. Northern Command, and Air Force Space Command. Since retiring from the U.S. Air Force, he has been a leader in the nonprofit world by creating Colorado's first military themed charter school and leading the Colorado Springs defense business community at the Chamber & EDC. He has served on multiple boards, including the Board of Advisors for the National Cybersecurity Center, and as an Alternate Member of the Colorado Springs Utilities Policy Advisory Committee.

Yohan Baillot

Yohan Baillot is a long term veteran in the field of Augmented Reality – with 25 years of hands-on experience with the technology. He has worked primarily with the U.S. Army and Navy and enterprise clients on many verticals, always staying at the forefront of AR technologies. Baillot was part of the 1999 ONR Battlefield Augmented Reality System (BARS) program at the DC Naval Research Laboratory Code 5580, where he trained and provided situational awareness to dismounted Marines. He also developed the ITT Situation Awareness for Fire Emergency augmenting personnel, as well as sensors on a video of unmapped buildings from an AR vehicle. His defense work culminated with the test of the same AR vehicle at C4ISR OTM NJ Army experiment in 2010, and the testing of that same platform to annotate underground bombs detected by the US Army Lab SIRE UWB radar at the China Lake proving ground in 2011 as well. Baillot founded ARCortex INC in 1999 – capitalizing on its experience by providing AR software development and integration services for the enterprise and defense markets. His production of the WorldEngine platform has also allowed developers to create large scale multi-users cross-platform AR experiences much faster. Baillot has a M.S. in EE and an M.S. in CS and is the author of 6 AR patents and more than 20 academic papers and is currently an advisor of the Open AR Cloud.

Megan Blackwell

Megan Blackwell has over a decade of experience developing sensors for medical sensing and intelligence, surveillance, and reconnaissance applications. She is a Principal Investigator at Pison Technologies.

Travis Balthazor

Travis Balthazor oversees flight instructors and pilots for UAS research, outreach, and flight training. He has extensive knowledge of the current 14 CFR Part 107 regulations and waivers, Public Certificates of Authorizations, and Section 44807 Exemptions. As a Flight Operations Manager, he ensures that all flight operations are conducted according to applicable regulations, and routinely works with the Federal Aviation Administration (FAA) to gain operational approval for flights that are outside the regulatory constraints. Balthazor received a master's degree with a focus in Unmanned Aerial Systems (UAS) technology following his completion of a B.S. in Aeronautical Technology Professional Pilot. He also previously completed a minor in Aviation Safety, and an Unmanned Aircraft Systems certificate from Kansas State University. Balthazor holds several manned flight ratings, including commercial instrument multi-engine airplane and certified flight instructor instrument airplane. As a flight instructor, Balthazor trains and endorses students on check rides. He holds part-time faculty status and routinely teaches course offerings to degree-seeking students. He also instructs professional courses directly to the public where he trains individuals, companies, and departments to integrate UAS within their respective industries. These courses span many industries but are often directly taught to DOTs, law enforcement, public safety, academia, and power infrastructure.

Suman Banerjee

Suman Banerjee is the David J. DeWitt Professor in Computer Sciences at University of Wisconsin-Madison and the founding director of the Wireless and NetworkinG Systems (WiNGS) (WiNGS) laboratory, which broadly focuses on research in wireless and mobile networking systems. He is the inaugural recipient of the ACM SIGMOBILE Rockstar award and a recipient of the NSF Career Award. He is a recipient of multiple award papers at various conferences such as ACM MobiCom, ACM CoNEXT, and IEEE Dyspan. Additionally, the technology developed by Professor Banerjee has won various accolades including the first prize at the Wisconsin Governor's Business Plan

Through competitions in 2011, and the Interdigital Innovation Challenge in 2012, he has led significant technical projects from design to full deployment, including the design of a wireless communications system that was installed in ambulances of the West Allis Fire Department, and later used as the main communication system for these vehicles for more than 2 years.

Scott Barthelmass

Scott Barthelmass is a 29-year veteran of public safety with experience in the fire service (structural and wildland), emergency medical services (EMS), law enforcement, hazmat, and search and rescue. He currently serves as Assistant Chief for the Eureka Fire Protection District in suburban St. Louis, Missouri.

John Beltz

John Beltz is the IT Security Manager for Communication Technology Laboratory (CTL), Public Safety Communications Research (PSCR) Division. He leads security-specific public safety research projects and incorporates security into all aspects of PSCR research. Additionally, he ensures that adequate security controls are in place to protect the diverse PSCR demonstration network from cybersecurity threats. Beltz's background is in network security. In his previous role, he managed security teams at NIST completing A&A activities such as project management, security architecture consultation, network, and web application vulnerability scanning and analysis, hands-on technical testing, and reporting results to executive authorizing officials. Prior to that, he performed similar services as a senior consultant with Booz Allen Hamilton. Beltz is a proud veteran of the US Army where he served his country for six years. He completed his bachelor's degree at Hawaii Pacific University during his military career, majoring in Computer Information Systems. He also completed a Graduate Degree at Johns Hopkins University in Information and Telecommunication Systems.

Kevin Berman

Kevin Berman is a Research Engineer II in the Aerospace, Transportation, and Advanced System Laboratory at the Georgia Tech Research Institute (GTRI). He joined GTRI in 2016 after graduating from Georgia Institute of Technology with a Master of Science in Electrical Engineering, where he specialized in digital signal processing. He received a bachelor's degree in Electrical Engineering

from the Georgia Institute of Technology with a minor in Mathematics in 2015. Berman has served as the secretary for the Atlanta section IEEE Signal Processing Society since 2019. His primary research interest areas are in digital signal processing, communication technologies, image processing, applying machine learning techniques to health applications, and wavelets.

Kyle Bishop

Kyle Bishop graduated from George Mason University with a Bachelor of Fine Arts in Computer Game Design in 2013. He co-founded Little Arms Studios (LAS), an innovative company currently focused on creating training simulation platforms for public safety and professional development. LAS leverages technology to help prevent loss of life and damage to property by making training safer, measurable, and more effective.

Saurabh Biswas

Saurabh Biswas is Executive Director for Commercialization and Entrepreneurship for Texas A&M Engineering Experiment Station (TEES). He leads the creation of start-ups and joint ventures at TEES/Texas A&M University and assists with commercialization of new technologies.

Sudipto Biswas

Sudipto is the Principal Investigator in the Mission-Critical-Voice-Test-Equipment project being executed by Polaris Networks, in a cooperative agreement with NIST since 2019. He has an M.S. in Computer Science, and has worked in various roles over 25 years, including software development and technical pre-sales. His experience covers various layers of software including user and system applications, OS subsystems, and device drivers. As a part of the software service industry, he has worked closely with customers worldwide, including IBM, Lucent, Ixia, Swisscom, Motorola, Toshiba, and Sony.

John Blackwell

John Blackwell is the founder and Chief Technology Officer at Diamond Age Technology, an innovation company focused on spatial-computed solutions, such as digital-twins, simulated realities, and extended reality (XR). He splits his time between leading the product innovation team and learning from stakeholders about the problems that need solving. He serves as a member of the UL 8400 Standards and Safety Technical Panel for Virtual Reality, Augmented Reality, and Mixed Reality, as well as the Technology Advisor for the Professional Aviation Board of Certification. In the past, he worked as a Multimedia Specialist for NASA's Lunar and Planetary Institute, and owned and operated a documentary media-production company.

Roger Blalock

Roger Blalock is the Resilient Systems portfolio lead for Public Safety Communications Research (PSCR) Division within NIST. In this role, he collaborates with award recipients to further innovation in reliable first responder communication technology. Recently, he became the technical lead for the PSCR UAS Challenges and was instrumental in the design and execution of the UAS Triple Challenge; he is now working with the Open Innovation team to plan future UAS challenges. In addition, he serves on the lab and network operations team and fills the role of facilities manager for PSCR. Roger joined PSCR with over 17 years' experience in the telecommunications industry. Initially, he worked with system test automation for 3G cellular networks, but also spent time doing new feature deployment in overseas markets. He earned a Bachelor of Science in Electrical Engineering in 1997 and will complete a Master of Science in Information Systems Security from the University of Denver later this year.

Jeff Bratcher

Jeffrey Bratcher is the Chief Network and Technology Officer of the FirstNet Authority. He is a key leader involved with the shaping of the technology for the Nationwide Public Safety Broadband Network (NPSBN). He has previously led the formation of the FirstNet Authority technology teams, as well as the state-of-the-art Innovation and Technology lab located at the FirstNet Authority office in

Boulder, Colorado. Building upon his success as the Chief Technology Officer, Bratcher was also appointed to lead the network team overseeing the implementation of the nationwide FirstNet broadband network built with AT&T. He began his federal service in 2003 with the National Telecommunications and Information Administration (NTIA) Institute for Telecommunication Sciences (ITS) also located in Boulder, Colorado. Prior to joining federal service, he worked for ten years within the wireless private sector deploying several of the first digital cellular systems in U.S. and international markets. Mr. Bratcher received his B.S. in Electrical Engineering from Texas Tech University and his M.S. in Telecommunications from Southern Methodist University.

Kerrianne Buchanan

Dr. Kerrianne Buchanan is currently a Social Scientist in the Visualization and Usability Group in the Information Technology Laboratory at NIST where she works on projects seeking to improve human system interaction. She has a master's degree in Applied Cognition in Neuroscience and a Ph.D. in Psychological Sciences from the University of Texas at Dallas.

Cody Buntain

Cody Buntain is an Assistant Professor at the iSchool at the University of Maryland. He studies social media and how people engage online, particularly during disasters and times of unrest. His work focuses on three areas: crisis informatics, online political engagement, and information quality. These areas include disinformation, health misinformation, and online manipulation.

Yang Cai

Dr. Yang Cai is the Director of Visual Intelligence Studio, College of Engineering, Carnegie Mellon University. He is the author and editor of six books about intelligence systems and the PI of the NIST PSCR-PSIAP-sponsored research project "Extreme Reality Interfaces for Telemetry". His team won the Haptic Interface Challenge in 2019.

Ian Carpenter

Ian Carpenter is a knowledgeable, innovative entrepreneur in telecommunication and network testing. With over 24 years of experience, he has traveled extensively to understand and address the latest telecommunications and network test challenges in several countries. He has remained at the forefront of testing and verifying next generation (NextGen) telecommunications and public safety test tools through his technical understanding of the network protocols and test challenges, providing innovative solutions to address the challenges, guaranteeing attentive services. More recently, he has played an integral role in the development of test technologies for Project25 (P25) Inter-RF Subsystem Interface (ISSI) and Console Subsystem Interface (CSSI), and Mission Critical (MC) Push-to-Talk/MCVideo/MCData. He is an active member of the TIA Project 25 ISSI Technology Interest Group and oversees the company's involvement in ETSI MCX Plugtest events.

Kurt Carraway

After serving 25 years with the United States Air Force, retired Colonel Kurt J. Carraway is the Unmanned Aircraft Systems (UAS) Executive Director of the Applied Aviation Research Center (AARC) and UAS Department Head at Kansas State University's (KSU) Salina Campus. In this capacity, Carraway provides strategic leadership in advancing KSU's UAS program goals. He directs the execution of research activities involving UAS through the AARC, as well as flight operations development and maturation of the UAS training program through direct supervision of the Flight Operations staff. He manages highly skilled UAS professionals that perform hundreds of UAS flights per year in civil airspace, and sets policies and procedures for unmanned flight operations. Carraway currently serves as Principal Investigator (PI) on UAS activities through the AARC and is the University PI representative to ASSURE, the FAA's UAS Center of Excellence. He received a Bachelor of Science in Mechanical Engineering at the University of Missouri Science and Technology in Rolla, prior to entering the Air Force. During his service, Carraway also completed a Master of Science in Systems Engineering at the Air Force Institute of Technology on the Wright-Patterson Air Force Base in Dayton, Ohio, and a Master of Arts in Management from Webster University in St. Louis, Missouri.

Richard Carrizzo

Chief Richard Carrizzo is the Vice Chair of the FirstNet Board. He has been in the fire and emergency service for more than 39 years and is currently the Fire Chief for the Southern Platte Fire Protection District (MO). Since his appointment to Fire Chief in 1995, he has successfully managed the transition from an all-volunteer to a combination department, to a fully career department operating out of four stations. Active in local, state and national fire service professional organizations, Chief Carrizzo served as President for the International Association of Fire Chiefs (IAFC) during the 2020-21 term; is Past-President of the Heart of America Metro Fire Chief's Council; and executive Board member for two regional fire chief associations. Regional collaboration is very important, and he serves on the Mid-America Regional Council's (MARC) Public Safety Communications Board as one of two metro fire chief representatives coordinating and setting policy for the entire 9-1-1 system in the nine counties and 120 cities within the metropolitan, bi-state region of Kansas City. Chief Carrizzo holds a Master of Business Administration degree, a Bachelor's degree in Business Administration, an Associate degree in Applied Science in Fire Science and is a graduate of the NFA Executive Fire Officer Program. He is also a graduate of the Executive Leaders Program at the Naval Postgraduate School for Homeland Defense and Security. He also holds the designation of MIFireE.

Julia Chelen

Dr. Julia Chelen is a Decision Scientist with the National Institute of Standards and Technology (NIST). Within NIST's Public Safety Communication Research Division, Chelen leads the User Interface/User Experience portfolio's research on human judgment and decision making. Her research combines computational methods and behavioral decision theory to understand how individuals and organizations make decisions in various contexts. Formerly, Chelen was a Research Associate with the Dartmouth Institute in the Geisel School of Medicine at Dartmouth College, the Assistant Director of the Johns Hopkins University Center for Advanced Modeling in the Social, Behavioral, and Health Sciences, and a research member of the Center for Social and Economic Dynamics at the Brookings Institution. She holds a Ph.D. in Engineering and Public Policy, as well as B.S. in Decision Science and Public Policy, and Management, from Carnegie Mellon University.

Yee-Yin Choong

Dr. Yee-Yin Choong is a Human Factors Scientist in the Visualization and Usability Group in the Information Technology Laboratory at NIST. She conducts research in human-centered design and evaluation, public safety communication technology, augmented-reality usability, usable cybersecurity, and biometrics usability. She also currently leads the usability research effort supporting NIST PSCR User Interface/User Experience (UI/UX) Portfolio. Dr. Choong received her master's degree in Industrial Engineering from the Pennsylvania State University and her Ph.D. in Industrial Engineering with a specialization in Human Factors from Purdue University.

Jeff Cohen

Jeffrey Cohen is Chief Counsel and Director of Government Relations at Association of Public-Safety Communications Officials (APCO) International. In this capacity, Jeff provides strategic guidance on policy, legislative, and regulatory matters to advance the Association's work on public safety and emergency communications. Prior to joining APCO, Jeff served as a detailee from the Federal Communications Commission (FCC) to the Communications and Technology Subcommittee of the House of Representatives Energy and Commerce Committee. While on the Hill, Cohen was one of the authors of the FirstNet public safety legislation enacted in February 2012. At the FCC, he was Senior Legal Counsel to the Chief of the Public Safety and Homeland Security Bureau. Before his move to the federal government, Cohen was a partner at the Washington, D.C. telecommunications law firm of Wilkinson Barker Knauer, LLP, where he worked over ten years on wireless regulatory matters after graduating from the George Washington University Law School with honors in 1994. Cohen also holds a B.S. cum laude in electrical engineering from The George Washington University. He is a recipient of the FCC's Silver Medal Award, APCO's Leadership in Regulatory Service Award, and the National Emergency Number Association's Presidential Award.

Kim Coleman

Kim Coleman Madsen is a Senior Public Safety Advisor with the First Responder Network Authority (FirstNet Authority), working in the Stakeholder Collaboration Division. She has over 25 years of experience in public safety communications, including supervising an Emergency Communications Center, working as the Policy Manager with the State of Colorado Public Safety Communications Network, and most recently at the state level in public safety broadband planning efforts before moving to the FirstNet Authority in 2019.

Jonathan Cook

Jonathan Cook has over 40 years of experience in radio frequency (RF) and software engineering. He has worked for NIST PSCR since 2011. His experience includes working for Northrup-Grumman, Qualcomm, and Ericsson before working at NIST. Cook obtained a Bachelor of Science degree in electrical engineering from the University of Missouri - Rolla (now Missouri University of Science and Technology), graduating summa cum laude.

Dalton Costa

Dalton Costa is a Research Assistant in the Interactive Realities Lab at the University of North Carolina - Greensboro. His research interests involve virtual reality (VR) simulations and global health. He also develops research in the field of psychology, specifically in psychological assessment. He received his bachelor's degree in Psychology (2021) from the Federal University of Health Sciences of Porto Alegre, Brazil.

Zhuangzhuang Dai

Zhuangzhuang Dai is currently a NIST Software Engineer at the Cyber Physical Systems group in the Oxford University, Department of Computer Science. He received a Bachelor of Engineering degree in Electrical & Electronics Engineering from University of Birmingham and a Master of Science degree in Digital Communications from the University of Bath. He obtained a Ph.D. from the University of Bath before completing a knowledge transfer project for the University of Manchester. His research interests include embedded systems, radio frequency (RF) modeling, and indoor and urban localization.

Alex Dimopoulos

Alexander Dimopoulos works as a machine learning (ML) Developer on the PSCR location-based services (LBS) team. He has spent his career researching machine learning at the Air Force Research Laboratory, competed in the DARPA SubT Challenge with NASA Jet Propulsion Laboratories, and studied Cognitive Science at the University of California San Diego.

Eric Jing Du

Eric Jing Du is an associate professor in the department of civil engineering and the department of industrial and system engineering at University of Florida. His research focuses on the use of Mixed Reality (e.g., VR and AR) and artificial intelligence (AI) for augmenting first responders' situational awareness in search and rescue tasks. He is the elected secretary of the Visualization, Information Modeling and Simulation (VIMS) committee of the American Society of Civil Engineers (ASCE). His research is continuously supported by NIST, National Science Foundation (NSF), and NASA.

John Dwyer

John is currently the Virtual Reality Product Owner at Health Scholars. He has a Ph.D. in Renaissance and Reformation history from the University of Colorado and a master's degree in Learning Design and Technology from Harvard. He taught History at the University of Colorado and has been working in instructional design in healthcare for over 25 years. He has created hundreds of instructional content pieces delivered in person and through live webinars, enduring elearning and virtual reality (VR). Dwyer has served as Director of Live Education for AMN Healthcare and as the Senior Instructional Designer for Simbionix, MEDamorphis, and the Optera Group.

Additionally, he contributed as the Co-principal Investigator on three studies into the efficacy of VR training in healthcare.

Charles Fair

Lieutenant Charlie Fair has been delivering information technology for the public safety community for over 31 years. Charlie started his EMS career as an EMT, advanced to paramedic, and was promoted to Lieutenant as the lead provider of the ambulance crew with Sedgwick County EMS, the largest EMS provider in the state of Kansas. He was also an assistant and active member of 3 special operations teams, Disaster Medical Support Unit (DMSU), Bike Medic Team, and the Radiation Support Team. He is active with a number of national projects and committees that Include First Net, Tech to Protect, NIST, PSRC, Napsgfoundation.org and I-AXIS. Charlie recently retired and is now a subject matter expert (SME) for public safety, EMS and a consultant.

JJ Farantatos

JJ Farantatos works part-time for NextGen Interactions as a first-responder subject matter expert. He is a career firefighter, a qualified instructor, and a hazmat specialist and technical advisor for Wake County Local Emergency Planning Committee (LEPC).He also serves as a member of North Carolina Hazardous Materials Regional Response team 4 and the North Carolina Urban Search and Rescue task force 8.

Peter Fink

Peter Fink is an Electronics Engineer on the Mission Critical Voice (MCV) team within PSCR at NIST. His focus is on designing new software to measure the quality of experience for first responders' communications and developing software enhancements to current systems. He holds a Bachelor of Science in Computer Engineering from California State University Fullerton.

Bill Fisher

Bill Fisher is a Security Engineer at the National Cybersecurity Center of Excellence (NCCoE). In this role, he is responsible for leading a team of engineers that work collaboratively with industry partners to address cybersecurity business challenges facing the nation. He led the center's Attribute Based Access Control (ABAC) project and was a member of the Informational Technology Laboratory (ITL) Cybersecurity for IoT program. Currently he lead's the NCCoE Public Safety and Data Security programs and is a member of the NCCoE ransomware team.

Sterling Folden

Chief Sterling Folden has been serving in the Boulder County area for over 30 years and has been Deputy Fire Chief for over 18 years. His service began at the Cherryvale Fire Protection District, climbing through the ranks from Firefighter to Deputy Chief. He has experienced many aspects of the fire service from emergency operations to prevention and administration. Chief Folden is a graduate of the University of Denver and holds a Master of Organizational Leadership focusing on innovation and change along with a Graduate Certificate in Organizational Development. He completed his Bachelor of Fire and Emergency Services Administration at Metropolitan State University and has his Chief Fire Officer Designation from the Center for Public Safety Excellence.

Joe Fournier

Joe Fournier has over 30 years of experience in the wireless domain working on product, system and network level research and development. He is currently with Defence Research and Development Canada's Centre for Security Science (DRDC CSS) in Ottawa where he is responsible for the Wireless Technology portfolio. Prior to this, he led the wireless network design group at the Communications Research Centre (CRC) at Innovation Science and Economic Development. Of significance, he has been active in Canada's Public Safety Broadband Network initiative for over 10 years. Before joining the Federal Government, Fournier held senior management positions at a number of Telecommunications organizations including Intelcan, Newbridge Networks and Alcatel Networks. While at Alcatel, he was Associate Vice President of Broadband Wireless. Over his career, he has traveled to and has been

involved with many turnkey wireless network designs and implementations in North and South America, the Caribbean, Europe, Africa and Asia. Fournier has a B.A.Sc. from the University of Ottawa in Electrical Engineering.

Nancy French

Dr. Nancy French has been working on applications of remote sensing to ecology and vegetation studies for more than 30 years. Dr. French's primary research has focused on wildfires and their effect on the structure and function of terrestrial ecosystems. Her research has included studies in boreal, arctic, and temperate ecosystems of North America and Eurasia and the use of remote sensing technologies to understand the impacts of fire on ecosystems and carbon cycling. Her research has included mapping and monitoring burn severity, as well as sensing surface moisture conditions and the development of geospatial methods for quantifying wildland fire emissions of carbon and air pollutants. Dr. French is currently leading projects to improve the characterization of wildland fire fuels, fire and smoke modeling, and access to geospatial data for wildfire operations.

Joe Gabbard

Dr. Joseph L. Gabbard is director of the COGnitive Engineering for Novel Technologies (COGENT) Lab at Virginia Tech. His research focuses on the connections between user interface design and human performance; and specifically the development of experiments to understand perceptual and cognitive affordances of novel augmented reality (AR) user interface designs. Gabbard has been designing and evaluating outdoor AR user interfaces for close to 25 years across a number of domains including transportation, military, search and rescue, education and emergency response.

Wesley Garey

Wesley Garey is a Computer Scientist at the Wireless Networks Division (WND) under the Communications Technology Laboratory (CTL) at NIST. His work primarily involves the analysis and design of simulation models to investigate Long Term Evolution (LTE) networks regarding public safety communications. Garey received a B.S. in Computer Science from Clarion University in 2014, and an M.S. in Computer Science from Johns Hopkins University in 2017.

John Garofolo

John Garofolo leads the PSCR Analytics portfolio spanning fundamental research in pre-standards studies for the development and use of artificial intelligence (AI) analytics in public safety communications. He has developed test and measurement methods and led research in forward-thinking AI R&D at NIST for 35 years. He created and led the Networking and Information Technology Research and Development (NITRD) Video and Image (VIA) working group, and Video Analytics for Public Safety (VAPS) program.

Kerianne Gibney

Kerianne Gibney is a Consultant with Corner Alliance, Inc., supporting the PMO team at PSCR. As part of the PMO team, Ms. Gibney supports and leads stakeholder engagement efforts, such as PSCR 2022. Ms. Gibney graduated from the University of Maryland, College Park in 2018 with a Bachelor of Science in Public Health Science and minors in Spanish and Public Leadership.

Jim Golden

Jim Golden leads system engineering for the NIST ITL Multi-Modal Information Group. He leads the PSCR Analytics Container Environment (ACE) framework project, providing open source tools for the agile development, integration, and testing of analytics tools for public safety. He has also created the data access framework for the ASAPS Resources Project.

Rod Goossen

Rod Goossen earned his Electrical Engineering degree in 1996 from Embry-Riddle Aeronautical University. He specialized in Avionics

Engineering on corporate jets and was responsible for the thorough design and management of the avionics package and certification process. Goossen also holds an A&P license and is currently an MBA candidate at Southern New Hampshire University. He holds three U.S. patents and a Copyright and currently resides in Denver, Colorado.

Sneihil Gopal

Sneihil Gopal received a Bachelor of Technology degree from Uttar Pradesh Technical University, a Master of Technology (Gold medalist) degree from NIT, Kurukshetra, and a Ph.D. degree from IIIT-Delhi, all in Electronics and Communications Engineering in 2009, 2013 and 2021, respectively. She currently works as a Postdoctoral Fellow at Georgetown University and an Associate in the Wireless Networks Division (WND) in the Communications Technology Laboratory at NIST, Gaithersburg. Her research interests are in the general areas of communications and networking, including dynamic spectrum sharing, age of information, wireless network optimization, game theory, and internet economics.

Jeronimo Grandi

Dr. Jeronimo Grandi is a visiting Assistant Professor and member of the Interactive Realities Lab at the University of North Carolina - Greensboro. His research interests revolve around extended reality (XR) and Human-Computer Interaction (HCI). He is deeply interested in understanding the human factors involved in virtual reality (VR), augmented reality (AR), and mixed reality (MR) experiences, both in individual and collaborative interactions.

Joe Grasso

Joe Grasso leads the Location-Based Services portfolio for PSCR. He is focused on accelerating the innovation and adoption of technologies in the areas of indoor mapping, tracking, and navigation for the Public Safety Community. He joined PSCR in 2019 after more than 14 years of research, development, and acquisition experience with the U.S. Army, where he worked in the areas of robotics, modeling, and computer vision.

Red Grasso

Red Grasso is the Director of the First Responder Emerging Technologies (FirstTech) Program at the State of North Carolina. After serving in AmeriCorps, he spent a decade as a firefighter in North Carolina before moving into the technology field and working to deploy a regional P25 radio system in Missouri. Focusing on public safety communications, he has served in many roles at different levels of government including disaster response at the local, state, and federal levels. He holds a bachelor's degree in Emergency and Disaster Management and is a graduate of the Community Preparedness and Disaster Management program at UNC-CH. Red is also responsible for the communications system at the annual Burning Man event in Nevada.

Chelsea Greene

Chelsea Greene is a mission critical voice electronics engineer for the Public Safety Communications Research (PSCR) Division at NIST's Communication Technology Laboratory. She has been on the team since 2018, where she develops data integrity measurements and performs speech signal analysis.

Robin Grier

Robin Grier is the President of Catalyst Communications Technologies, Inc. Catalyst is a leader in Radio Control over IP, providing dispatch, interoperability, and incident command solutions for municipalities, federal agencies, utilities, and other organizations. Prior to founding Catalyst, Grier spent seven years with Ericsson's (now Harris) Private Radio Systems division in its product management and systems engineering departments. He spent five years designing communications satellites for TRW's (now Northrop Grumman) Space Communications Division. Grier earned his Bachelor of Science in Electrical Engineering from the University of Virginia, his Master of Science in Electrical Engineering from the University of Southern California, and his MBA from Lynchburg College.

David Griffith

David Griffith works with the Wireless Networks Division (WND) in the Communications Technology Laboratory (CTL) at NIST. He received a Ph.D. in electrical engineering from the University of Delaware in 1998 and has authored or co-authored nearly 100 publications, including two book chapters, on signal processing, optical communications, public safety communications, and machine learning for communications. His current work includes performance analysis and metrics for public safety communications, including analysis of coexistence with other radio access technologies and resource allocation for 5G wireless networks using machine learning.

Charles Guddemi

Charles Guddemi is the District of Columbia's Homeland Security and Emergency Management Agency's (HSEMA) Statewide Interoperability Coordinator (SWIC). He is responsible for coordinating interoperability and communications projects involving voice, data, and video. In this capacity, he also chairs and participates in several public safety interoperability and communication working groups, along with assisting with several large-scale events, such as the 2021 Inauguration. Guddemi joined HSEMA after a 25-year career with the United States Park Police (USPP) with assignments in the Washington, D.C., New York, and San Francisco Field Offices and the National Park Service Northeast Regional Headquarters in Philadelphia, Pennsylvania.

Laura Haak Marcial

Laura Haak Marcial is a Senior Health Informatics Research Scientist and Director of the Data to Evidence Program (D2E) in the Center for Health Informatics and Evidence Synthesis (CHIES) within the Translational Health Sciences Division (THSD) at RTI International. She has leadership experience in all aspects of the design, development, implementation, and evaluation of health IT tools, including leading projects which include conducting environmental scans, developing implementation guides, and creating supporting training and operations materials. She has served as project director on multiple projects leading teams of researchers to develop and implement complex health IT systems. She has led work leveraging development teams and implementation sites on the design, development, implementation and pilot of patient- and provider-facing SMART on Fast Healthcare Interoperability Resources (FHIR) based clinical decision support and eCare plan applications for ambulatory practice use.

Hussein Hammoud

Hussein Hammoud received his Bachelor of Science in Electrical Engineering from the American University of Beirut in July 2016. He is currently working towards his Ph.D. in Electrical Engineering at the University of Southern California (USC). His research interests include Millimeter-wave (measurement-based) MIMO channel Modeling and analysis, Parameter Estimation, and Localization systems.

Peter Hanna

Peter Hanna is a GIS Specialist with Montgomery County Police Department in Maryland, focusing on preparing the county for NextGen 911. He is also a retired Firefighter/Paramedic after serving 22 years in Baltimore City. As a National Alliance for Public Safety GIS (NAPSG) member, he has worked on several projects over the years and is passionate about public safety GIS.

Charlsea Hansen

Charlsea Hansen joined PSCR in 2019 as a member of the Location-Based Services portfolio. Prior to coming to NIST, she worked as a Software Engineer for Raytheon and the Department of Defense. She graduated from the University of Arizona with a master's in Electrical and Computer Engineering in 2018.

Jennifer Harder

Dr. Jennifer Harder is the Director of Roadmap Domains with the First Responder Network Authority. The FirstNet Authority is the independent agency within the U.S. Department of Commerce chartered to help create, maintain, and evolve the nation's public

safety network, called FirstNet. She leads a team focused on identifying and evaluating innovative opportunities to help enhance public safety communications. In addition, she works with public safety agencies and industry to foster innovation in the public safety communications and technology marketplace. Before her work at the First Responder Network Authority, Dr. Harder spent 12 years with SAIC and SPAWAR Systems Center Pacific supporting the Interoperable Communications Technical Assistance Program (ICTAP) sponsored by the DHS Office of Emergency Communications (OEC) supporting public safety interoperable communication operations, exercises, and events across the country. She served as the Administrative Sergeant for the San Diego County Sheriff's Department Search and Rescue K9 Unit, training and deploying three of her own search and rescue dogs while leading the training and evaluation effort for numerous other volunteer teams. She has also served as a Communications Specialist for the Broomfield Police Department in Colorado. She received her Ph.D. in Experimental Psychology from the University of Southern Mississippi.

Lance Hartung

Lance Hartung, a Systems Engineer at the University of Wisconsin - Madison, has a background in design and implementation of wireless networked systems. His experience varies from deploying systems for connecting vehicles to designing software container orchestration for distributed edge computing systems. His primary research interests include exploring the role of edge computing in collaborative AR experiences, machine learning, and indoor localization and mapping. Hartung coordinates development efforts on the various system components that make up the EasyVizAR project.

Jason Haskins

Jason Haskins is the Creative Director at NextGen Interactions. He leads the software team to tackle day-to-day challenges of conceptualizing, designing, and implementing extended reality (XR) solutions using tools such as the Unity game engine, Adobe Suite, and Autodesk Maya. His design focus is on training and educational research in New Media, and his technical proficiencies help him ideate on a broad range of projects, enabling him to better empathize with his team while generating solutions that fit with big picture thinking. Haskins has over 17 years of work experience where he has worked for multiple research companies, including BTEC (Biomanufacturing Training and Education Center) and CEI (Center for Educational Informatics) as a Game designer using the Unity engine. He has a degree in Art and Design from North Carolina State University, and a background in Computer Science, Information Technologies, and Intensive/Trauma Nursing Practices as a Corpsman in the US Navy.

Alex Hauptmann

Alex Hauptmann is Research Professor in the School of Computer Science, Language Technology Institute at Carnegie Mellon University. His research seeks to combine multiple modalities (audio, images, video, and text) to develop systems that can be more efficient despite the exponential growth of multimedia in the world. His recent research has concentrated on applications that serve the public good.

Brian Hobson

Brian Hobson currently serves as the First Responder Network Authority (FirstNet) Senior Director of the Roadmap Development Division. He has previously held multiple roles at FirstNet including Ecosystem and Roadmap Development within Enterprise Strategy, as well as the Product Lead, State Plans Director, and State Plans Technical Lead, all within the Market Engagement Office. Hobson started at FirstNet in 2014, but worked on this initiative before the legislation was created. Prior to FirstNet, he worked as a Navy civilian at Space and Naval Warfare (SPAWAR) contributing to a variety of different wireless communications programs in support of the Navy, Army, U.S. Marine Corps, Air Force, Defense Advanced Research Projects Agency (DARPA), Department of Defense (DoD) research laboratories, and Department of Homeland Security (DHS). In supporting DHS, Hobson served as the Chief Engineer of the Interoperable Communications Technical Assistance Program (ICTAP), working with public safety in all states and territories to solve their communications challenges. Hobson has over 20 years of government service. Hegraduated from Washington State University with a degree in electrical engineering.

Gary Howarth

Gary Howarth has led the development of several unique analytics-focused prize challenges for PSCR. He helped to develop the multi-phase Differential Privacy Prize Challenge, which has produced a variety of open source tools and data to support research in differential privacy. Howarth also helped to curate, refine, and document the data for the ASAPS Resources project.

Sarah Hughes

Sarah Hughes joined the Public Safety Communications Research (PSCR) Division's Open Innovation team in April 2018 and serves as a Prize Competition and Challenge Specialist. In this role, she manages internal and external R&D, communications, legal, administrative, and procurement resources to design and implement prize competitions and challenges to advance PSCR's mission. She is responsible for managing all aspects of the prize competitions and challenges assigned to her within the Open Innovation portfolio. Hughes and the NIST Open Innovation team recently received their agency's 2021 George A. Uriano Award in recognition for their outstanding leadership in delivering public-private partnerships that drove the research and development of critical, life-saving communications capabilities for first responders. Prior to PSCR, she supported entrepreneurs, small businesses, and innovation at the U.S. Small Business Administration (SBA) for five years in many different roles within Colorado and Washington, D.C. Hughes first started her federal public service as a Presidential Management Fellow. Sarah holds a Master of Public Affairs degree from the School of Public and Environmental Affairs (SPEA) at Indiana University and a Bachelor of Arts degree from DePauw University.

Travis Hull

Travis Hull is the User Experience Domain Lead within the First Responder Network Authority (FirstNet) Roadmap Development Division. Within that role, he has focused on the development and use of devices and applications for public safety. Prior to joining FirstNet, Hull was a Project Engineering Manager at General Atomics, where he worked to integrate systems into unmanned aircraft systems (UAS) for the Department of Homeland Security (DHS), U.S. Customs and Border Protection (CBP), and Missile Defense Agency programs. He currently resides in Washington state and works as a canine handler with the Kitsap County Search Dog Team. He is also a member of the search and rescue dive unit.

Jan Janak

Jan Janak is a PhD student at Columbia University.

Charles Jennings

Charles Jennings is the Director of the Christian Regenhard Center for Emergency Response Studies (RACERS) at John Jay College of Criminal Justice (CUNY). He researches public safety response and decision making. He has also investigated numerous major events including studying communications. Jennings is a credentialed Chief Fire Officer and former fire officer and emergency manager.

Jason Jerald

Jason Jerald, Ph.D., is CEO at NextGen Interactions and serves on multiple advisory boards. He has been creating VR systems and applications for over 20 years with more than 70 VR-related projects across 40+ organizations, including Valve, Oculus, Virtuix, Sixense, MergeVR, AT&T, NASA, Google, General Motors, Raytheon, Lockheed Martin, three U.S. national laboratories, and seven universities. Jason's work has been featured on ABC's Shark Tank, on the Discovery Channel, in the New York Times, and on the cover of the MIT Press journal Presence. He has authored numerous publications, most notably the best-selling book, The VR Book: Human-Centered Design for Virtual Reality.

Shalin Jyotishi

Shalin Jyotishi, Senior Policy Analyst on Education and Labor at New America Foundation and Fellow in the Center for the 4th Industrial Revolution at the World Economic Forum. His mission is to solve public problems where higher education and the workforce meets emerging technologies and science & innovation policy. Jyotishi is on the Advisory Board for the National Science Foundation's

Convergence Accelerator's National Talent Ecosystem Council.

Alison Kahn

Alison Kahn is an Electronics Engineer with NIST's Public Safety Communications Research (PSCR) Division in Boulder, Colorado. She currently leads the Mission Critical Voice Quality of Experience project, as well as Public Safety IoT research within PSCR. Alison also works with the Department of Homeland Security's Science and Technology directorate on issues related to IoT interoperability.

Jason Kahn

Jason Kahn is a research engineer and a Federal Program Officer for the NIST Communication Technology Laboratory (CTL) where he also acts as the standards coordinator. Kahn transitioned to NIST from the private sector in 2015. He started his career in telecommunications by earning a Bachelor of Science degree in Electrical Engineering from the University of Texas at Austin in 1997. After graduating, he worked for Motorola (now Motorola Solutions), where he specialized in interoperability between mobile devices and telecommunications networks. Kahn participated in related standards organizations while earning a Master of Science from Southern Methodist University in Dallas, Texas. After starting at Nokia in 2011, he focused on smart phone application performance and functionality as well as enhanced network feature verification. Today, among his many duties, he is involved in public safety testing standards within the 3GPP standards organization.

Alden Kane

Alden Kane is a Wireless Solutions Engineer with Keysight Technologies, specializing in 5G Network Emulation.He holds a degree from the University of Notre Dame in Electrical Engineering. His technical interests include wireless communications, computer vision, OTA cybersecurity, and Raspberry Pi for embedded systems. A native of Michigan that is now local to San Diego, he enjoys snowboarding, surfing, golf, and gardening in his free time.

Jeff Karhoff

Jeff Karhoff is a full-stack digital designer working closely with our nation's first responder community to create virtual and augmented reality scenarios to better understand how the technology of tomorrow will help aid in their day-to-day jobs. His expertise includes UI/UX design, 3D modeling and texturing, virtual reality development, and project design and management. Karhoff started his digital art career in the architectural visualization industry by creating renderings and real-time virtual tours for architects, designers, and real estate developers. His experience in the interior design and architecture industry gives him a unique advantage when it comes to accurately representing the surroundings of our virtual environments. He strives to create truly immersive experiences that encourage interaction, engagement, and education.

Zak Kassas

Dr. Zak Kassas' specialty is in cyber-physical systems, navigation systems, cognitive sensing, and intelligent transportation systems. He is an Associate Professor at the University of California, Irvine and the Director of the U.S. Department of Transportation Center: CARMEN (Center for Automated Vehicle Research with Multimodal AssurEd Navigation). He has published over 120 journal and conference papers, eight magazine articles, and three invited book chapters. Dr. Kassas is a recipient of the National Science Foundation (NSF) CAREER award, Office of Naval Research (ONR) Young Investigator Program award, Institute of Electrical and Electronics Engineers (IEEE) Walter Fried award, Institute of Navigation (ION) Burka award, and ION Colonel Thurlow award, among others.

Kevin Kay

Kevin Kay serves as the Director of State and Local Programs for the National Alliance for Public Safety GIS (NAPSG) Foundation, where he helps bridge the gap between first responders and technologists. Throughout his career, Kay has implemented technology at the

local level in Emergency Operations Center environments, across disciplines, and at all levels of government.

Randy Kerr

Randy Kerr joined the First Responder Network Authority (FirstNet) in October 2018 and is assigned to the Roadmap Development Division as the Situational Awareness Domain Lead. Other areas of responsibility include working with the various components of the FirstNet Central Portal and providing support for internal functional communities in the disciplines of Emergency Management and 9-1-1/Emergency Communications Centers. Kerr's public safety experience includes serving and retiring as a Law Enforcement Captain/Technical Services Division Commander in northern Florida, where he was responsible for emergency communications, as well as a variety of other operational and technical functions within the Sheriff's Office. Prior to joining FirstNet, Kerr also served as a communications SME contract support for the Department of Homeland Security Cybersecurity and Infrastructure Security Agency (CISA) Interoperable Communications Technical Assistance Program.

Solmaz Kia

Dr. Solmaz Kia's specialty is in decentralized algorithm design for networked systems, control theory and probabilistic robotics. Her research involves cooperative navigation, sensor fusion and integrity monitoring, in-network coordination, distributed optimization algorithms, and multi-robot motion planning. She is an associate professor in the MAE department of UCI, with a joint appointment in the Computer Science department. Dr. Kia has published 76 peer-reviewed journal and conference papers. She was the recipient of UC President's Postdoctoral Fellowship from 2012-2014. She is also a recipient of the 2017 National Science Foundation (NSF) CAREER award.

Sonny Kirkley

Sonny Kirkley, Ph.D. is the Director of User Experience at the Indiana University (IU) Crisis Technologies Innovation Lab. He is also the Project Director for the First Responder Smart Tracking (FRST) Challenge. Dr. Kirkley is a serial entrepreneur founding companies focused on augmented reality, voice artificial intelligence (AI), serious games, and other technologies. Two of these companies emerged from participating in prior Public Safety Communications Research (PSCR) Division technology challenge competitions. He has taught human-centered computing courses for over 20 years at IU Bloomington and Indiana University-Purdue University Indianapolis (IUPUI) courses including human-computer Interaction (HCI) for Emergency Response.

Regis Kopper

Dr. Regis Kopper is an Assistant Professor of Computer Science at the University of North Carolina at Greensboro. His research centers around extended reality (XR) user experience, virtual reality (VR) simulation and applied XR research. His work focuses on improving the usability of virtual and augmented reality systems by designing novel interaction techniques, mitigating visually induced motion sickness, and integrating tangible devices onto XR user interfaces. His research is also transdisciplinary and collaborative, where he investigates the employment of XR interfaces in areas such as public safety, health care, neuroscience, and the humanities.

David Kortenkamp

Dr. David Kortenkamp is a recognized international expert in intelligent systems. He has developed software applications for a variety of NASA programs, including software used in NASA mission control and NASA Lunar rover operation. Dr. Kortenkamp has significant experience transitioning research to deployed applications and oversees commercial products used by Fortune 500 companies for worldwide operations.

Nicole Kosoris

Nicole Kosoris leads the Human Computer Interaction research for the Georgia Tech Research Institute ARTEMIS project. Her work focuses on novel interactivity in Serious Games as applied to health, education, and defense. Her teams are cross disciplinary, as they

engage with experts to apply new research to practical challenges.

Joanne Krumel

Joanne Krumel is a Prize Specialist in the Open Innovation (OI) Team at the Public Safety Communications Research (PSCR) Division. Krumel provides her budgeting, writing, and editorial talents to the team, along with auditing, analysis, and reporting of completed prize challenges. Prior to joining PSCR in 2018, she served multiple Federal agencies in financial and administrative management roles in Colorado, New Mexico, Washington, D.C., Virginia, Florida, and Japan. She holds a Master of Business Administration from the College of William and Mary and a Bachelor of Science in Chemical Engineering from Lafayette College. Krumel hails from Philadelphia, PA, but is happy to call Colorado home.

Charles Laird

Charles Laird works part-time as a first-responder subject-matter expert. He works full-time as a Program Specialist for the First Responder Emerging Technologies Program in the Broadband Infrastructure Office of the North Carolina Department of IT. Laird is also a volunteer firefighter with the Youngsville Fire Department in Franklin County, North Carolina, and has been in the fire service for 12 years. He previously worked for Emergency Management for 4 years as a Search and Rescue Coordinator and Emergency Management Officer.

Guillaume Lambert

Guillaume Lambert is a Senior Executive of the Ministry of the Interior, with 15 years of operational experience at the highest level of the State, alternating executive responsibilities and the conduct of strategic projects. He is a leader resolutely turned towards innovation and capitalizing on numerous successes in the various missions he has directed: head of the French public safety broadband network programme (RRF); design and development of the NexSIS digital emergency services platform; deployment of eCall National Infrastructure; definition of Artificial Intelligence strategy in the field of relief within the Ministry of the Interior; and transposition of the Directive establishing the European Code for Electronic Communications.

Stephanie Layman

Stephanie Layman joined the PSCR Division's OI Team in November 2021 as an Open Innovation Project Manager. In this role, she supports internal and external R&D, communications, legal, administrative, and procurement resources to design and implement prize challenges that advance PSCR's mission. Prior to PSCR, Stephanie accumulated six years as a contracted project manager and research analyst for federal and local government clients, including the National Institute of Standards and Technology (NIST), Department of Energy (DOE), Colorado Energy Office (CEO), Denver International Airport (DIA), Regional Transportation Authority (RTA), and the City and County of Denver. She has additional experience in project management, research, and communications through her time with the United States Peace Corps, Urban Leaders Fellowship, Seoul Metropolitan Government, and LIVESTRONG Foundation. Layman holds a Master of Public Affairs degree from the Indiana University School of Public and Environmental Affairs (SPEA) and a Bachelor of Arts degree from the University of Texas.

Scott Ledgerwood

Scott Ledgerwood leads the User Interface/User Experience portfolio at the Public Safety Communication Research (PSCR), where he is focused on improving usability and user interface testing for first responders. His team is developing new test methodologies leveraging virtual and augmented reality to enable improved research, testing, and development of first responder technologies. They are also conducting research and development on technology systems like camera and video capture devices for improving user experiences. Ledgerwood holds a B.S. in Applied Information Technology from George Mason University, an MBA from Bellevue University, and an M.S. in Telecommunications from the University of Colorado, Boulder. He moved from the Washington, D.C. area to join NIST in 2015.

Marc Leh

Marc Leh has supported PSCR since 2014 through a variety of efforts. He co-authored PSCR Technology Roadmaps on Location-Based Services, Public Safety Analytics, and User Interface / User Experience to ground PSCR R&D strategy in public safety's most pressing operational needs. Mr. Leh contributes to ongoing PSCR strategy, process improvement, and connecting research activities to measurable, long-term economic outputs.

Mr. Leh also supports NIST's Wireless Networks Division to identify long-term technology gaps and share state-of-the-art methods for high-frequency channel measurement and modeling.

Outside of work Marc enjoys music, sports, and spending time with family.

Barry Leitch

Barry Leitch is a Senior Network Services and Solutions Engineer within the First Responder Network Authority (FirstNet Authority) and is currently a member of the Boulder FirstNet Lab team. He has been part of the FirstNet Authority for a total of eight years where he has been primarily focused in the area of FirstNet devices during this time. Prior to the FirstNet Authority, Leitch worked for over 18 years within the private sector at a number of companies involved in wireless cellular communications which included Omnipoint, Xircom, Intel, and Broadcom. Overall, he has a total of 40 years of electrical engineering experience working in the private and public sector. Leitch holds a Bachelor of Science in Electrical Engineering from the University of Idaho and an MBA in Engineering Management from the University of Dallas.

Jonathan Lewin

Jonathan Lewin is a Senior Public Safety Advisor for the First Responder Network Authority (FirstNet), an independent authority under the U.S. Department of Commerce. He served briefly as CIO for the Metropolitan Police Department in Washington, DC after retiring as Chief of the Bureau of Technical Services for the Chicago Police Department (CPD), where he was a sworn member for 28 years. Lewin served as a board member and past-Chair of the International Association of Chiefs of Police (IACP) Law Enforcement Information Technology Section and was the Major Cities Chiefs of Police representative on DHS SAFECOM and FirstNet's Public Safety Advisory Council. He has served as a Subject Matter Expert (SME) and peer grant reviewer for the Department of Justice for multiple law enforcement technology projects. He earned a Bachelor of Science in Administration of Justice at Southern Illinois University, a Master of Arts in Public Policy at Northwestern University, and a Master of Arts in Security Studies at the U.S. Naval Postgraduate School.

Jack Lewis

Jack Lewis is the Lead Virtual Reality (VR) Developer at PSCR. For the past four years, he has overseen the development of VR scenarios for public safety research. Lewis was formally a designer in the video games industry and worked on various indie game titles.

Francis Li

Francis is a full-stack Software Architect with nearly two decades of experience building and launching new products in Silicon Valley. As a serial entrepreneur, he has been a consultant, a co-founder and held executive level roles in numerous prior startups where he was responsible for executing the development of new web and mobile applications and services across a broad spectrum of industries, including healthcare, digital marketing, and entertainment. With a complementary background in interaction design, Francis is also a passionate advocate for user-centered design and serves as a bridge facilitating the tight integration between product and engineering. Francis holds B.A. and M.S. degrees in Computer Science from UC Berkeley and a Master of Interaction Design degree from the Interaction Design Institute Ivrea.

Fidel Liberal

Dr. Fidel Liberal is a well-recognized expert in mission critical communications. He works as a professor at the University of the Basque Country (UPV/EHU) where he leads different mission critical communications and 5G related R&D projects including MCS TaaSting (www.mcstaasting.com) aimed at providing flexible testing as a service mechanisms for MCS certification.

Chunmei Liu

Dr. Chunmei Liu received her Ph.D. in Computer Systems from the Massachusetts Institute of Technology (MIT) in 2005. She has been working in the areas of wireless communications and networking since then. She is currently a researcher with the Wireless Networks Division at NIST. Her research interests include public safety communications in cellular networks and machine learning.

Walt Magnussen

Dr. Walt Magnussen Directs the Internet2 Technology Evaluation Center at Texas A&M University (ITEC). The ITEC has been at the forefront of public safety interoperability work on high visibility projects such as the NG 9-1-1 Proof of Concept for the DoT, creating the NENA Industry Collaboration Event (ICE) and supporting Harris County and the State of Texas in implementation of the first Public Safety Broadband Network (PSBN) in the world. Currently they are involved in both NG 9-1-1 and Mission Critical Services standards conformance work. Magnussen has spoken at over 100 sessions at public safety venues, has testified before both Congress and the FCC and has served on or chaired over a dozen committees over the past 20 years.

William Magrogan

William Magrogan is a Mathematician and Data Analyst. He has worked at NIST for about two years in the Public Safety Communications Research (PSCR) Division. Prior to joining NIST, he worked as a computational physicist at Los Alamos National Laboratory (LANL).

Bill Maheu

William "Bill'' Maheau is a member of the Qualcomm Cyber Security Solutions senior management team, where he is responsible for working with government partners to bridge the gaps between commercial wireless technologies and government missions. In this role, Maheu's objective is to pioneer efforts in cellular standards and microelectronics design, broadband data, encryption and value-added end-user applications to enhance the government's wireless capabilities. He led the team in developing the first 4 finger mobile ultrasonic fingerprint sensor ever certified by the Federal Bureau of Investigations.

Prior to joining Qualcomm's Government Technologies team in 2008, Mr. Maheu was a member of the San Diego Police Department for 28 years. During his tenure, he served as Commanding Officer and Executive Lieutenant of the Special Weapons and Tactics Team and rose to the rank of Executive Assistant Chief of Police.. He currently sits on the San Diego Crime Stoppers board. Maheu graduated from the University of San Diego with a Bachelor of Arts degree in Psychology, and is a graduate of the FBI National Academy and Police Executive Research Forum's Senior Management Institute for Police.

Sirilal Mallawa-Arachchi

Sirilal Mallawa-Arachchi has 42 years of experience in the telecommunications industry and possesses bachelor's and master's degrees in Telecommunications from the University of Sri Lanka (Moratuwa Campus). He has worked on a variety of communications projects in Sri Lanka, the State of Qatar, and New Zealand. Mallawa-Arachchi currently serves as Principal Technical Advisor-Mission Critical Communication for New Zealand Police ICT working towards a next generation critical communication network for emergency services in New Zealand.

Terese Manley

Terese Manley is a Prize Challenge Manager for PSCR's Open Innovation team. In this role, she manages PSCR's Unmanned Aerial Systems (UAS) program and procurement resources to design and implement prize challenges to advance PSCR's mission. Prior to PSCR, Terese led industry outreach efforts for the Interdisciplinary Telecom Graduate Program at the University of Colorado, Boulder where she brought industry experts together with faculty and students. For much of her career, Terese held management and engineering positions at Sprint Nextel Corporation in Sales Engineering, managing technical teams in support of Fortune 100 & 500 companies. Terese has expertise in the area of Business Development, Telecom Engineering, Vendor Relations, and Resource Management. She holds a Bachelor of Science in Chemical Engineering from the University of Colorado, Boulder.

Michael Marino

Michael Marino is the Chief Executive Officer of Emergency Services Group International (ESGI) and a proud alumnus of PSCR's PULSE Accelerator program. Marino retired after twenty-one years of honorable service across Fire/EMS, law enforcement, and emergency management disciplines. At ESGI, he facilitates a team that envisions leveraging technology smartly for frontline personnel to optimize response and recovery using COTS hardware. He was previously a Department of Homeland Security Fellow, and currently holds a faculty appointment at George Washington University facilitating learning in high threat response. He has published in the Homeland Security Affairs Journal, Special Operations Medical Association Journal, and has co-authored a textbook for first responders. Marino is a graduate of Harvard University's Public Policy executive certificate program, an Executive and Chief Fire Officer, Certified Public Manager, and has a Master's degree in Security Studies from the Naval Postgraduate School where he researched knowledge management for first responders.

Richard McCreadie

Richard McCreadie is a Lecturer at the University of Glasgow. He is an active researcher in the areas of real time IR, machine learning, big data stream processing and evaluation methodologies over streaming data. His specialties are real time IR technologies to enable users to efficiently and effectively find information in big data streams, the research and development of automatic (assistive) agents to detect events, extract knowledge and summarize information within big data streams,as well as methodologies to evaluate systems that process such streams.

Kirk McKinzie

Captain (Ret.) Kirk McKinzie is President of McKinzie Smart Technologies and a SMART First Responder Technologist, a 30+ year fire service veteran, and currently works with international teams focused on Next Gen solutions. He serves as an adjunct professor, SME, advisor, speaker, and author to government, enterprise, academia, start-ups, and operators focused on SMART city design, emergency response, venture capital, interoperability, fire/explosion investigation, standards, and codes. Captain McKinzie's areas of expertise include NextGen first response systems, remote sensing, biometrics, artificial intelligence, IoT, computational fluid dynamics, holographic light display, haptic feedback, 3D+ Virtual/Mixed/Augmented Reality, and related lifesaving technological solutions.

Alessio Medda

Dr. Alessio Medda is a Senior Research Engineer at the Georgia Tech Research Institute (GTRI) and he is the ARTEMIS QUARC project Co-PI and main technical lead. Dr. Medda received his M.S. in Electronic Engineering in 1993 from the University of Cagliari, Italy, and his Ph.D. in Electrical and Computer Engineering in 2009 from Florida State University. He joined the Georgia Institute of Technology in 2011 and his research interests include wavelets and time-frequency analysis, beamforming, acoustics, and machine learning. Dr. Medda is the recipient of the 2013 and 2015 GTRI Junior Research Excellence Award, the 2016 Outstanding Technical Achievement Award, and two Georgia Tech Teaching Fellowship Awards. As a senior member of IEEE, he serves as Chair of the Institute of Electrical and Electronics Engineers (IEEE) Atlanta Section.

Ranjana Mehta

Ranjana Mehta is Associate Professor and Mike and Sugar Barnes Career Development Faculty Fellow II in the Wm Michael Barnes '64 Department of Industrial and Systems Engineering at Texas A&M University. Her research is focused on understanding, measuring, and supporting human performance through wearable systems. She is the principal investigator of the National Science Foundation (NSF) Convergence Accelerator project on Learning Environments with Augmentation and Robotics for NextGen Emergency Responders.

Jad Meouchy

Jad holds dual degrees in Computer Engineering and Psychology from Virginia Tech, and attended the Thomas Jefferson High School for Science and Technology. Over the last 15 years, Meouchy has founded and exited multiple startups, and engaged his healthy

passion for user-friendly product innovation and engineering architecture. He specializes in machine learning, data analytics, and AR/VR development. As the Principal Investigator for BadVR, Meouchy has led the development of proprietary algorithms and techniques for spatialization and visualization of data that has resulted in awarded patents.

Paul Merritt

Paul Merritt joined PSCR in 2018 after finishing his degree at NYU in Computer Science with a minor in Game Engineering. He has completed several projects in augmented reality (AR) as part of the UI/UX portfolio intended for firefighters, bomb squads, and police officers. Merritt has experience programming and designing for a variety of augmented reality headsets as well as consulting and judging the CHARIoT Challenge.

Viyom Mittal

Viyom Mittal is a third year Ph.D. student at the University of California, Riverside advised by Professor K. K. Ramakrishnan. He completed his master's degree at NITK Surathkal, India where he worked on transport protocols and active queue management techniques. He also worked with Qualcomm's Atheros team on kernel module development for custom wireless chipsets. He currently works in the field of building network infrastructure for effective disaster response using natural language processing (NLP) and machine learning (ML) techniques.

Jason Moats

Jason Moats, Ph.D. is the Director for the TEEX Testing and Innovation Center (TT&IC). In this position, Dr. Moats oversees technical services to assist and guide technology developers as they develop and refine technologies for the public safety, workplace safety, and homeland security ecosystems. The TT&IC also collaborates with researchers and scientists to develop technical solutions for the unique challenges of these same ecosystems by managing, coordinating, and consulting on research, training and education efforts, and technology transfer projects. Dr. Moats' research interests include disaster response and management, technology transfer, technology adoption, human resource development, and the development of expertise in the future workforce.

Haley Molchan

Haley Molchan is the Project Manager for the FRST Challenge at IU's Crisis Technologies Innovation Lab. For the FRST Challenge, she has also helped to create and manage the FRST Community Portal. Prior to joining CTIL, she was a member of ProHealth and managed multiple research projects at the Luddy School of Informatics, Computing, and Engineering such as HomeSHARE, Cyberstart, and ITEST.

Andreas Molisch

Andreas F. Molisch is Professor and Solomon Golomb - Andrew and Erna Viterbi Chair at the University of Southern California. His research interest is wireless communications, with emphasis on wireless propagation channels, multi-antenna systems, ultrawideband signaling and localization, novel cellular architectures, and cooperative communications. He is the author of four books, 19 book chapters, more than 240 journal papers, 320 conference papers, as well as 80 patents. He is a Fellow of the National Academy of Inventors, IEEE, AAAS, and IET, as well as Member of the Austrian Academy of Sciences and recipient of numerous awards.

Vince Nguyen

Vince Nguyen is General Manager for Keysight Technologies Aerospace Defense and Government Solutions (ADGS) Team. Vince leads the ADGS business for Keysight spanning the entire Aerospace Defense ecosystem of solutions across multiple subsegments including 5G/6G, SigMon, MilCom, Mil-ATE, Avionics, Device Test, and Quantum. Nguyen recently led the successful acquisition and integration of Scalable Network Technologies. He manages a team of experts leading the solution conception, development and go-to-market strategies across the aerospace industry, delivering solutions to customers worldwide. Nguyen brings over 22 years of

worldwide experience with Agilent/Keysight including management roles in global applications engineering and sales coupled with his successful leadership in many customer-facing positions. Before joining Agilent/Keysight Technologies in 2000, he worked as an RF systems engineer at Lockheed Martin. He holds an MBA from UC Irvine and a master's Degree in Electrical Engineering from Santa Clara University.

Jordan O'Dell

Jordan O'Dell graduated from the University of Alaska Fairbanks in 2017 with a bachelor's degree in Electrical Engineering and is currently pursuing a Masters of Science in Technology, Cybersecurity and Policy from University of Colorado, Boulder. He has worked with NIST PSCR over the past four years focusing on development of software-defined radio-based interoperability solutions detailed under NIST-IR 3883.

Michael Ogata

Michael Ogata is a Computer Scientist in the Applied Cybersecurity Division at NIST. Over his 18-year career at NIST, he has worked on projects involving digital forensics, healthcare standards, mobile application security, cybersecurity for public safety, and cybersecurity for the smart grid.

Mark Ogren

Mark Ogren is an IT Analyst at Duke University's Pratt School of Engineering. His related interests include rapid prototyping, virtual and augmented reality (VR and AR), user interface design, communication, and human-computer interaction. He also has experience developing custom tracked hardware and input devices. Before volunteering at University of North Carolina-Greensboro, he assisted Dr. Regis Kopper's team with the upgrade and maintenance of Duke's CAVE VR computer cluster. When not helping faculty and staff with their various computing needs, Ogren dabbles in robotics, radio control, music, and mountain biking.

Cara O'Malley

Cara O'Malley is a Mathematician on the Mission Critical Voice (MCV) team at PSCR. While her work mainly supports Quality of Experience projects and is focused on the acquisition and analysis of data, Cara also contributes to laboratory configuration, implementation, and metrology system deployments. Prior to joining NIST, O'Malley taught secondary mathematics at several school districts in Colorado; she is currently an active member of the NIST Educational Outreach Working Group. She holds a Master of Science in Mathematics from Emporia State University and a Bachelor of Science in Mathematics from Southern Illinois University.

Dereck Orr

Dereck Orr is Division Chief for the Public Safety Communications Research (PSCR) Division at NIST, which serves as an objective technical advisor and laboratory to FirstNet, the Department of Homeland Security and public safety. Its mission is to accelerate the adoption and implementation of the most critical public safety communications standards and technologies. Since 2002, Orr has led the trajectory of PSCR's research and impact by working closely with first responders, government(s), academia, and industry. In 2018, he testified as an expert witness for the Emergency Preparedness, Response, and Recovery Subcommittee of the Department of Homeland Security. In 2019, he was recognized by the Association of Public-Safety Communications Officials (APCO) with the Leadership in Advocacy Award. He has a Masters in Public Policy from the College of William and Mary and a Bachelor of Arts in American History from the University of Texas at Austin.

Jason Pennington

Jason Pennington is the Executive Director of the Indiana IoT Lab and focuses on supporting lab members' needs, partners, and sustainable growth initiatives. Pennington has more than 20 years of experience in the Process Automation industry, specifically in applying sensors, software, and services in various industrial, agricultural, and municipal sectors. Jason currently serves as chair of the technical advisory panel of the FRST Challenge.

Margaret Pinson

Margaret H. Pinson is an internationally recognized expert with 33 years of experience developing improved methods for assessing video quality (VQA). Her research includes algorithm development, human testing, international standards, and no-reference (NR) metrics that predict what people would say is the quality of an image or video. Pinson is a Video Quality Experts Group (VQEG) Co-Chair and administers the Consumer Digital Video Library (CDVL, www.cdvl.org). She makes her algorithms, tools, image quality (IQA) datasets, and VQA datasets available as open-source or open data. Mrs. Pinson has written 79 publications.

Ryan Poltermann

Ryan Poltermann has performed public safety communications design and consulting for over a decade, and has been involved in over half the US states and six countrywide systems. He is a Wireless Communications Research Engineer at Pacific Northwest National Laboratory, with a focus on 5G communications. He is also the National Public Safety Telecommunications Council (NPSTC) Vice Chair for LMR-LTE Integration and Interoperability, as well as the Co-Chair of Public Safety IoT.

Michael Proestler

Michael Proestler, CEO of GridGears, has more than 10 years of experience in public safety. In 2017, he founded GridGears, a company that provides multiple products and solutions in the public safety sector, while driving and contributing to relevant standards to enable better, more integrated and more efficient mission critical services. That includes a Testing as a Service Platform that enables flexible testing and verification mechanisms for MCS and NG911.

Robert Putfark

Robert Putfark started into EMS in 1993 in rural Colorado as an EMT and paramedic. In October of 1999, he moved to Arvada, Colorado to work at Pridemark Paramedic Services until 2011. He has held his current position as EMS Captain for the Arvada Fire Protection District since 2011.

K. K. Ramakrishnan

Dr. K. K. Ramakrishnan is a Professor of Computer Science and Engineering at the University of California, Riverside. Previously, he was a Distinguished Member of Technical Staff at AT&T Labs-Research. Dr. Ramakrishnan is an ACM Fellow, IEEE Fellow and an AT&T Fellow, recognized for his fundamental contributions on communication networks, congestion control, traffic management, and VPN services. K. K. received his MTech from the Indian Institute of Science (1978), M.S. (1981) and Ph.D. (1983) in Computer Science from the University of Maryland, College Park, USA.

Srinivas Ranganathan

Sreenivasan Ranganathan is Research Director at the Fire Protection Research Foundation, NFPA. His research area is in advancing the acceptance of technology in fire training.

Sam Ray

Sam Ray is an Electronics Engineer with the Public Safety Communications Research Division (PSCR) at NIST's Communication Technology Laboratory. In that role, he serves as the Mission Critical Voice Portfolio Lead. Prior to his arrival at NIST in 2016, Ray spent 20 years in system test, deployment, and engineering management roles in cellular/LTE infrastructure and device teams for Motorola and Nokia. He earned his BA from Hardin-Simmons University and BSEE from Texas Tech University and studied Systems Engineering at the University of Texas at Arlington.

Chris Rogers

Chris Rogers is a fire lieutenant with over 25 years of experience and an unusual fascination with maps. He started his fire service experience as a resident firefighter while going to college for cartography. He became a career firefighter in the Seattle area nearly 20 years ago, where his department was one of the first users of GIS in the region. This ignited his passion for the different uses of GIS in the fire service.

Daniel Rubenstein

Daniel Rubenstein is a Professor in the Department of Computer Science at Columbia University. He designs, builds, and analyzes computer networked systems. His significant contributions are in the area of multimedia networks, peer-to-peer (P2P) networks, wireless systems, and ultra-low power networked systems. Rubenstein's primary interest is in understanding the performance of the design of systems, measured by a combination of mathematical analysis and prototype implementation.

Justin Sadinski

Justin Sadinski has served the PSCR Division as an Electronics Engineer since 2018, working most recently on a mobile LTE geolocation system. He previously worked for the National Oceanic and Atmospheric Administration (NOAA) as an Electronics Engineer building, testing and troubleshooting meteorology equipment. Sadinski graduated from Christopher Newport University in 2016 with a Bachelor of Science degree in Computer Engineering.

Joel Scharlat

Joel Scharlat is an extended reality (XR) and cybersecurity executive who brings over 20 years of leadership and management experience. Scharlat currently serves as the Director of Operations for Cyber Bytes Foundation, a nonprofit based in the DC region, where he works closely with the Board of Directors to set the strategic vision and strategy of a start-up organization focused on education, innovation, and outreach programs for cybersecurity and emerging technologies like augmented reality (AR), mixed reality (MR), and virtual reality (VR). He holds a Master of Science degree from The Naval Postgraduate School, where he researched using immersive virtual environments to influence people's behaviors. He continues to research influence operations, privacy, and security issues associated with immersive environments. Scharlat retired from the United States Marine Corps after 20 years of service.

Henning Schulzrinne

Henning Schulzrinne is the Julius Clarence Levi Professor of Computer Science at Columbia University. Schulzrinne is recognized for internet standards development, and his research interests include Internet multimedia systems, quality of service, and performance evaluation. He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), and was previously the Chief Technology Officer for the U.S. Federal Communications Commision. He has received the New York City Mayor's Award for Excellence in Science and Technology, the VON Pioneer Award, CCC service award, and the IEEE Region 1 William Terry Award for Lifetime Distinguished Service to IEEE.

Hulya Seferoglu

Dr. Hulya Seferoglu is an Associate Professor in the Electrical and Computer Engineering Department of the University of Illinois at Chicago. Before joining the University of Illinois at Chicago, she was a Postdoctoral Associate at Massachusetts Institute of Technology. She received her Ph.D. degree in Electrical and Computer Engineering from the University of California, Irvine, M.S. degree in Electrical Engineering and Computer Science from Sabanci University, and B.S. degree in Electrical Engineering from Istanbul University. She serves as an associate editor for IEEE/ACM Transactions on Networking. She received the National Science Foundation (NSF) CAREER award in 2020.

Shishir Shah

Shishir Shah is a Professor of Computer Science at the University of Houston. His research focuses on fundamentals of computer

vision, machine learning, and statistical methods in image and data analysis with applications in multi-modality sensing, video analytics, object recognition, biometrics, and microscope image analysis. His recent efforts have focused on understanding challenges related to public safety video and the adoption of video analytic solutions to facilitate real-time alerting for first responders.

Radhakishan Shetty

Radhakishan Shetty is a Principal Software Engineer with JANUS Research Group's Mission and Training Solutions Business Unit. Shetty has used innovative technologies and processes to produce cost-effective solutions for JANUS customers for 16 years. He has Supported organizations such as NIST Public Safety Communications Research Division, NATO Allied Command Transformation, U.S. Army, U.S. Air Force, the National Institutes of Health and the Federal Bureau of Investigation creating Interactive Multimedia Instruction I-IV, serious games, simulations, and extended reality applications. This includes the research of mobile (iOS and Android) based Augmented Reality to enhance teaching of Modular Emergency Response Radiological Transportation Training (MERRTT), haptic interfaces for public safety situational awareness, and head mounted displays for presenting Internet of Things(IoT) data. Shetty graduated with a B.S. of Computer Science from the Georgia Institute of Technology.

Connor Shipway

Connor Shipway is a Technical Designer at NextGen Interactions, where he lends his creative and technical knowledge to help create effective user experiences in Extended Reality (XR). He earned his master's Degree in Art and Design from the College of Design at North Carolina State University, conducting his graduate research on game-based learning experiences as tools for education. He aims to use his education and experience to ensure that XR technology is applied as productively and responsibly as possible. A self-taught Unity Developer and C# programmer, he also assists with software development and implementation. In his spare time, Shipway enjoys working on his own game design and development projects.

Andrei M. Shkel

Dr. Andrei Shkel has been on faculty at the University of California, Irvine since 2000, where he is now a Professor of Mechanical and Aerospace Engineering. His research involves the development of precision gyroscopes, integrated inertial measurement units, systems and algorithms for inertial navigation, and chip-scale solutions for navigation aiding and self-contained navigation. His research interests are reflected in over 300 publications, 42 issued patents, and three books. He was awarded in 2013 with the Office of the Secretary of Defense Medal for Exceptional Public Service. Dr. Shkel is a Fellow of IEEE and a Fellow of the National Academy of Inventors (NAI).

Lauren Shluzas

Lauren Shluzas is CEO and Co-Founder of Bio1 Systems, Inc. Dr. Shluzas has over 15 years of experience in digital health and medical device design. She concurrently serves as a Lecturer at Stanford University in the Department of Mechanical Engineering. Prior to that, she was a Senior Research Engineer and Executive Director of the Healthcare Design Research Program within the Stanford Center for Design Research from 2013 to 2019. Dr. Shluzas' research focus areas include digital health, medical device design, health informatics, and health systems engineering – with an emphasis on mobile computing technologies for clinical care. Dr. Shluzas completed a Postdoctoral Fellowship in Medical Informatics through the U.S. Department of Veterans Affairs. She holds an M.S./Ph.D. in Mechanical Engineering from Stanford University and a B.S. from the Massachusetts Institute of Technology.

Jordan Smart

Jordan graduated from University of Colorado, Boulder with a B.S. in Computer Science before joining the PSCR team. He has experience in mobile augmented reality development specializing in WebXR.

Ian Soboroff

Ian Soboroff is the leader of the Retrieval Group at NIST and the head of the Text Retrieval Conference (TREC) program. He is widely recognized as an expert in building datasets to measure search and other information access tasks. His research focuses on methods for efficiently building datasets, measuring the quality of datasets, and building test collections for expert searchers with complex information needs.

Kevin Sofen

Kevin Sofen is a Business Development Manager with W.S. Darley and Company. He is engaged in developing VR training products and services tailored for first responders and is constantly exploring innovation in this field.

Geoff Spring

Geoff Spring holds the position of Senior Industry Advisor and Honorary Fellow within the Mission Critical Communications Research Unit of the Center for Disaster Management and Public Safety at the University of Melbourne, Australia. The Research Unit works to promote and influence the need for the Mission Critical Communications Ecosystem to be formally recognised as "Critical Infrastructure" by Australian Governments in the context of the impact of new and future public safety technologies and the associated research underpinning their ability to provide safer work environments for First Responders and safer communities for all Australians utilizing the lessons learned from international public safety communications organizations and their associated activities and projects underway, completed, and operational.

Maciej Stachura

Dr. Maciej Stachura is the Chief Technology Officer for Black Swift Technologies. He received his M.S. and Ph.D., in aerospace engineering, from the University of Colorado Boulder. During his time at CU, Dr. Stachura was involved in over 300 flight experiments ranging from multi-aircraft cooperative flight experiments to the VORTEX2 field campaign, which involved the first-ever intercept of a tornadic supercell thunderstorm. Dr. Stachura has also been responsible for securing and maintaining over 150 FAA Certificates of Authorization (COA) to perform legal flight operations over large parts of Colorado, Kansas, and Nebraska. Dr. Stachura was the Principal Investigator for a Phase I and Phase II NASA Small Business Innovation Research (SBIR), where he focused on the development, testing and on-going commercialization of a soil moisture mapping unmanned aerial system (UAS).

Bryce Stirton

Bryce Stirton is co-founder and President at Responder Corp and Program Director for the R2 Network. Responder Corp is a venture capital firm dedicated to supporting life-saving technology for the public safety industry. Responder invests through its Ventures division and builds and manages innovation programs through its Labs division. Responder's portfolio includes over 50 leading first responder technologies. The R2 Network is an innovation program built in partnership with the Department of Commerce to support response and resiliency innovation. He is a recipient of the GovTech Top 25 Doers, Dreamers & Drivers Award, an active Team Rubicon volunteer, and a graduate of Texas Christian University with degrees in Economics and Finance.

Radu Stoleru

Dr. Radu Stoleru is a Professor in the Department of Computer Science and Engineering at Texas A&M University and currently heads the Laboratory for Embedded & Networked Sensor Systems (LENSS).

Yishen Sun

Yishen Sun received her Ph.D. from the Department of Electrical and Computer Engineering at Northwestern University, and her M.S. and B.S. from the Department of Automation at Tsinghua University, China, respectively. Currently, Dr. Sun is a researcher in the Wireless Network Division (WND) in the Communications Technology Laboratory (CTL) at NIST. Her current research efforts focus on next generation solutions for mission critical communications, especially when facing out-of-coverage challenges, where device-

to-device links are necessary. Prior to joining NIST, Dr. Sun was a member of corporate research and standards teams for more than 10 years, working for well-known technology companies, including Motorola and Siemens. She contributed actively to the global standardization effort of 3GPP, and has been granted more than 20+ patents in the area of wireless communications.

Martin Swany

Dr. Martin Swany is Chair and Professor in the Intelligent Systems Engineering Department in the School of Informatics, Computing, and Engineering at Indiana University. His research interests include embedded systems and reconfigurable computing as well as high-performance parallel and distributed computing and networking. Dr. Swany has 30 years of experience with networking, from commercial networks to forward-looking network research. His group created the first perfSONAR network measurement implementation, now the most widely deployed performance measurement infrastructure serving the global research and education network community.

Niels Tangherlini

Section Chief Niels Tangherlini has been a paramedic for 32 years. During that time, he has served in many roles, working on ambulances, fire engines, and helicopters. He holds a bachelor's degree in social welfare from UC Berkeley. He has used his education to develop many programs aimed at improving the lives of high-need populations, work that informed the development of community paramedic programs and training across the United States. During his career Niels has been very involved in planning, training, and response to mass casualty incidents, most notably the Asiana airline disaster in 2013. As the Section Chief for EMS Operations in the San Francisco Fire Department, Niels has worked to leverage technology to address some of the greatest challenges faced by EMS units.

Jian Tao

Dr. Jian Tao is an Assistant Professor in the Department of Visualization at Texas A&M University and the Assistant Director for Project Development at the Texas A&M Institute of Data Science. He is an NVIDIA Deep Learning Institute University Ambassador, Extreme Science and Engineering Discovery Environment (XSEDE) Campus Champion, and a contributor to the Standard Performance Evaluation Corporation (SPEC) CPU 2017 benchmark suite. In 2018, Tao led the Texas A&M team to the final of both the ASC18 and SC18 student cluster competitions. He currently serves as a faculty advisor for the Texas A&M team for the SAE/GM AutoDrive Challenge Competition. His research interests include numerical algorithms, data analysis, high performance computing, machine learning, and scientific visualization.

Christine Task

Christine Task is the Lead Privacy Researcher at Knexus Research. She has served as the technical lead for the NIST, PSCR Differential Privacy Challenge series, and is the Data Architect for Knexus' disclosure avoidance work with the U.S. Census. She is also a report co-lead for the UNECE BSTN Working Group on Synthetic Data. She earned her Ph.D. in Computer Science at Purdue University, where her research focused on Privacy-preserving Social Network Analysis.

David Van Ballegooijen

David Van Ballegooijen has 17 years of experience managing small teams in a wide variety of fields, including politics, technology, for-profit and nonprofit organizations. He is the General Manager of the Western Fire Chiefs Association, and is part of a team that develops and supports leaders and organizations that provide protection for people and the environment from fires and other natural, technological, and human-behavior-caused emergencies.

Michael Varney

Michael Varney is the First Responder Network Authority (FirstNet) Director of Stakeholder Collaboration, responsible for supporting

FirstNet consultation efforts across the U.S.. He joined FirstNet in 2015, after serving for over 28 years in Information Technology and Public Safety Communications positions at the State of Connecticut where he most recently served as the Statewide Interoperability Coordinator and FirstNet State Point of Contact. In those roles he also served as the Chairman of the National Council of Statewide Interoperability Coordinators and as their representative on the FirstNet Public Safety Advisory Committee. Additionally, Varney has a strong public safety background serving for over 35 years in the fire and emergency medical services, including 14 years as Fire Chief.

Thomas Watson

Thomas Watson's passion is in embedded systems. He loves creating and implementing unconventional solutions to engineering problems. He has been working with 3D data as part of Map901 for several years. He received his Bachelor and Master degrees in Electrical and Computer Engineering from the University of Memphis and is currently working on an Electrical Engineering Ph.D there as well.

Matt Whitlock

Matt Whitlock is an Extended Reality (XR) Researcher in PSCR's User Interface/User Experience portfolio, focusing on improved usability for augmented reality (AR) and virtual reality (VR) interfaces. Prior to starting at NIST, Matt completed his B.S. in Computer Science at the University of Alabama and his Ph.D. in Computer Science at the University of Colorado, Boulder. Whitlock's graduate research explored the use of immersive AR and VR technology for information visualization and data analytics.

David Wild

David Wild, Ph.D. is a researcher, practitioner, educator and author in data science, biomedical research, and crisis technologies. He is a Professor in the Luddy School of Informatics, Computing and Engineering at Indiana University, where he also serves as the Director of the Crisis Technologies Innovation Lab. Dr. Wild is the Principal Investigator for the First Responder Smart Tracking Challenge. He focuses on crisis technologies, digital resilience, integrative data science, data privacy, security and ethics, and biomedical data science.

Jeremy Zollo

Jeremy Zollo brings more than 25 years of experience in public safety communications and engagement to the First Responder Network Authority (FirstNet). He is responsible for overseeing the organization's collaboration with stakeholders across market segments including public safety, industry and academia, and federal government partners. Zollo joined FirstNet in 2014 as the State and Local Outreach Branch Chief. He later served as the Deputy Director of Consultation focused on incorporating public safety's inputs into the development and delivery of FirstNet State Plans, which supported opt-ins from every state and territory. In 2018, he joined the newly created FirstNet Authority Enterprise Strategy Division as the Senior Director of Enterprise Strategy. Previously, Zollo worked at Booz Allen Hamilton providing telecommunications subject matter expertise and overseeing federal, regional and state outreach and planning activities for FEMA's Disaster Emergency Communications Division and DHS of Emergency Communications, among other programs. He is also an 8-year veteran of the United States Air Force.