

PSCCR

PULLING THE FUTURE FORWARD: Accelerating Public Safety Communications Research

Dereck Orr, Division Chief
Public Safety Communications Research

PSCR Overview

NIST



NIST



Primary federal laboratory conducting research, development, testing, and evaluation for public safety communications technologies



PSCR Mission

PSCR is driven towards **advancing public safety communications technologies** by accelerating the adoption and implementation of the most critical communications capabilities **to ensure the public safety community can more effectively carry out their mission** to protect lives and property during day-to-day operations, large scale events, and emergencies.



Public Safety communications research matters.



The investigation into the loss of 343 firefighters and 23 police officers at the World Trade Center on 9/11/2001 highlighted interoperability issues in first responder communications nationwide.

From fixing interoperability issues...

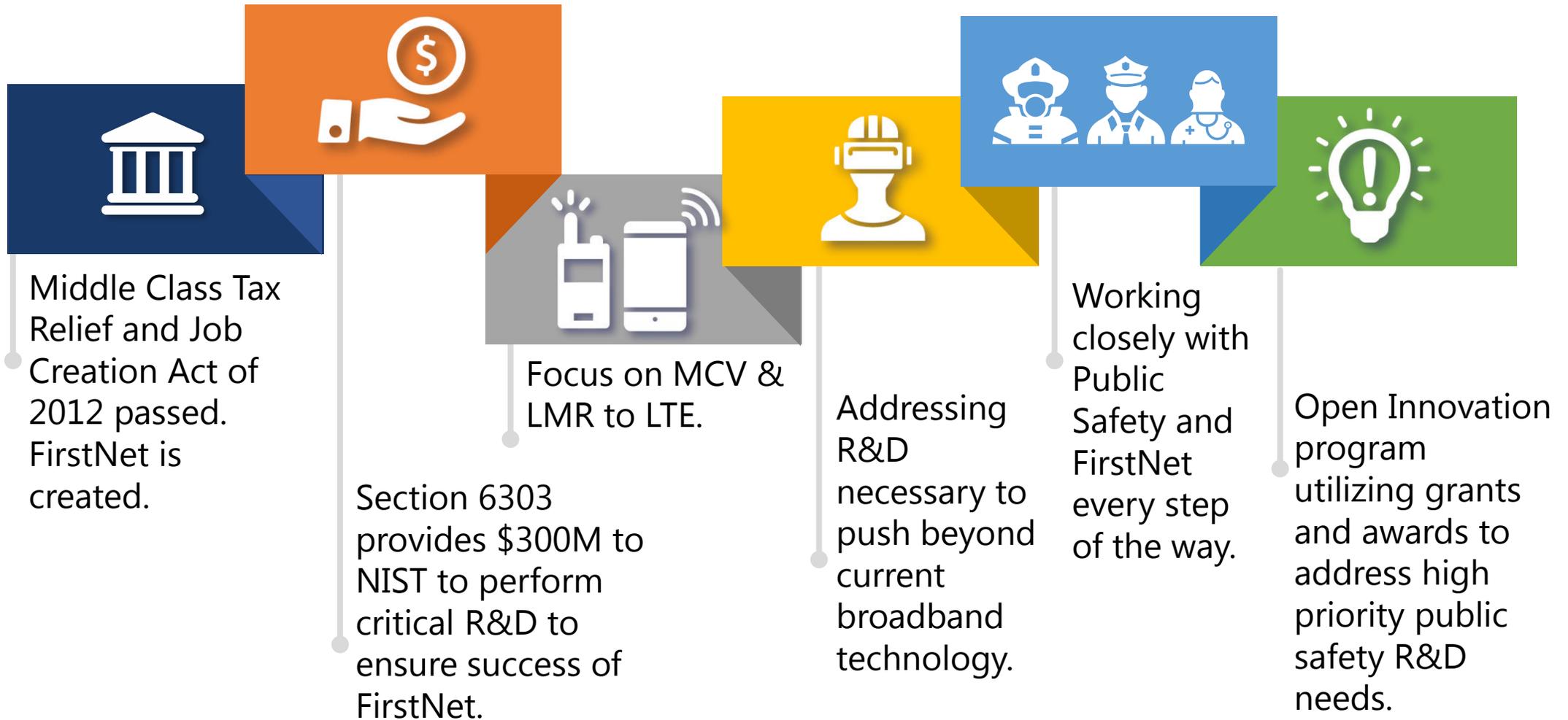


Photograph: Six Rivers Communications Inc.



To transforming public safety operations.

PSCR Innovation Accelerator Program



PSCR Roadmap Process



PSCR Management Core Values



Continuously solicit stakeholder input through a variety of channels



Build on momentum from current efforts in industry, academia, federal partners



Transparency, open information sharing



Identify highest priority public safety needs before launching R&D projects



Consistent, repeatable planning logic to justify decisions



Measure project management effectiveness and R&D impact to continuously improve program outputs

Stakeholder Driven



Management Approach (2013-Present)

1

2013 Stakeholder Workshop

Gathered, prioritized input to determine what R&D investments are necessary to transition public safety from LMR to LTE broadband.

- **Output = 250 possible investment areas, evaluation criteria**

2

Technology Roadmaps & Summits

Convened annual working groups, events to identify gaps and opportunities to meet public safety's highest-priority communications needs.

- **Output = LBS, Analytics, UI/UX roadmap reports**

3

Strategic Planning

Ideas collected in roadmaps and summits informed PSCR's current portfolio structure, project plans, and strategic planning efforts to focus resources.

- **Output = Portfolio Structure, *PSCR Success Framework*, Funnel Vision**

4

Performance Measurement

Developed portfolio dashboards, performance metrics to observe research progress and impact over time.

- **Output = Quarterly portfolio reviews to monitor program effectiveness, mitigate risk, improve outcomes generated by PSCR**

5 Key Research Areas

LMR to LTE

User Interface User Experience
Mission Critical Voice

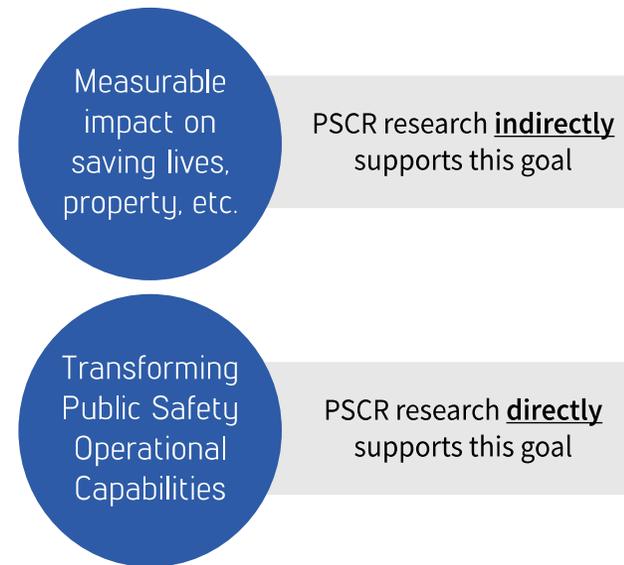
Location-Based Services
Public Safety Analytics

Security
Resilient Systems

Cross Cutting Research Areas

PSCR 2022 Success Framework

PSCR 2022 Success Framework [March 2018]



PSCR primarily focuses on developing, expanding, or influencing these 5 areas

How are we doing this?



Internal
Research

External
Research

Prizes &
Challenges

Our Ambition:



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5 Key Research Areas

LMR to LTE

User Interface User Experience
Mission Critical Voice

Location-Based Services
Public Safety Analytics

Security
Resilient Systems

Cross Cutting
Research Areas

LMR to LTE

PSCR's primary strategic focus in the LMR to LTE area is in capabilities that can interface existing LMR systems with LTE (and future broadband) systems.

Internal Research

- Implementing software defined radio (GNURadio/ USRP) for proof of concept to bridge LMR to interworking function without LMR radios/ base stations
- PSCR serves as the convener for a working group with the Department of Homeland Security Emergency Communications Preparedness Center





While access to broadband data is improving public safety operations and providing new applications, voice remains the most critical communications capability.

Internal Research

- Mission Critical Push-to-Talk
 - Push-to-Talk and QPP Modeling
 - List of FirstNet Certified Devices and 3GPP RAN Test Cases
 - Test Bed
- Mission Critical Quality of Experience
 - Measurements
 - LTE Impact on LMR
- Direct Mode
 - Device-to-Device Modeling
 - MCV Call Model

External Research

- PSIAP-2017 – MCV – 9 current award recipients, Nearly \$10 Million
- PSIAP-2019 – QoE – Over \$2 Million

User Interface / User Experience

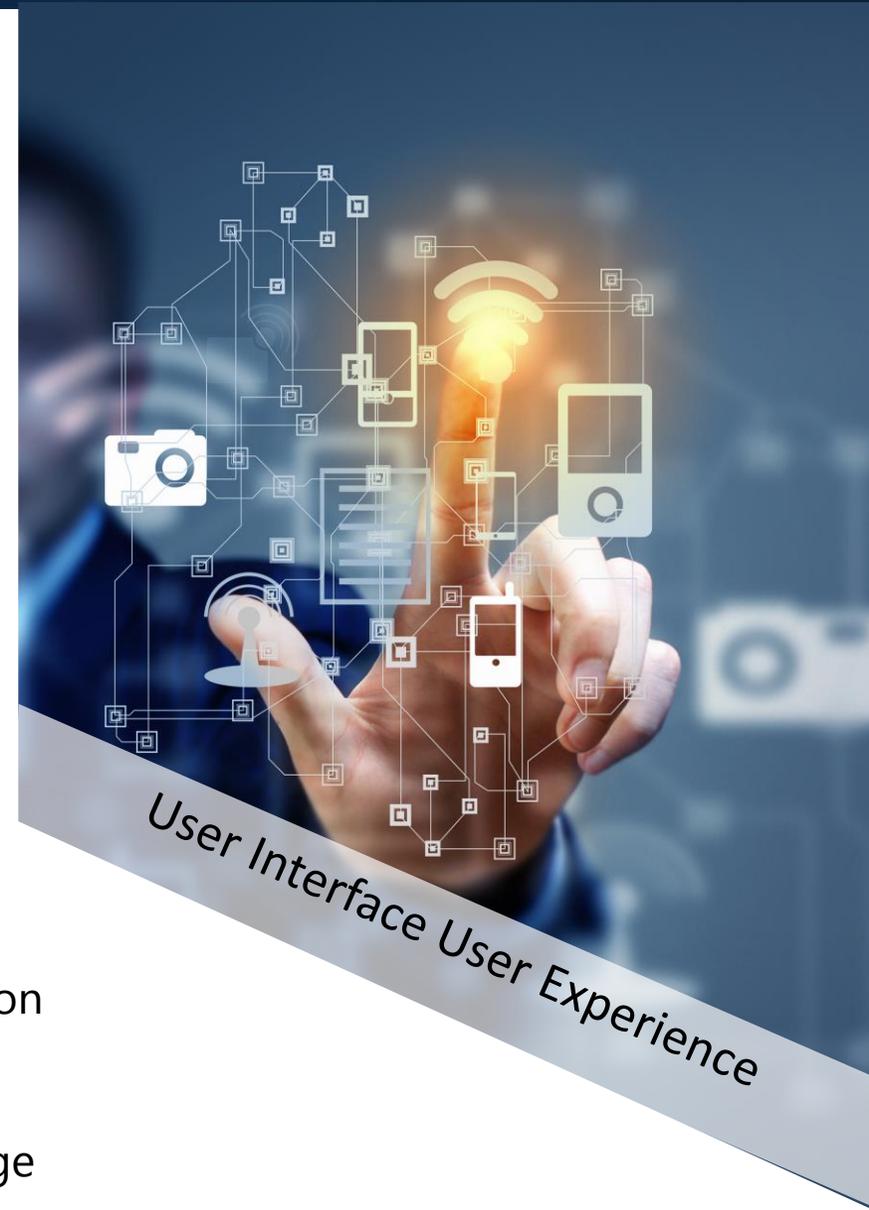
UI/UX was identified as a priority research area for PSCR. Stakeholders from across the United States identified Augmented Reality (AR) and Virtual Reality (VR) as the R&D areas.

Internal Research

- User Experience Research and Testing Methodologies
 - Qualitative and Quantitative Surveys
 - Technology Needs and Wants for First Responders
- Virtual Reality and Augmented Reality Scenarios
 - Situational Awareness, Navigation, and Patient Monitoring

External Research

- VR/AR for Improved UI
 - VR NAV HUD Prize challenge – 6 Finalist, \$125,000 Prize Purse
 - PSIAP-2018–UI – 7 Awardees and Cooperative Agreements, \$6.4 Million
- UI/UX Haptic Interfaces
 - Current prize challenge iteration to build off of VR HUD NAV Challenge

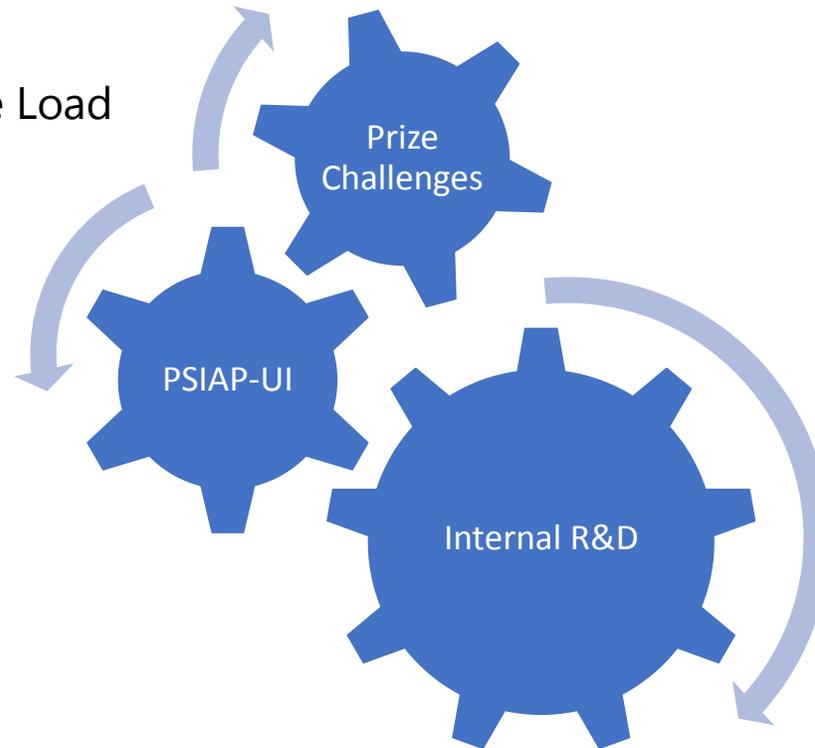


User Interface User Experience

User Interface / User Experience

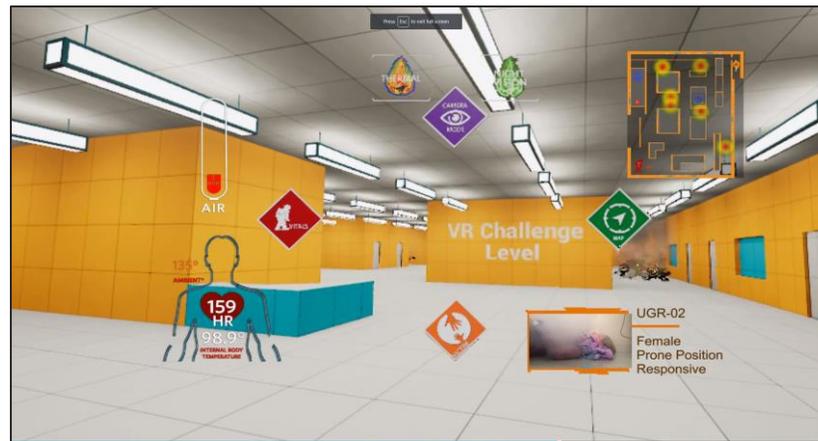
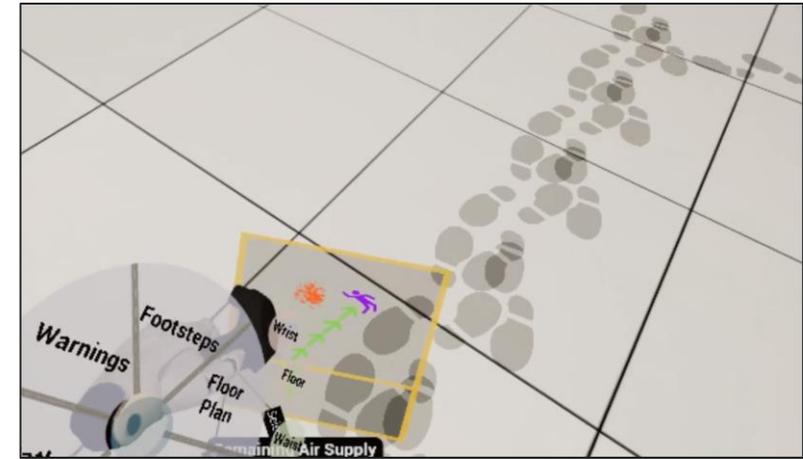
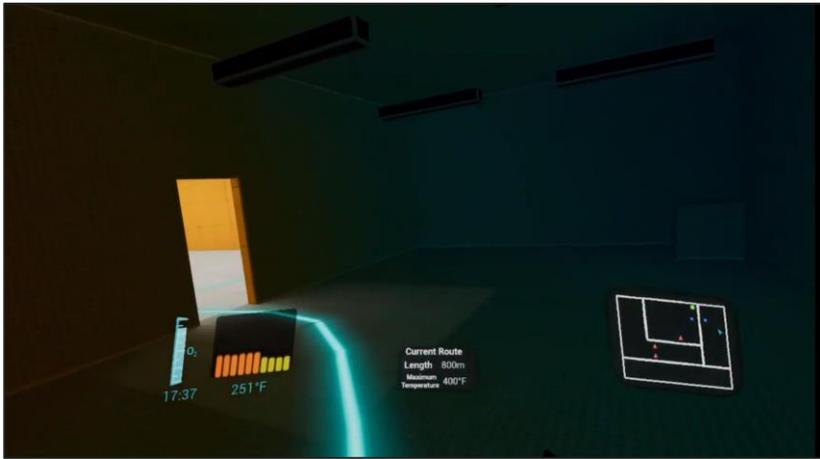
UI/UX Outcomes

- Improved Test, Development, and Training for Public Safety
- PSIAP-UI
 - Immersive Environments - passive haptics, VR overlay on physical props
 - Induce Physical and Cognitive Load
 - Improved Measurements
 - Smart/AI User Interfaces
- PSCR
 - Develop Testbeds
 - Prototype Dev
 - Prize Challenges
 - Industry & Academia
 - Training for PS Technology



User Interface User Experience

Heads-up Display Navigation Challenge Finalists



PSCR UI/UX at work using virtual reality...



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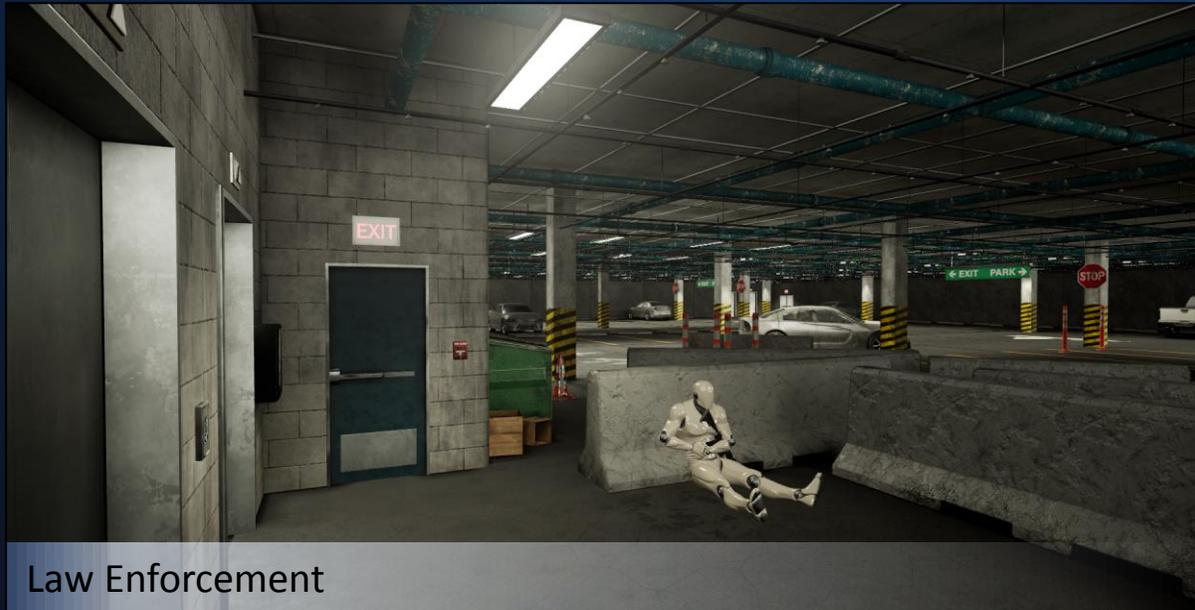
Our plan for what's next:

HAPTIC PROVIDERS

HELP MAKE OUR FIRST RESPONDERS BETTER EQUIPPED



Emergency Medical Services

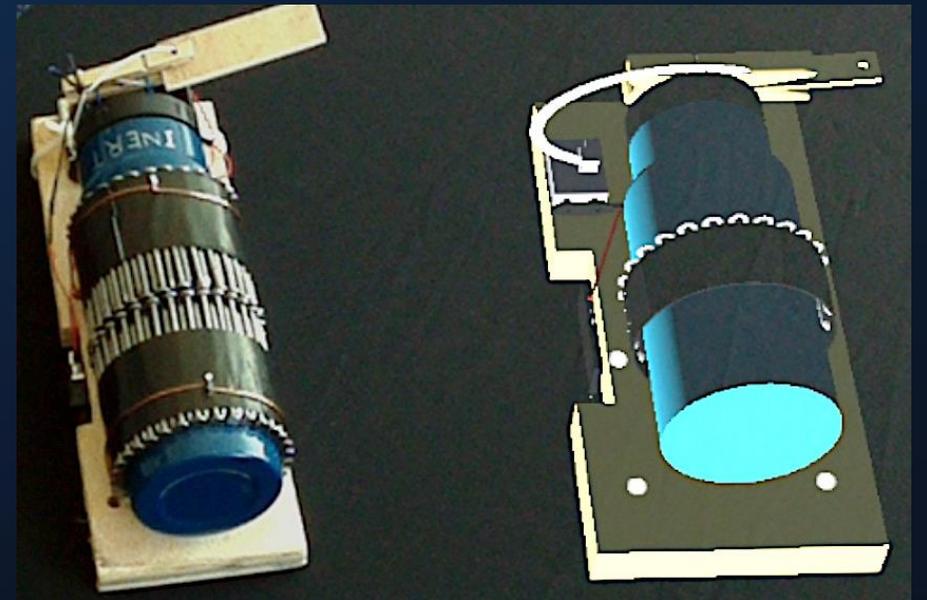
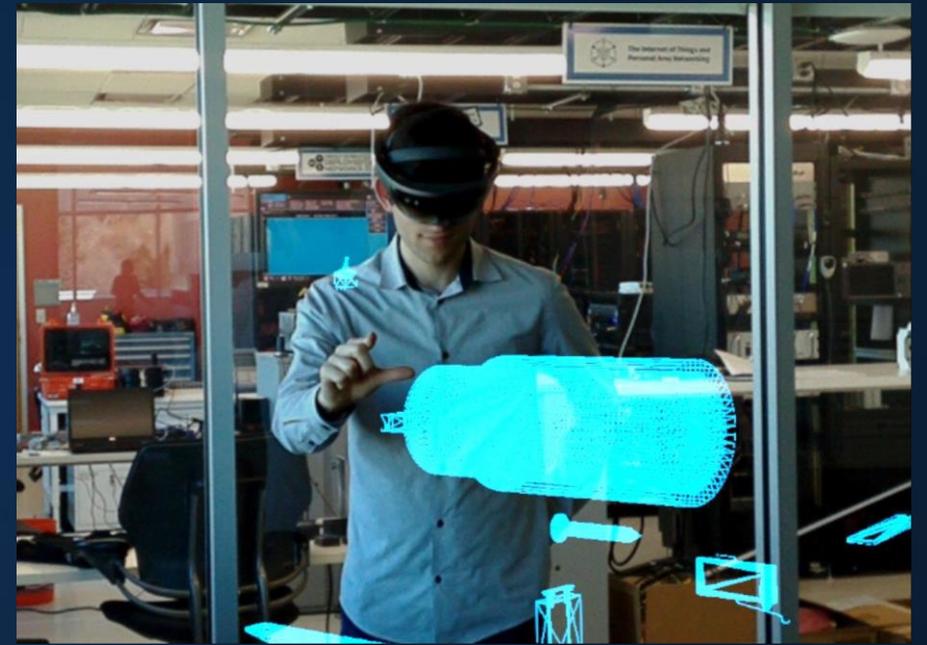
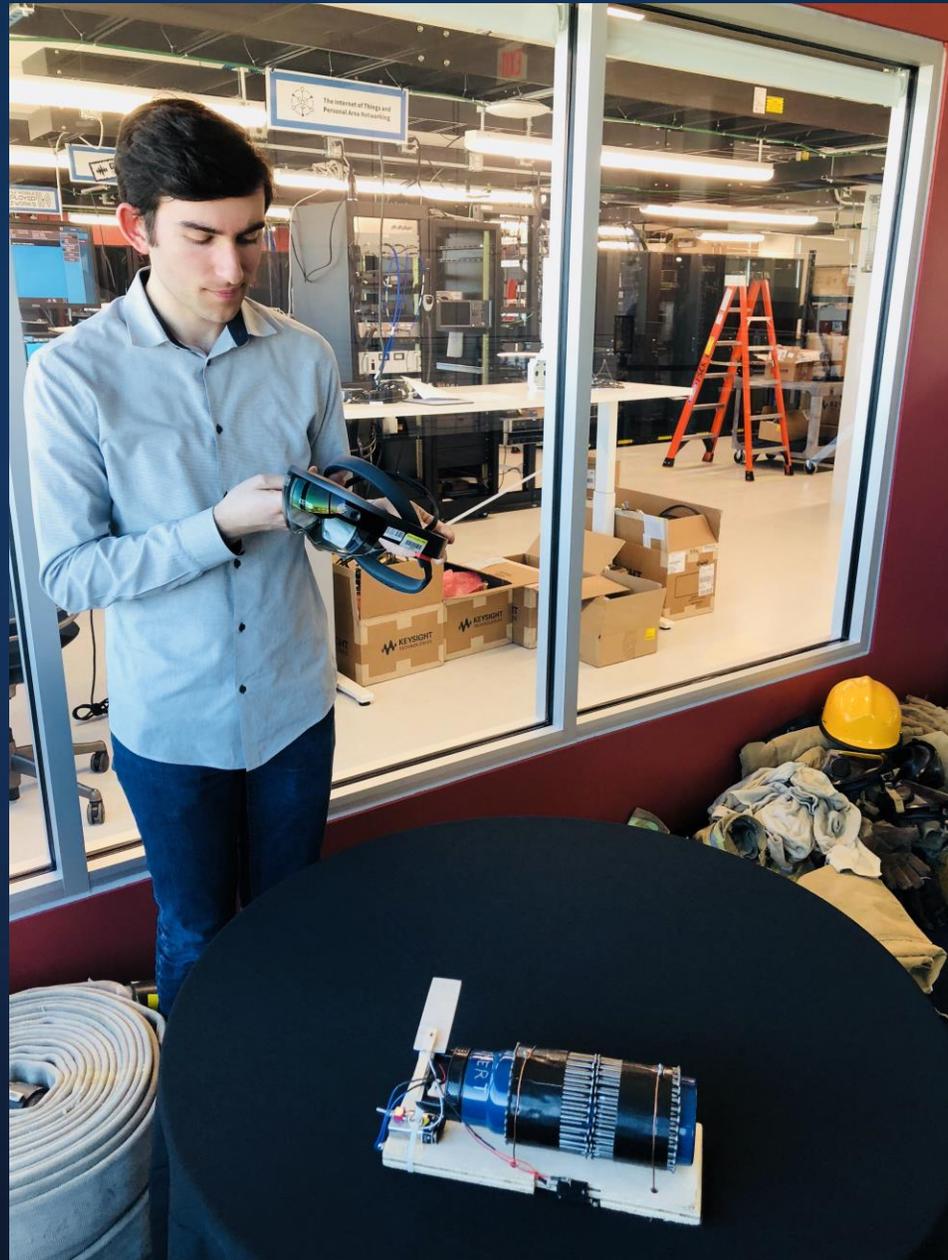


Law Enforcement



Fire

... and in Augmented Reality



Location Based Services

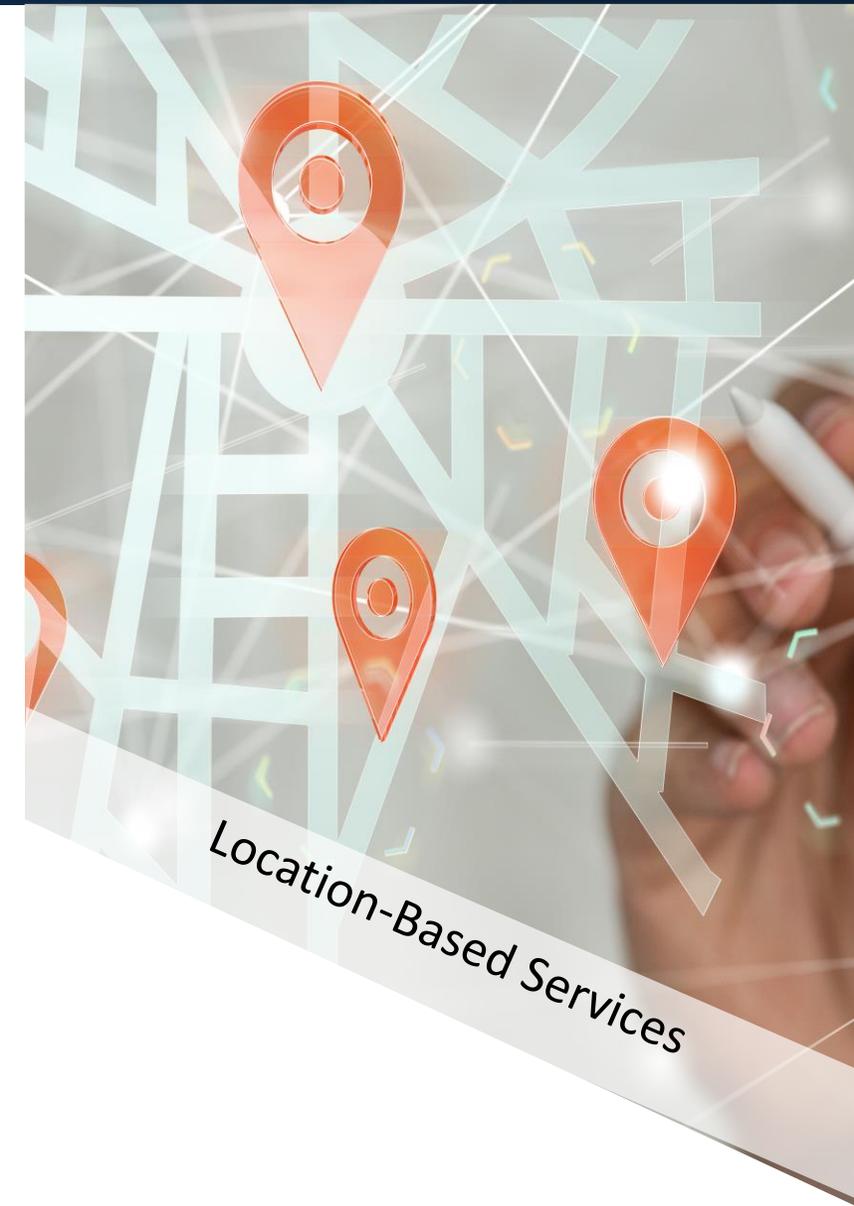
The ability to locate, track, and inform first responders while indoors under difficult conditions remains a critical capability sought by public safety.

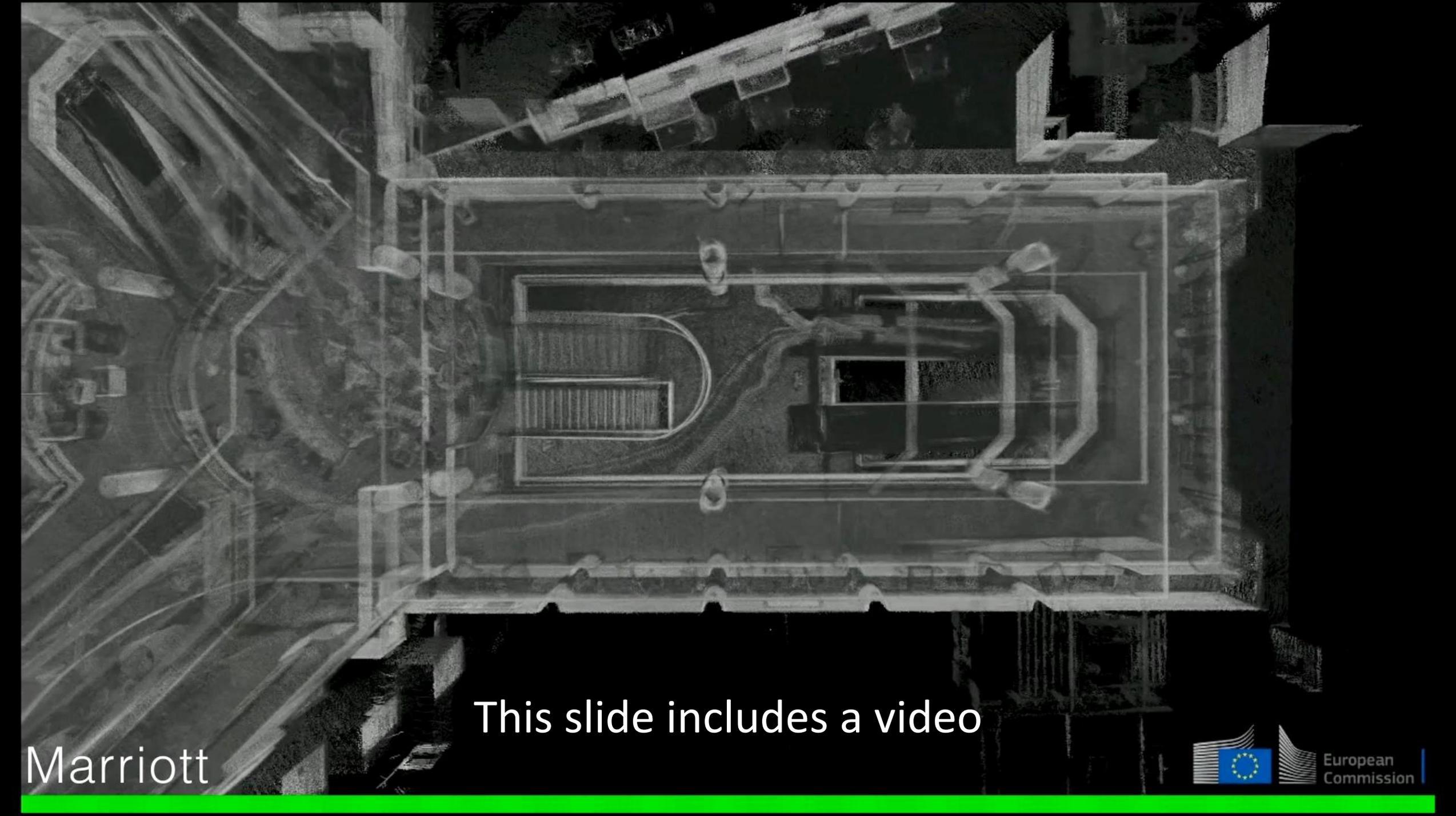
Internal Research

- LiDAR Point Cloud Mapping Demonstrations
- OGC Indoor Mapping & Navigation Pilot:
 - 10 deliverables, 7 companies, 5 countries

External Research

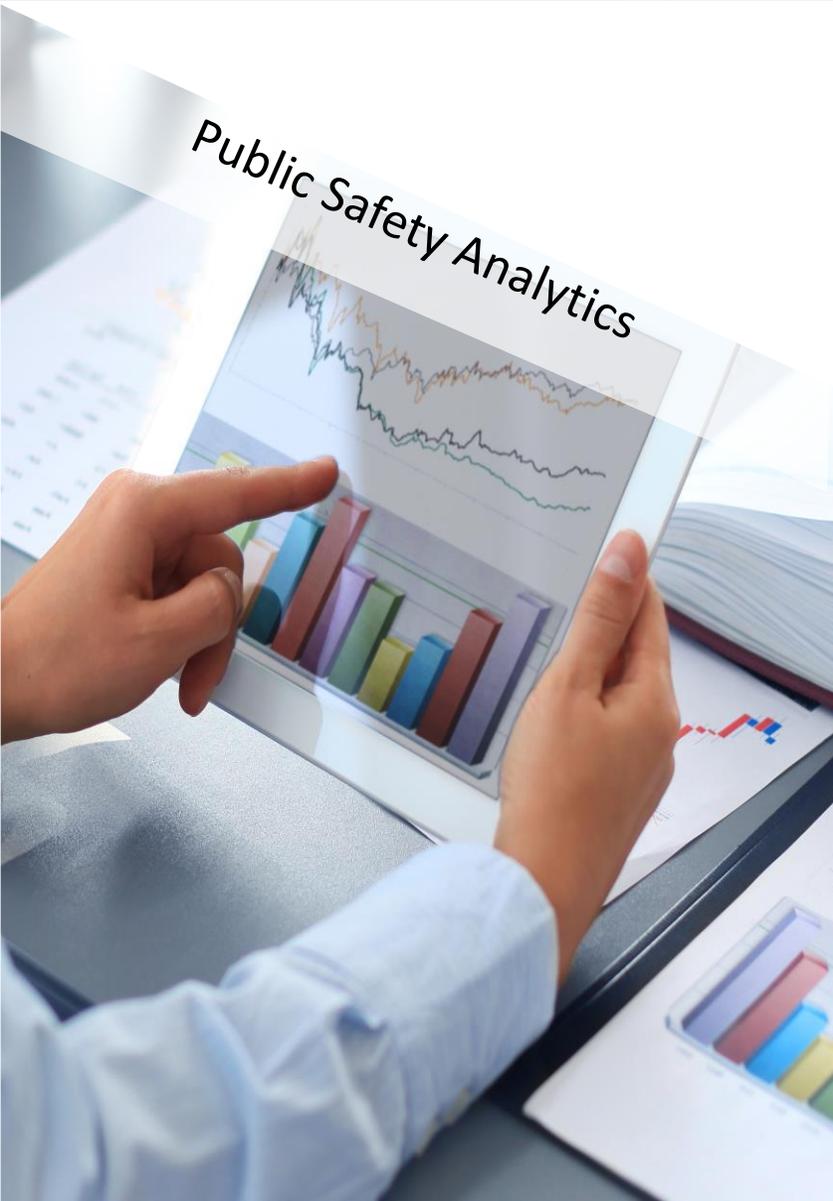
- Positioning
 - PerfLoc Prize Challenge
- PSIAP-2017– LBS – Over \$6.3 Million
- PSIAP – 2018 – Point Cloud City – Three Current Awards, Over \$775K
- PSIAP – 2019 – iAxis – One current award, \$200K





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Marriott



Analytics, identified as a priority R&D investment area for PSCR, will play a role in every component of future public safety workflows, including optimizing FirstNet to reach its full potential.

Internal Research

- Information retrieval for public safety text challenge – social media incident streams

External Research

- Public Safety textual data deidentification and differential privacy Prize Challenge
 - Match #1 (concept papers) and Match #2 (algorithm design) complete!
 - Final Match, Match #3 (sequestered data testing) ending soon!
- Automated Streams Analytics for Public Safety (ASAPS) live real-time multimodal analytics grand prize challenge

Security

Security, including cybersecurity, is an area which will affect every aspect of public safety communications. PSCR serves to develop and enhance security solutions to current and future public safety communications.

Internal Research

- Federated Identity Credential and Access Management (ICAM) & Enhanced Authentication
- Mobile Single Sign-on (SSO) Shared Devices
- Mobile Application Security Vetting
- Public Safety Handset and Wearable Security

External Research

- Expanding the SIM Card Use Challenge – Just launched!





Public safety communication systems must continue to work, and are even more necessary under circumstances in which other networks fail.

Internal Research

- Broadband Demonstration Network – Deployables
 - Architect, prototype, and demonstrate the use of standalone Deployable System solutions to provide users with broadband services

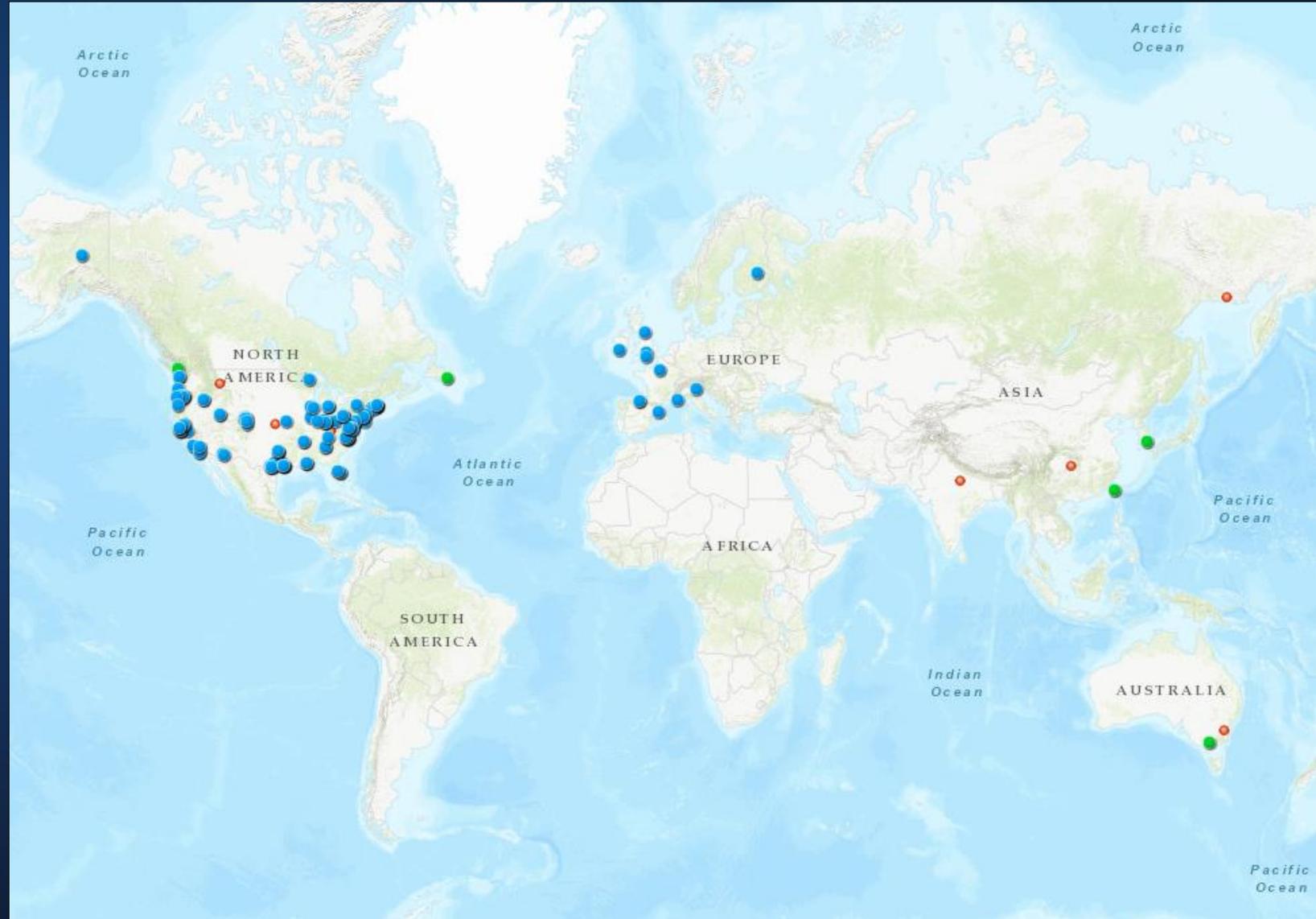
External Research

- PSIAP-2017– Resilient Systems – Over \$6.5 Million
- Unmanned Aerial System Flight and Payload Challenge
 - Winning team completed a UAS prototype and demonstrated flight capabilities within public safety build and cost limitations
 - Awarded \$50,000

PULLING THE FUTURE FORWARD

An abstract graphic featuring a complex network of interconnected nodes and lines in shades of blue, green, and orange, set against a dark blue background. The nodes are represented by small circles, and the lines are thin, creating a web-like structure that suggests connectivity and data flow. The overall aesthetic is modern and technological.

Pulling the future forward will require a worldwide effort.

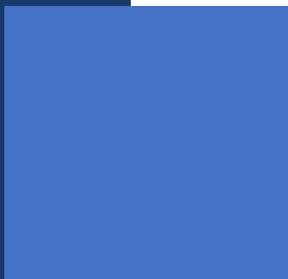
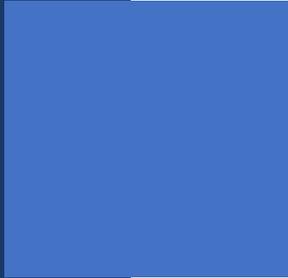


We will get there through partnerships with researchers across sectors.

NIST



PSCR award recipients rely on partnerships with Public Safety to advance research.



Georgia Tech



PSCR award recipients rely on partnerships with Public Safety to advance research.



- Mission Critical Voice Test Equipment
- Public Safety Tech to Protect
- Public Safety Data Analytics
- 3D Indoor Tracking
- Unmanned Aircraft Systems (UAS) Flight and Payload II
- Image & Video Capture and Quality





QUESTIONS?