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* Please note, unless mentioned in reference to a NIST Publication, all information and data presented is preliminary/in-progress and subject to change

70+ PRESENTATIONS
50+ DEMOS
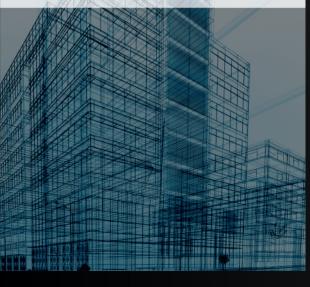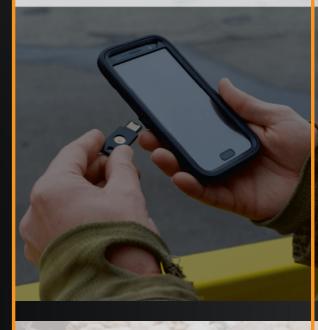
5 KEY RESEARCH AREAS

USER INTERFACE USER EXPERIENCE

LOCATION-BASED SERVICES

SECURITY

LMR to LTE

MISSION CRITICAL VOICE

PUBLIC SAFETY ANALYTICS
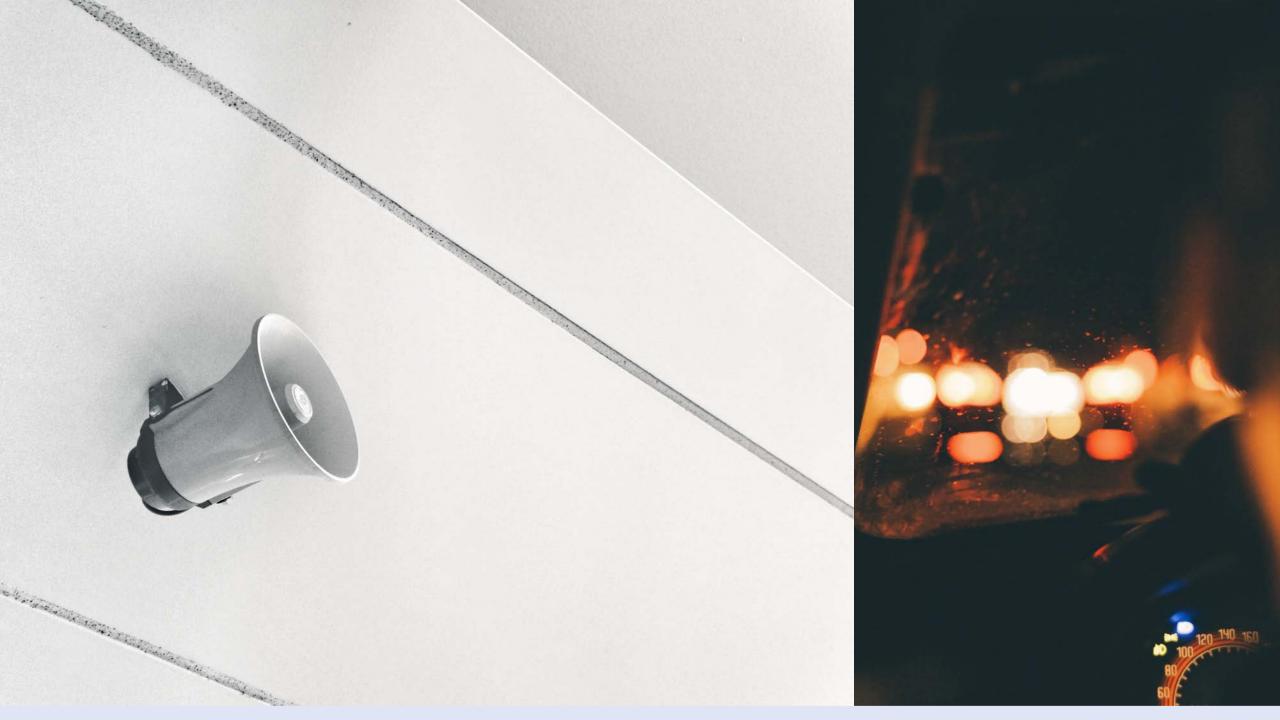
RESILIENT SYSTEMS
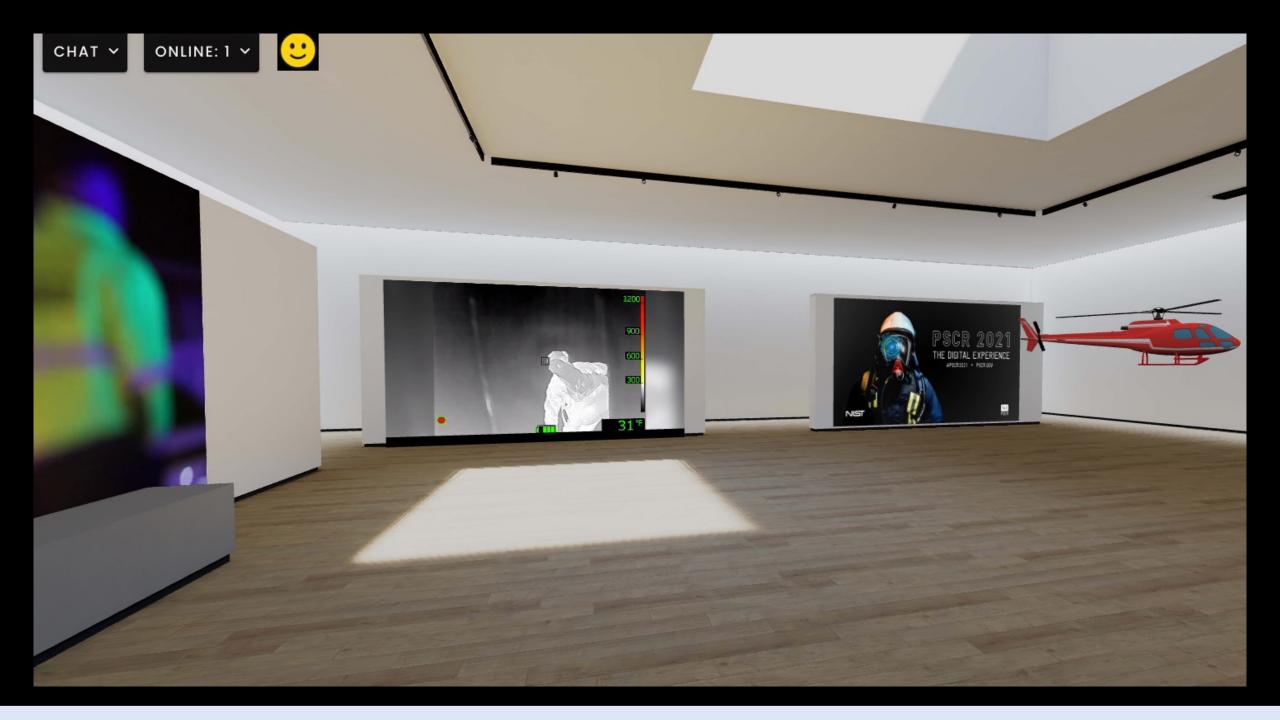
CROSS CUTTING RESEARCH AREAS
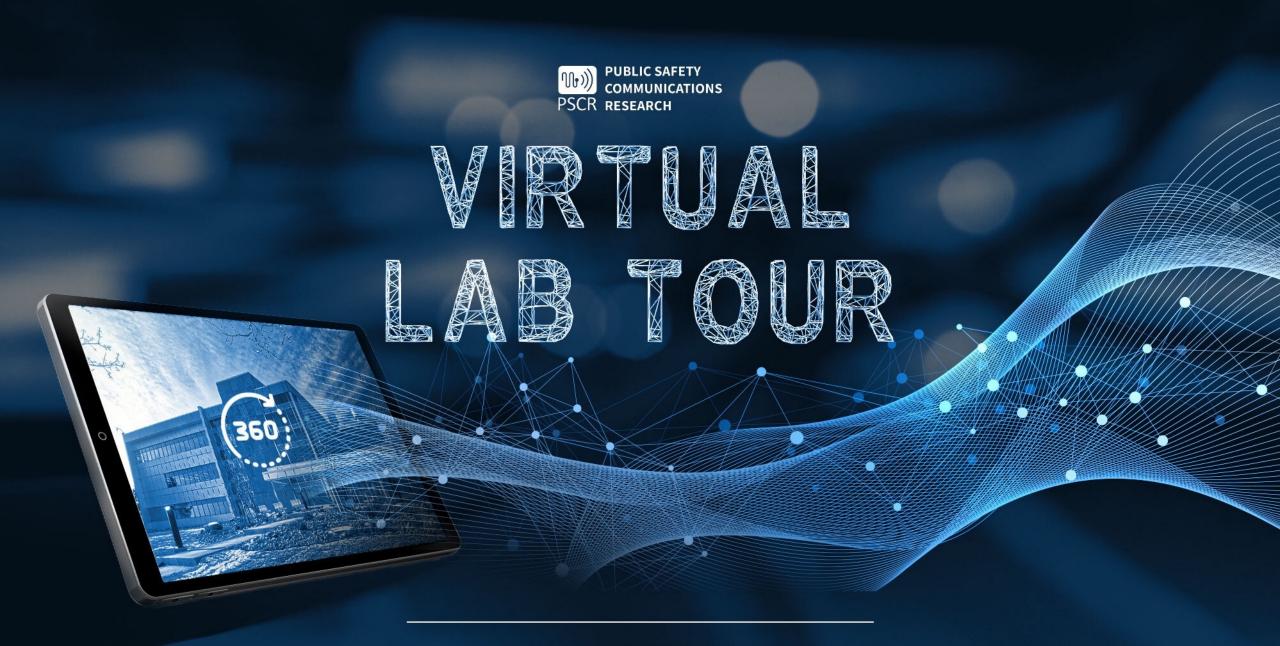
PECHA KUCHA

20 X 20

ADD TO CALENDAR

#PSCR2021

THANK YOU

#PSCR2021 • PSCR.GOV

Learn. Connect. Lead

PSCR UIUX Presenters

Scott Ledgerwood

Margaret Pinson

Yee-Yin Choong

Jack Lewis

Kate Kapalo
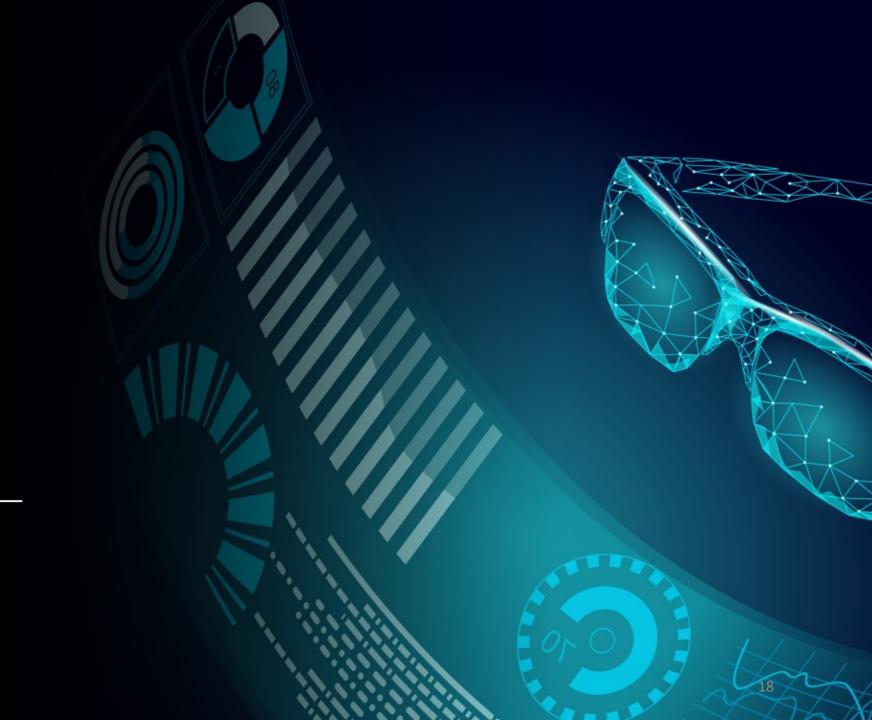
Paul Merritt

PSIAP-AR

2020 Funding
Opportunity

Computer Vision

Prize Challenge

No Reference Metrics

Lens Distortion

Lens Flare

Reflections

Dark Shadows
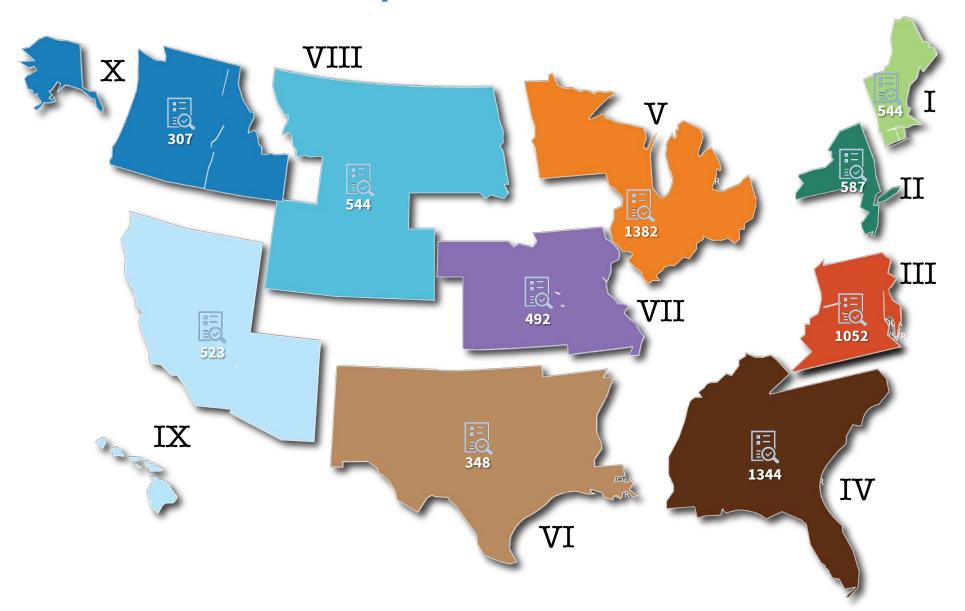
Voices of First Responders User-Centered Research

X — 307

VIII — 544

V — 1382

I — 544

II — 587

VII — 492

III — 1052

IX — 523

VI — 348

IV — 1344

Voices of First Responders

193 Interviewed — 2017-2018

Law Enforcement 72	Fire Service 71	EMS 25	9-1-1 COMMS 25

1486 TECH PROBLEMS QUOTES

883 TECH NEEDS QUOTES

7182 Survey Responses — 2018-2019

Law Enforcement 2099	Fire Service 2617	EMS 902	9-1-1 COMMS 1564

DAY-TO-DAY TECH QUESTIONS

26 DEVICES USAGE & RANKING

300 TECH PROBLEMS WITH 26 DEVICES

19 APPS/SOFTWARE USAGE & RANKING

24 FUTURISTIC TECH

16 PUBLICATIONS To Date

8 NISTIR VOICES OF FIRST RESPONDERS

2 NISTIR INCIDENT SCENARIOS PSCR USABILITY HANDBOOK
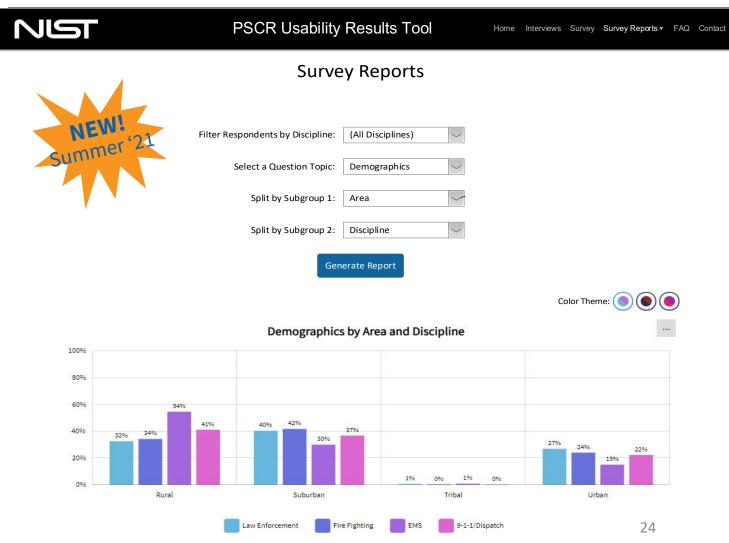
5 PROFESSIONAL PAPERS PEER-REVIEWED

1 WEB TOOL PSCR USABILITY RESULTS

Voices of First Responders Research Highlights

NISTIR.8340

Specific Operational HFE Guidelines to Improve the Usability of Communications Technology for First Responders

NIST Usability Team

Report available at: https://doi.org/10.6028/NIST.IR.8340

WEB TOOL @ https://publicsafety.nist.gov

NIST | PSCR Usability Results Tool — Home Interviews Survey Survey Reports ▾ FAQ Contact

Survey Reports

NEW!
Summer '21

Filter Respondents by Discipline: (All Disciplines)

Select a Question Topic: Demographics

Split by Subgroup 1: Area

Split by Subgroup 2: Discipline

[Generate Report]

Color Theme:

Demographics by Area and Discipline

Rural: 32%, 34%, 54%, 41%
Suburban: 40%, 42%, 30%, 37%
Tribal: 1%, 0%, 1%, 0%
Urban: 27%, 24%, 15%, 22%

Law Enforcement Fire Fighting EMS 9-1-1/Dispatch
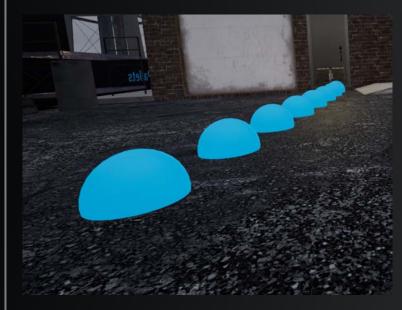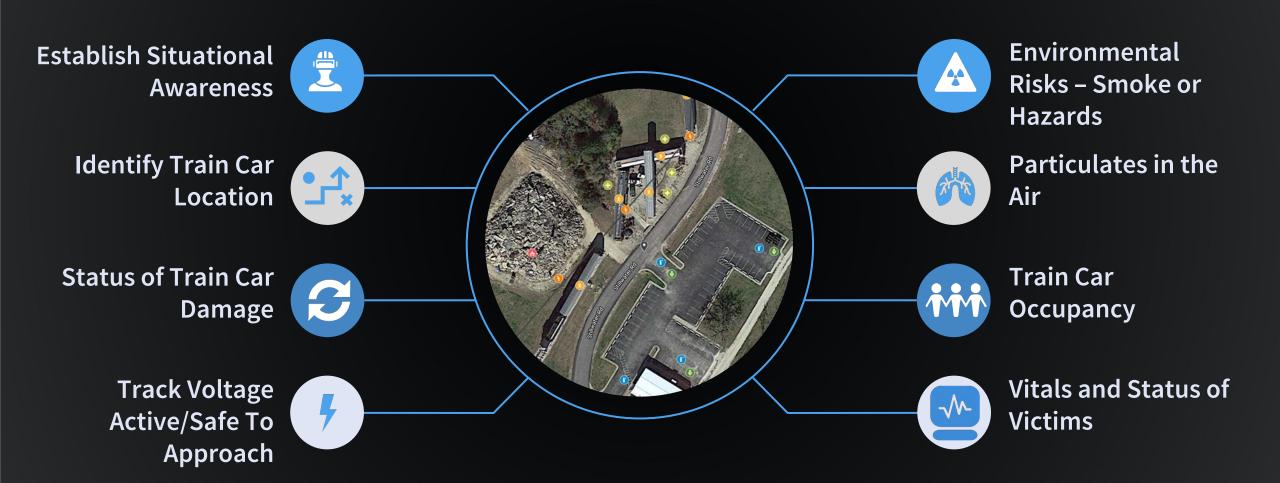
PSCR Virtual Reality Testbed

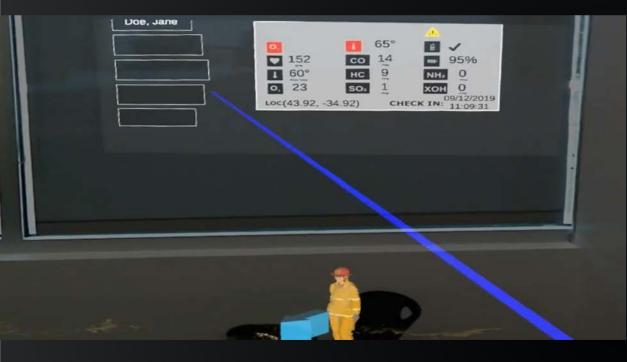# User Study/User-Centered Approach
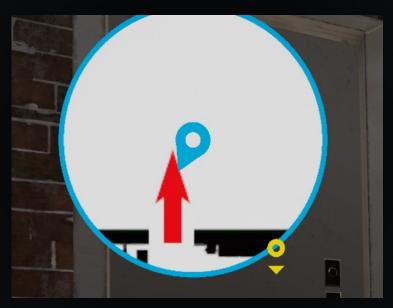
Navigational HUD Study

Mass Transit Accident

Establish Situational Awareness

Identify Train Car Location

Status of Train Car Damage

Track Voltage Active/Safe To Approach

Environmental Risks – Smoke or Hazards

Particulates in the Air

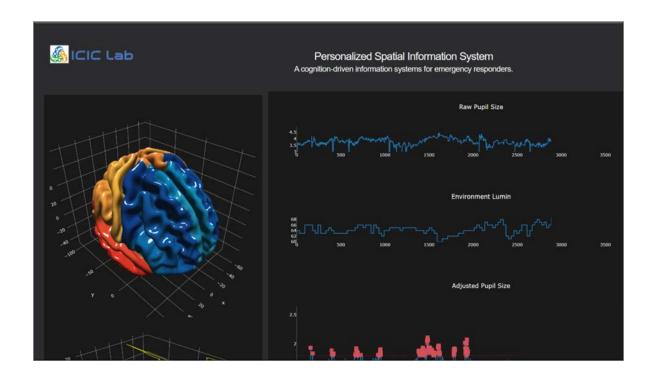Train Car Occupancy
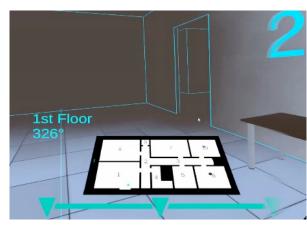
Vitals and Status of Victims
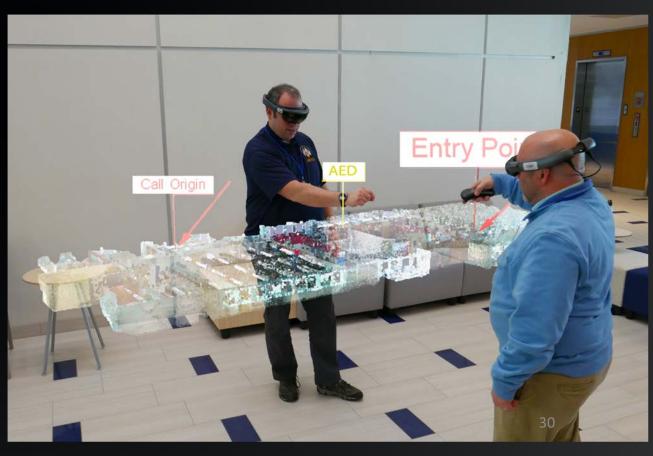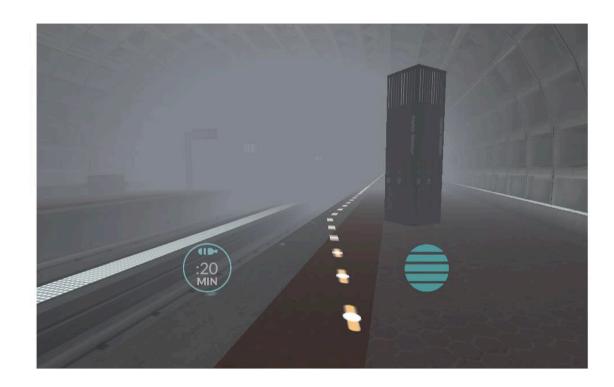
Using AR
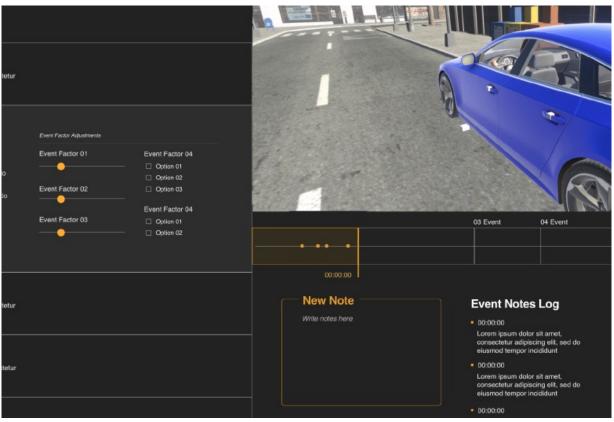
UF and NC State

Health Scholars and GTRI
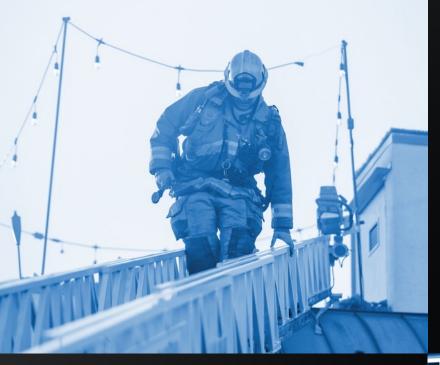
NextGen Interactions and UNC
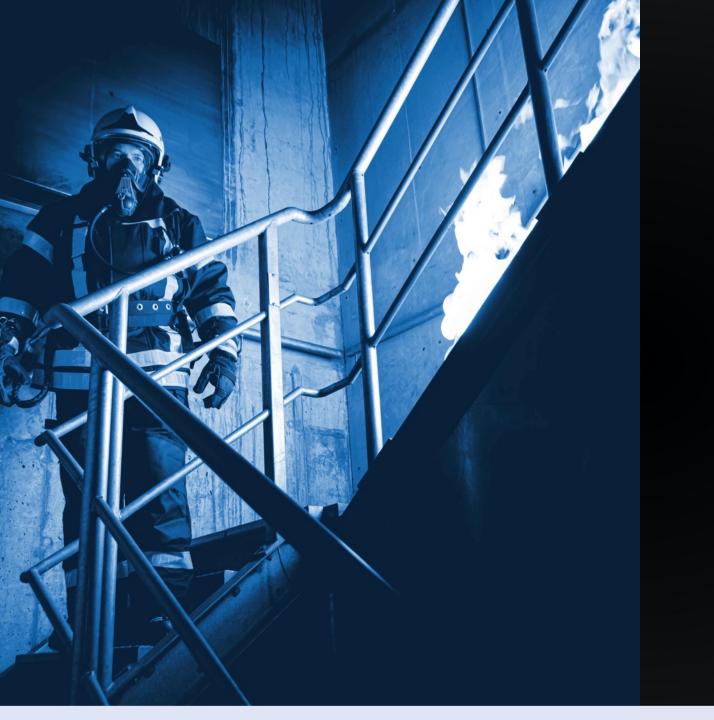
Traclabs

THANK YOU

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Location-Based Services Overview
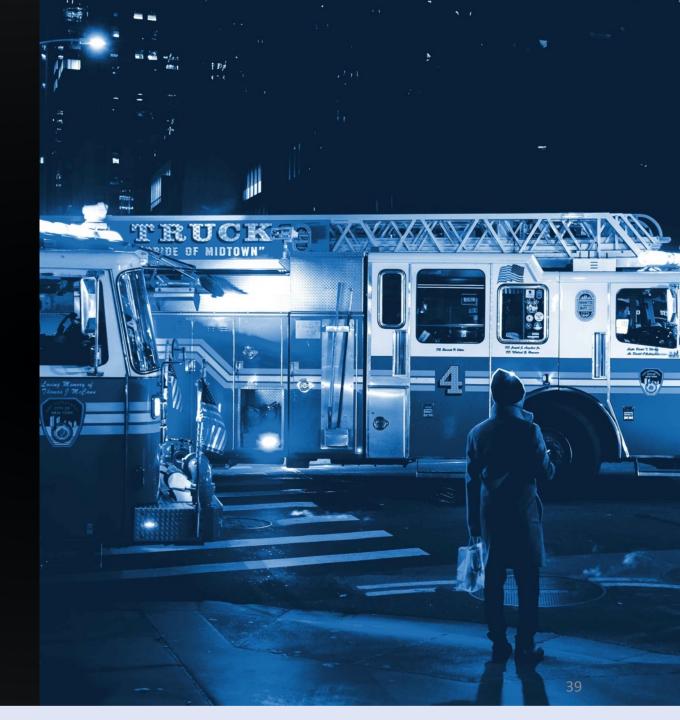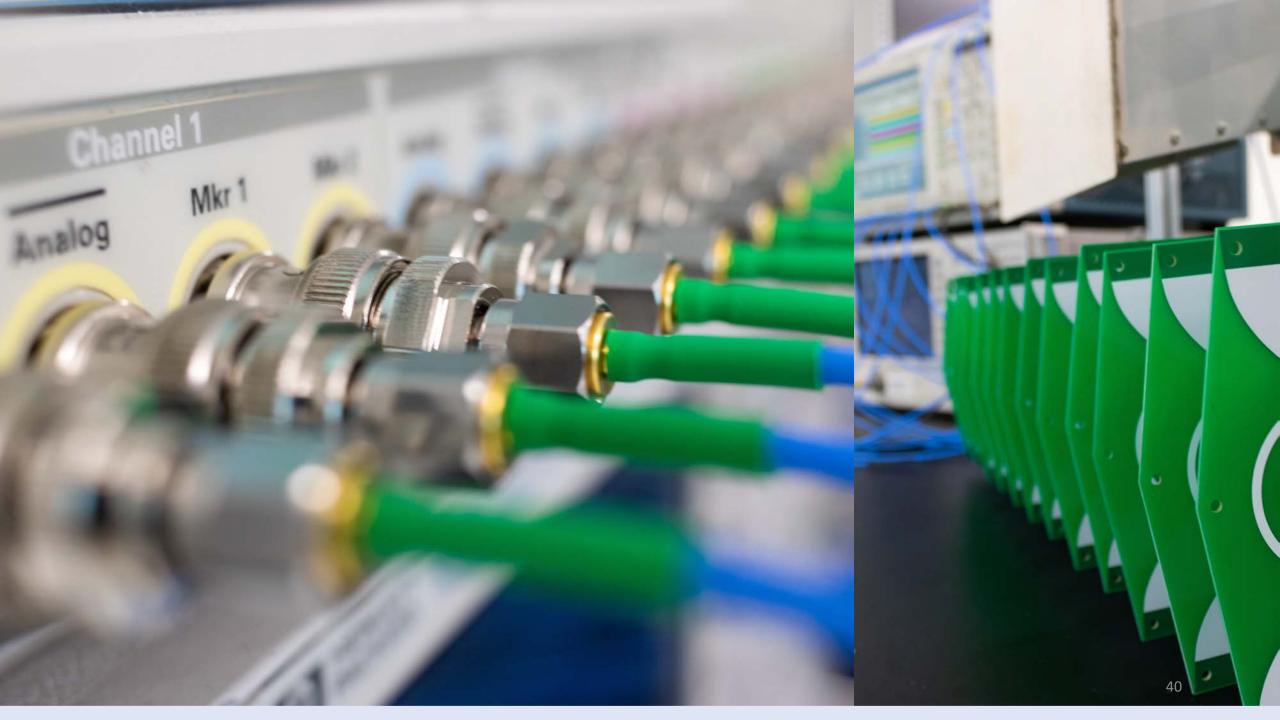
Joe Grasso

Tracking

Mapping

Navigation

External Research

Point Cloud City

Ground Truth System

i-Axis

FR3D

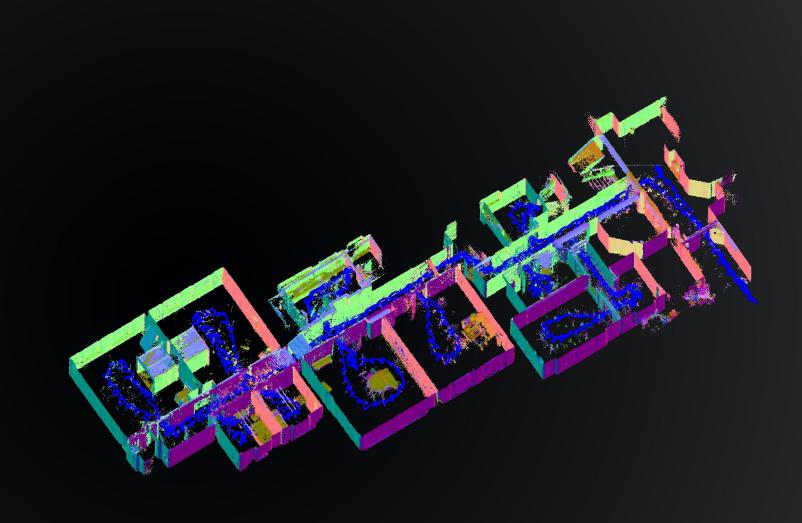X, Y, Z: 2.848, 3.322, 1.541   Roll, Pitch, Yaw: 85.84, 2.64, 85.32

INDIANA UNIVERSITY
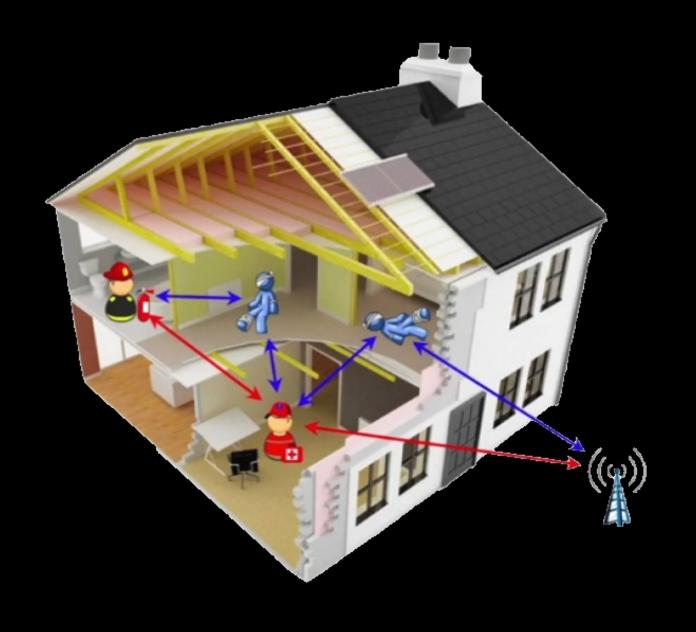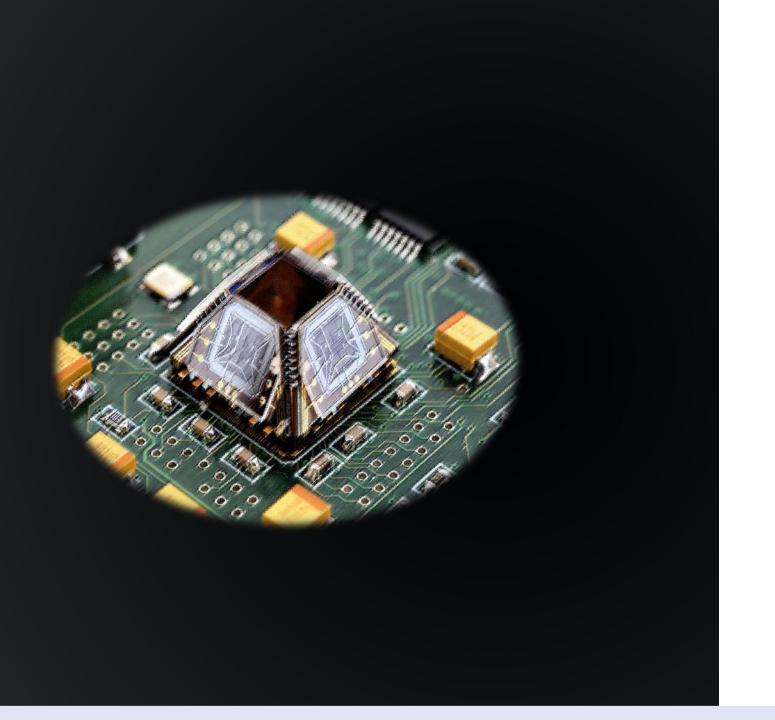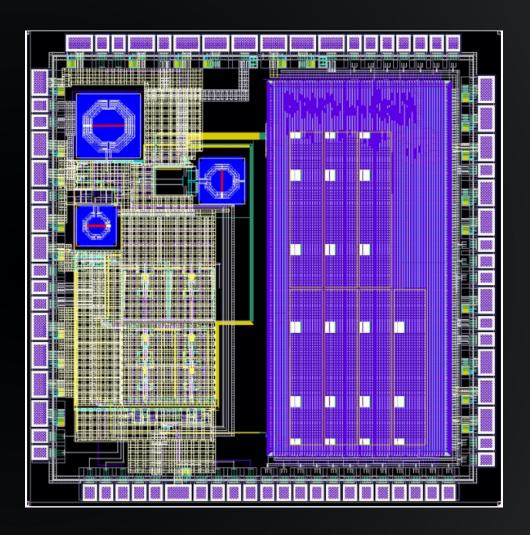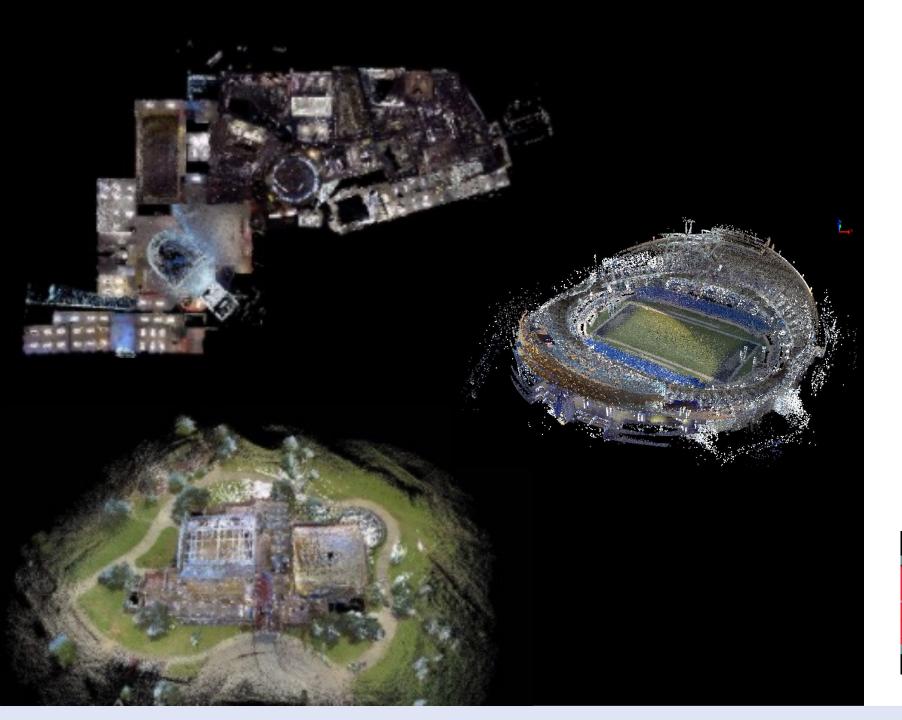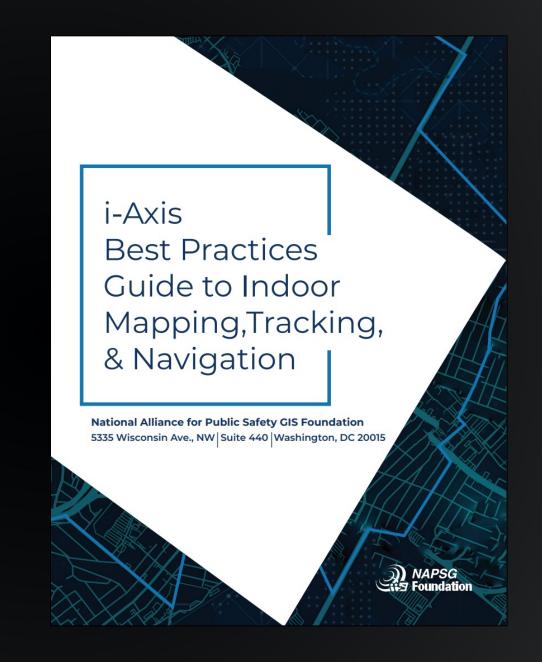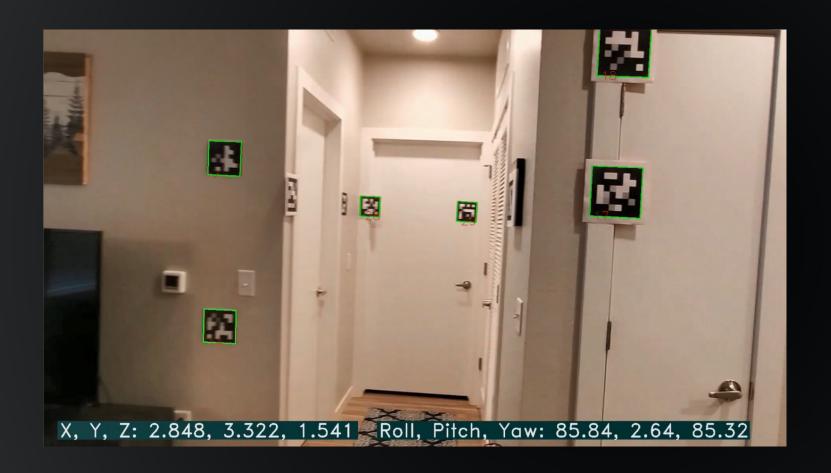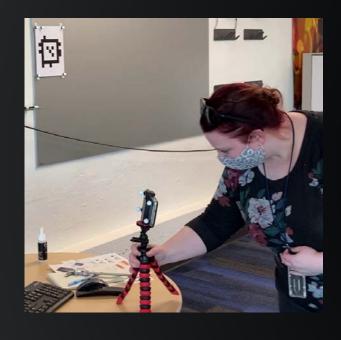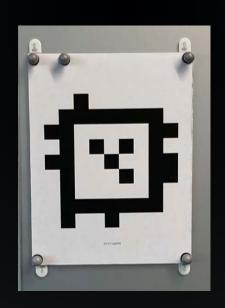
TRUSTEES OF
INDIANA UNIVERSITY
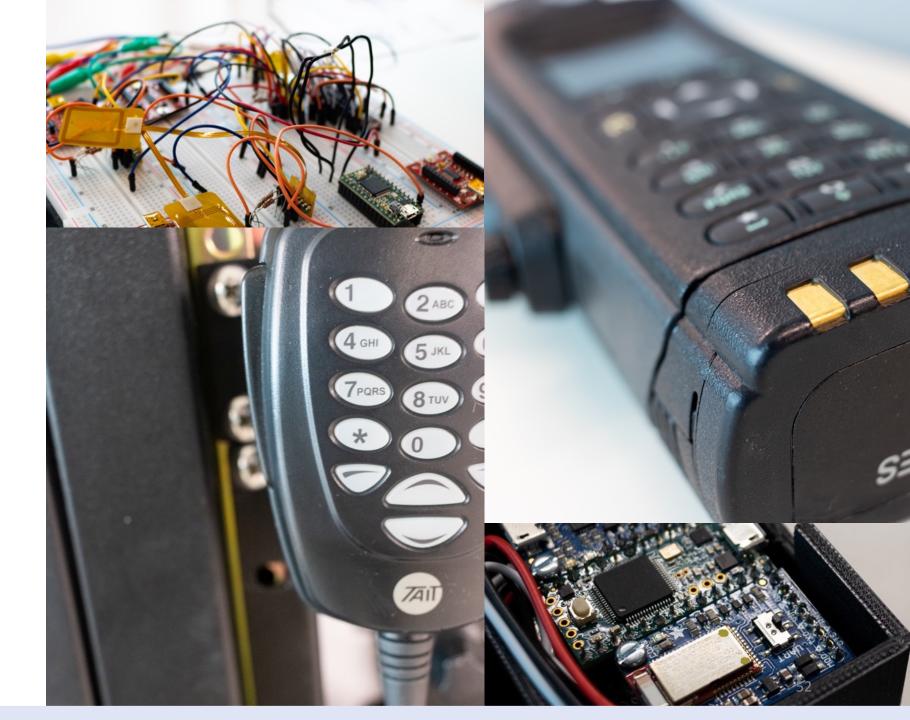
FIRST RESPONDER
3D INDOOR
TRACKING PRIZE
COOPERATIVE AGREEMENT

52

Enjoy the Digital Experience!

joseph.grasso@nist.gov

#PSCR2021
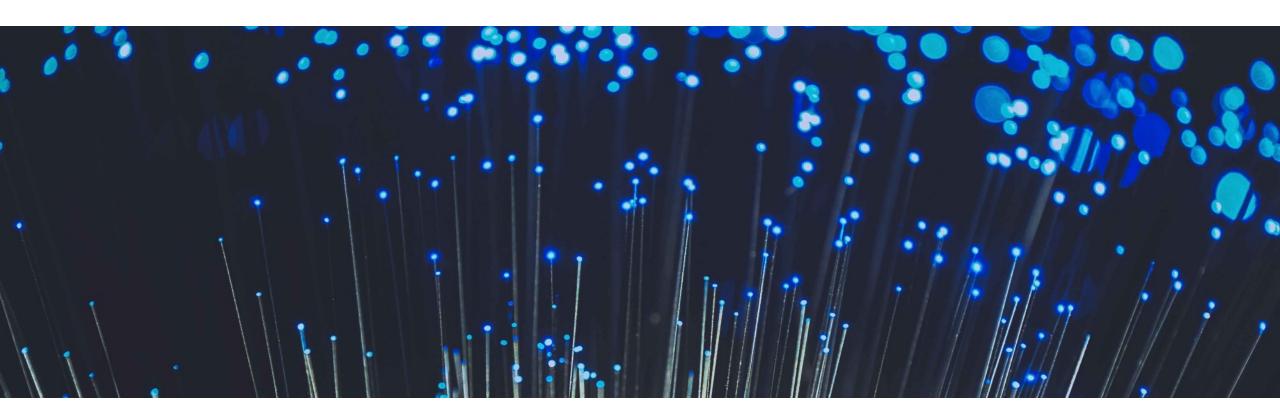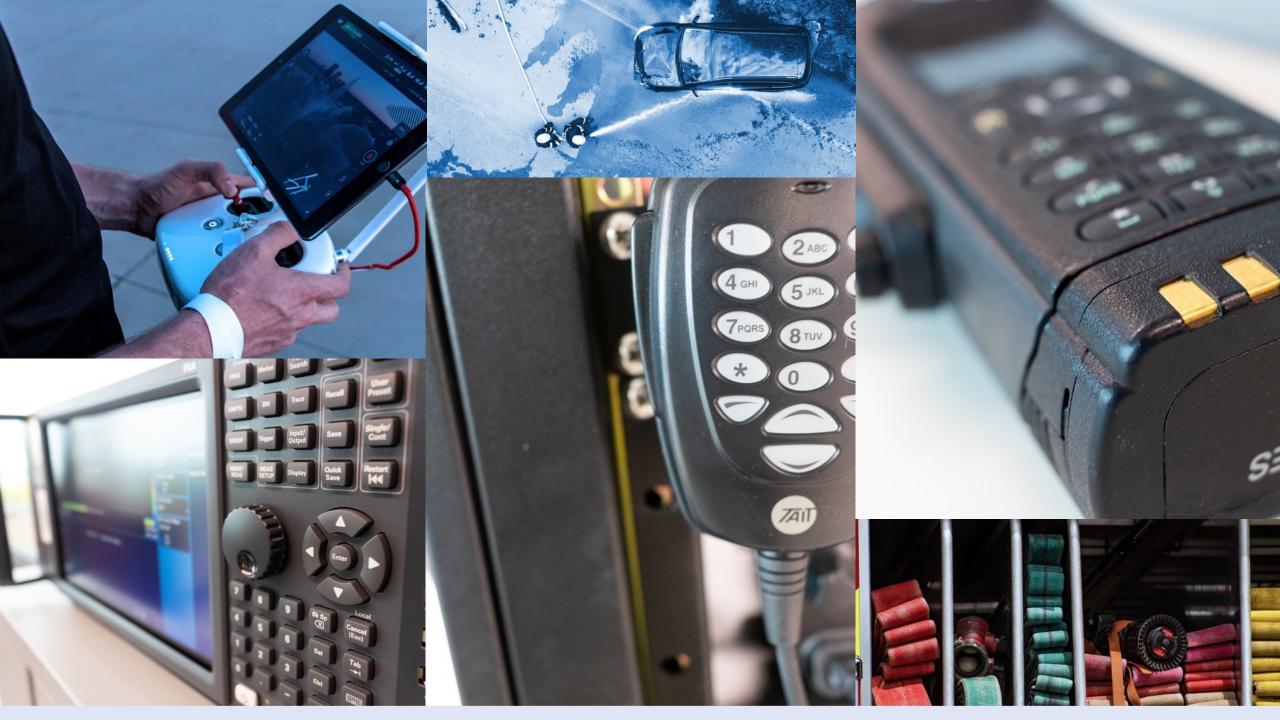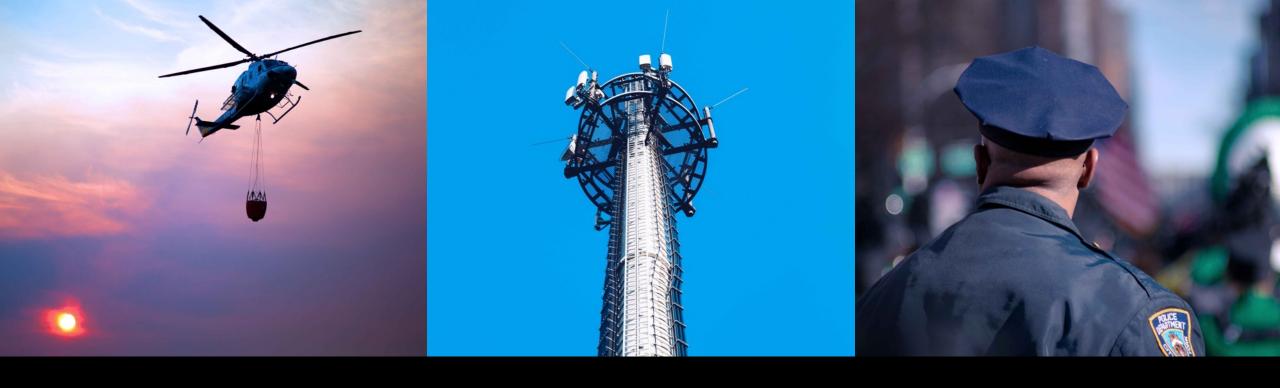
MISSION CRITICAL VOICE (MCV)
PECHA KUCHA
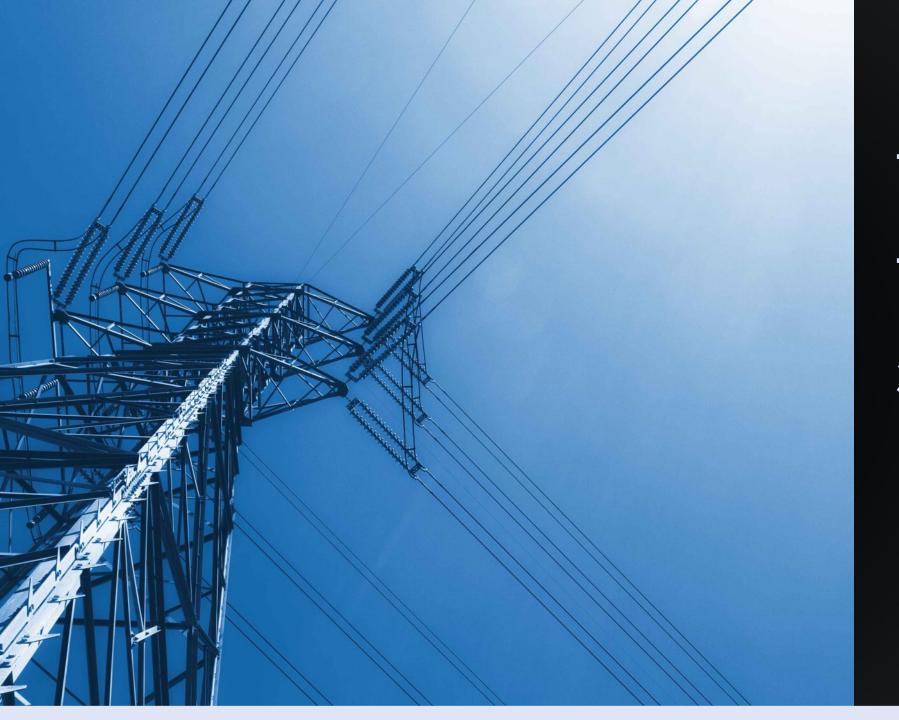
Cara O'Malley
Jesse Frey
Fernando Cintron

CONTRACT AWARDED
for Interworking Function (IWF) to be built; can be bought in industry as a commercial-grade solution

TEST LMR TO BROADBAND 3GPP INTERWORKING FUNCTION (IWF)

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PHASE III COMMERCIALIZATION AWARD

Catalyst Communications Technology

Radio over IP (RoIP) 3GPP-standard interfacing

CONNECTION

AT&T and FirstNet's Enhanced Push to Talk (EPTT) capability
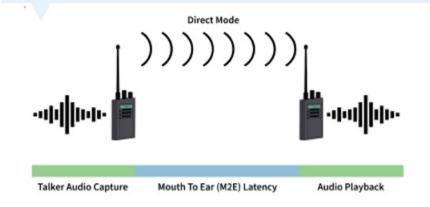
PSCR - MCV LMR system
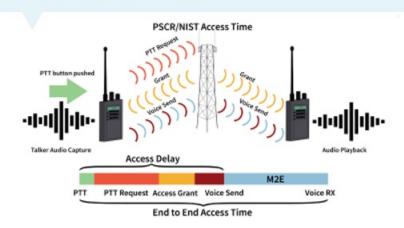
MISSION CRITICAL VOICE (MCV) QUALITY OF EXPERIENCE (QOE) MEASUREMENTS

MOUTH TO EAR LATENCY

Direct Mode

Talker Audio Capture | Mouth To Ear (M2E) Latency | Audio Playback

END TO END ACCESS TIME

PSCR/NIST Access Time

PTT Request
PTT button pushed
Grant
Voice Send
Grant
Voice Send

Talker Audio Capture
Audio Playback

Access Delay

PTT | PTT Request | Access Grant | Voice Send | M2E | Voice RX
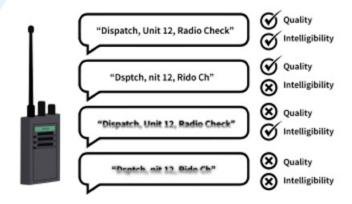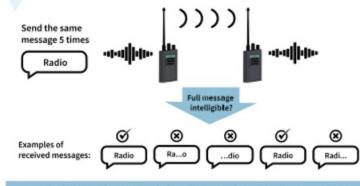
End to End Access Time

VOICE QUALITY & SPEECH INTELLIGIBILITY

"Dispatch, Unit 12, Radio Check" — Quality ✓ / Intelligibility ✓

"Dsptch, nit 12, Rido Ch" — Quality ✓ / Intelligibility ✗

"Dispatch, Unit 12, Radio Check" — Quality ✗ / Intelligibility ✓

"Dsptch, nit 12, Rido Ch" — Quality ✗ / Intelligibility ✗

PROBABILITY OF SUCCESSFUL DELIVERY

Send the same message 5 times

Radio

Full message intelligible?

Examples of received messages: Radio ✓ | Ra...o ✗ | ...dio ✗ | Radio ✓ | Radi... ✗
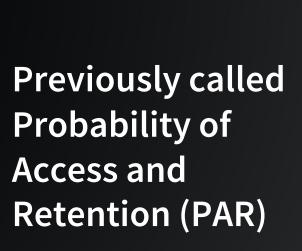
Probability of Successful Delivery of "Radio" = ⅖ = 40%

PROBABILITY OF SUCCESSFUL DELIVERY (PSuD)

Final Quality of Experience (QoE) Key Performance Indicator (KPI)

Previously called Probability of Access and Retention (PAR)

61

VOLUME IMPACT PROJECT 🎯

Identify optimal V_{tx} settings

Frequency Slope Fit (FSF)

START OF WORD CORRECTION

MISSION CRITICAL PUSH-TO-TALK (MCPTT)

MCPTT WORK ITEMS

5G NR

Incident Modeling

Protocol Validation

On-network

GUI

EXPERIMENTAL TESTBED
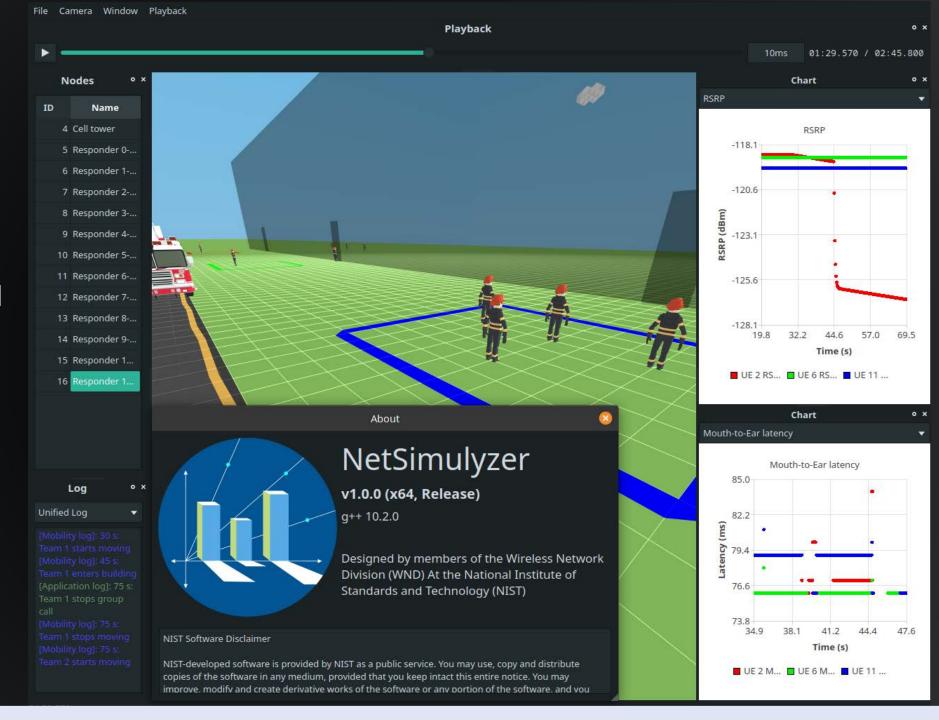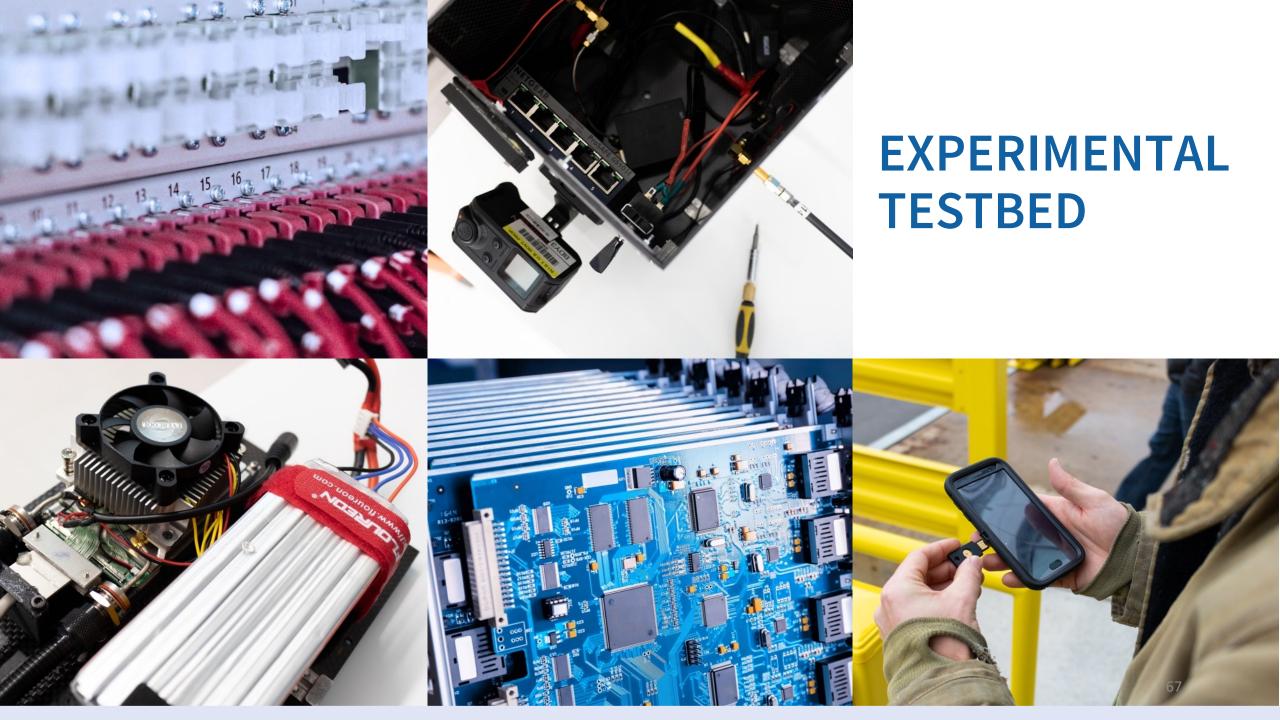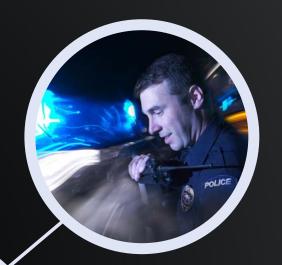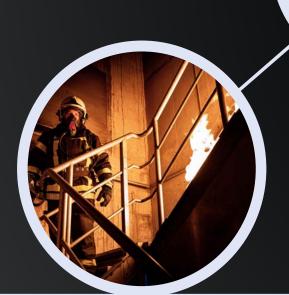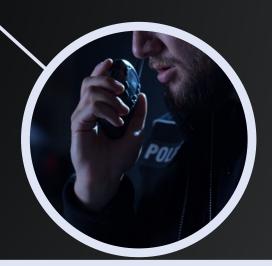
UE-BASED RELAY TECHNOLOGIES IN 3GPP NR

5G

LTE

~ 97 Mbit/s

~ 18 x

✓ **Higher Spectral Efficiency**
✓ **Flexible Physical Layer Configurations**

~ 5 Mbit/s

LTE

NR
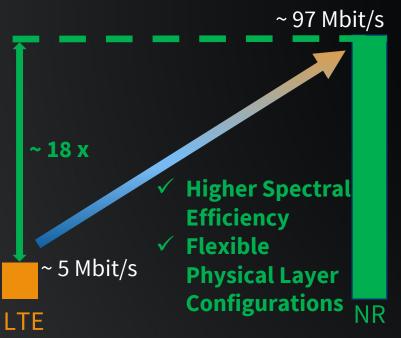
SIDELINK CAPACITY IN DATA RATE

RESOURCE MANAGEMENT AND COEXISTENCE
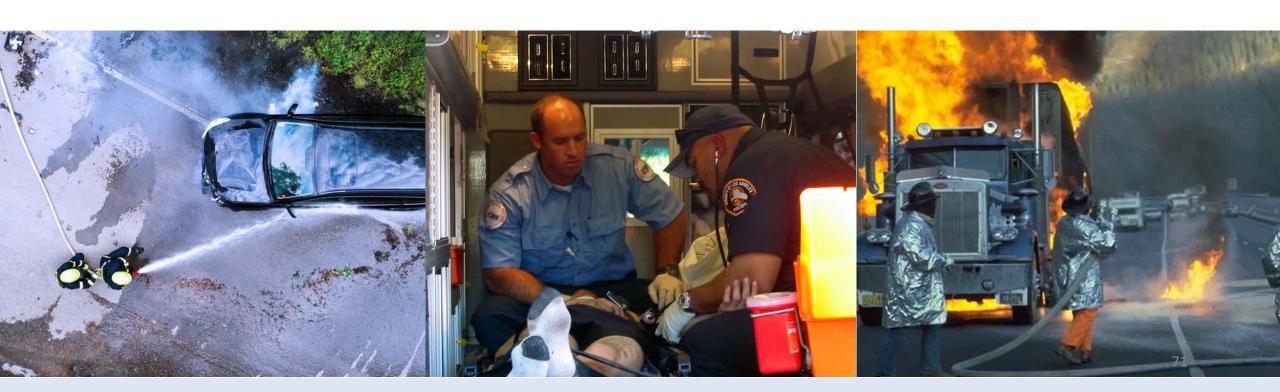
CENTRE TECNOLOGIC DE TELECOMUNICACIONS DE CATALUNYA (CTTC)
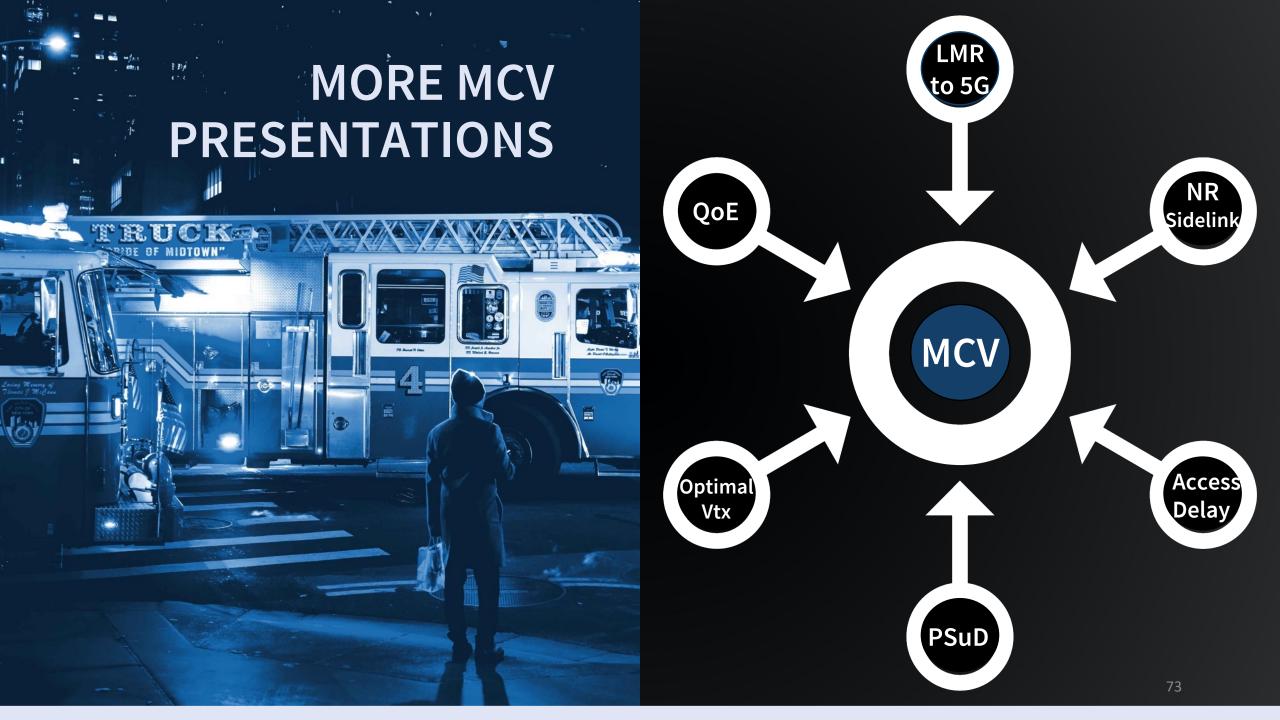
Modeling, Simulation and Performance Evaluation for NR V2X

UNIVERSITY OF WASHINGTON

Cross-Layer (PHY/MAC) Modeling & Performance Evaluation of 5G Public Safety based on NR C-V2X Sidelink

MORE MCV PRESENTATIONS

- LMR to 5G
- NR Sidelink
- QoE
- MCV
- Optimal Vtx
- Access Delay
- PSuD

THANK YOU

#PSCR2021 • PSCR.GOV

Analytics Portfolio Overview

John Garofolo

PSCR Analytics Portfolio Lead

NIST PIs:

Jim Golden, ACE Framework

Ian Soboroff, Social Media Streams

Gary Howarth, Differential Privacy Challenge

Craig Connelly, ASAPS Challenge

Alison Kahn, AI3 Challenge

#PSCR2021

Analytics to Save Lives, Property, and Infrastructure

Where every second counts!

The Analytics Portfolio is Making a Strategic Difference

The Analytics Portfolio is fueled by data-driven AI
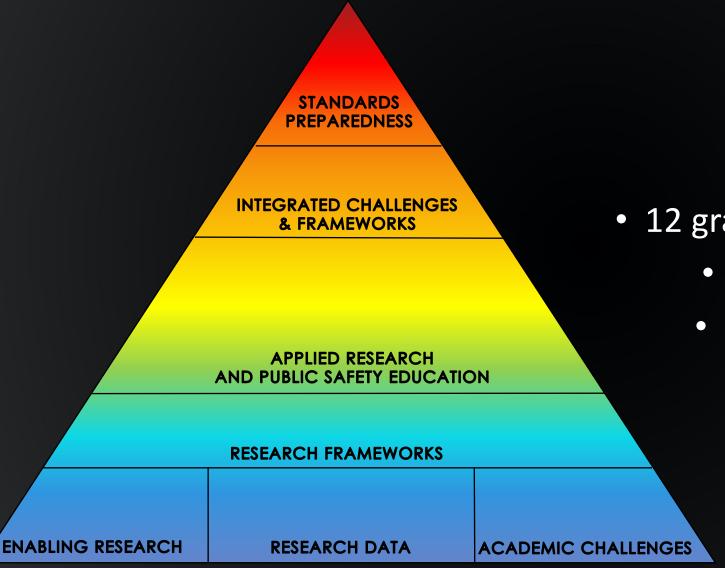
- Machine Learning
- Expert Systems
- Computer Vision
- Multimedia Analytics
- Speech Recognition
- Natural Language Understanding
- Differential Privacy
- System and Network Analysis and Balancing
- Data Compression and Stream Optimization
- Information Fusion

The PSCR Analytics Portfolio Strategy
Built on a Foundation of Robust Research

STANDARDS PREPAREDNESS

INTEGRATED CHALLENGES & FRAMEWORKS

APPLIED RESEARCH AND PUBLIC SAFETY EDUCATION

RESEARCH FRAMEWORKS

ENABLING RESEARCH | RESEARCH DATA | ACADEMIC CHALLENGES
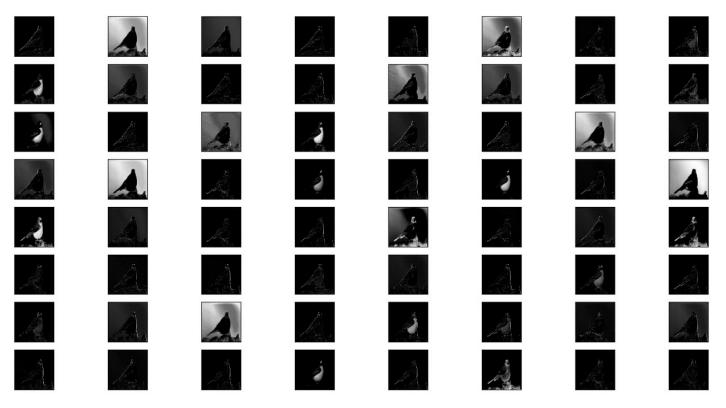
- 2 NIST projects
- 3 prize challenges
- 12 grants/agreements (8 completed)
- SW tools & research data
- Over 30 reports published

University of Cincinnati

Measuring and Optimizing Video Quality for Analytic Performance
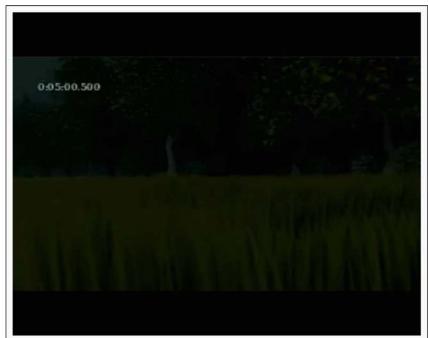
Visualization of a VGG-16 feature map

Courtesy of the University of Cincinnati

University of Cincinnati

Measuring and Optimizing Video Quality for Analytic Performance

Before adjustment

After adjustment

Courtesy of the University of Cincinnati

University of Michigan
Leveraging Human Gaze for Video Analysis
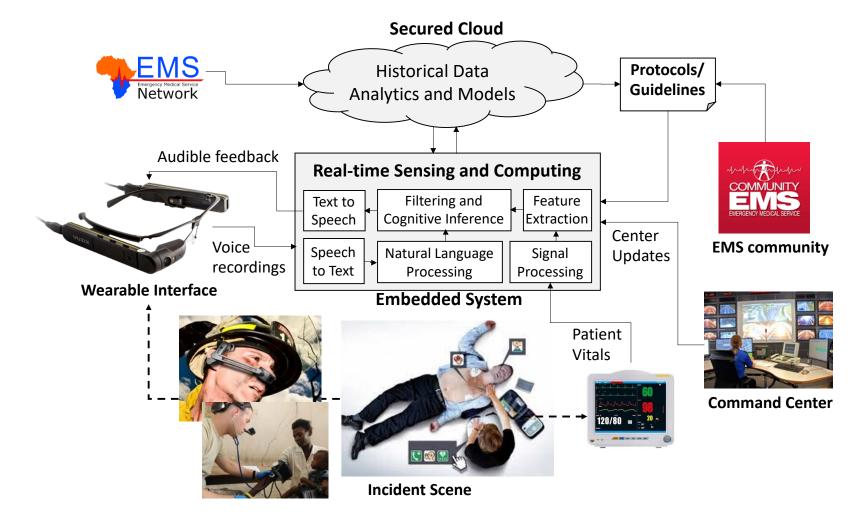
Courtesy of the University of Michigan

University of Virginia

CognitiveEMS: Intelligent Cognitive Assistant for EMS

Courtesy of the University of Virginia

University of Virginia

CognitiveEMS: Intelligent Cognitive Assistant for EMS

Courtesy of the University of Virginia

Carnegie Mellon University

Automatic Natural Disaster Assessment Using Drone Videos

Courtesy of Carnegie Mellon University

Carnegie Mellon University

City-scale Vehicle Tracking and Re-ID

Courtesy of Carnegie Mellon University
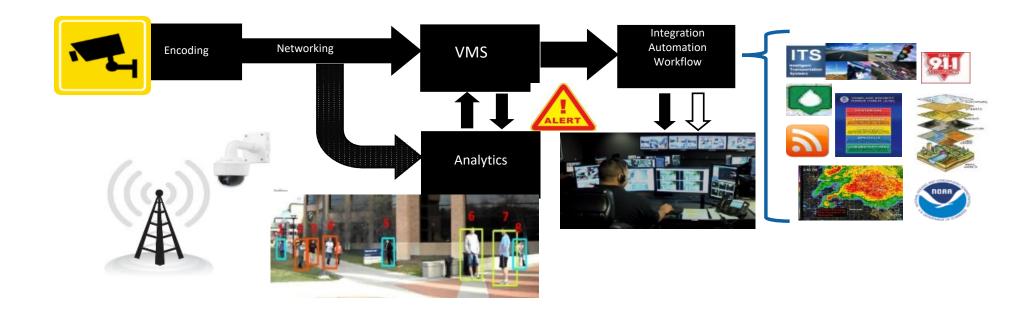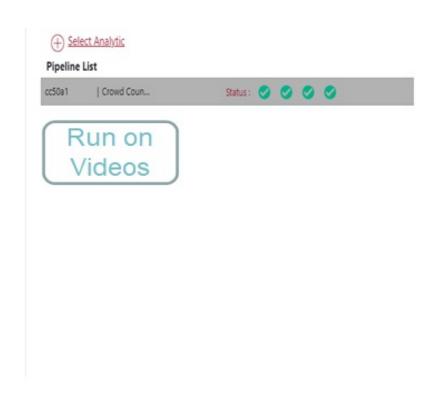
University of Houston with City of Houston

Multi-Tiered Video Analytics for Public Safety

Courtesy of the University of Houston

University of Houston with City of Houston

Crowd Counting Demonstration Analytic
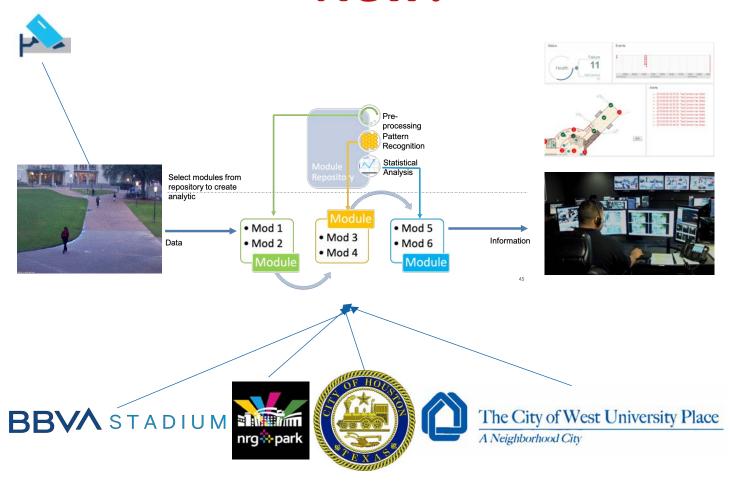
University of Houston with City of Houston
Customizable Video Analytics as a Service Platform
New!

Courtesy of the University of Houston
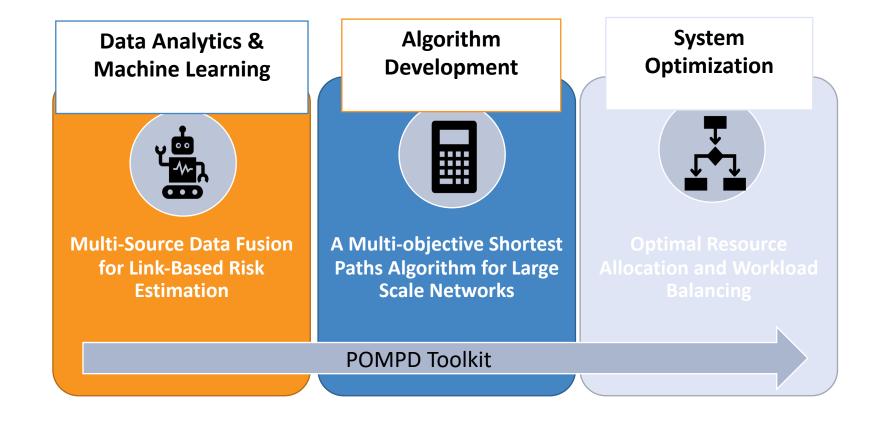
Southern Methodist University with UT Dallas

SAFE-NET: Computing Platform for Public Safety Dispatch Analysis

Data Analytics & Machine Learning

Multi-Source Data Fusion for Link-Based Risk Estimation

Algorithm Development

A Multi-objective Shortest Paths Algorithm for Large Scale Networks

System Optimization

Optimal Resource Allocation and Workload Balancing

POMPD Toolkit

Courtesy of the University of Southern Methodist University

NIST Projects and Prize Challenges

Jim Golden, Analytics Container Environment (ACE) Framework

Ian Soboroff, Social Media Incident Streams TREC Track

Gary Howarth, Differential Privacy Map Challenge
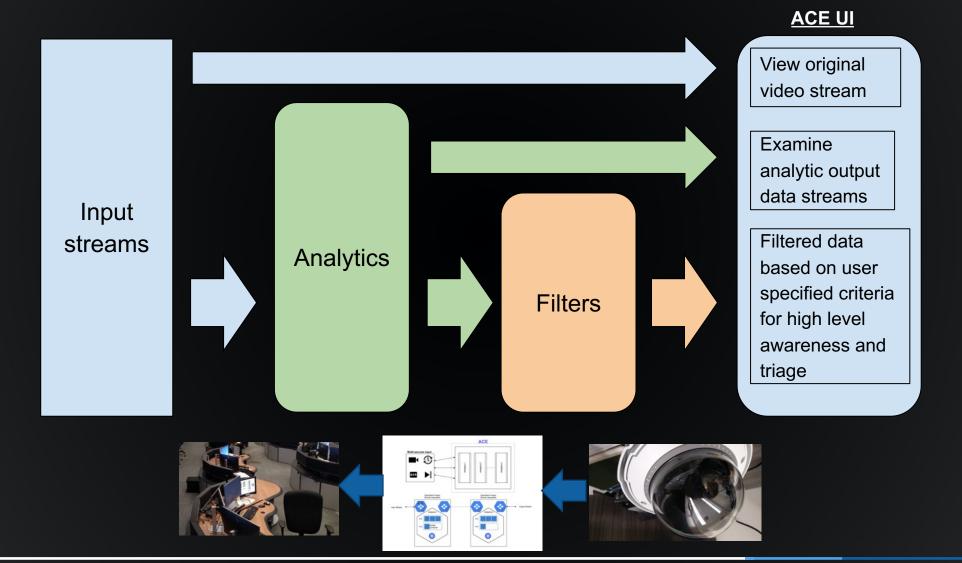
Craig Connelly, Automated Streams Analysis for Public Safety (ASAPS) Challenge

Alison Kahn, Artificial Intelligence for IoT Interoperability Challenge

ACE Analytics Toolkit
(Analytics Container Environment)

ACE UI

Input streams

Analytics

Filters

View original video stream

Examine analytic output data streams

Filtered data based on user specified criteria for high level awareness and triage
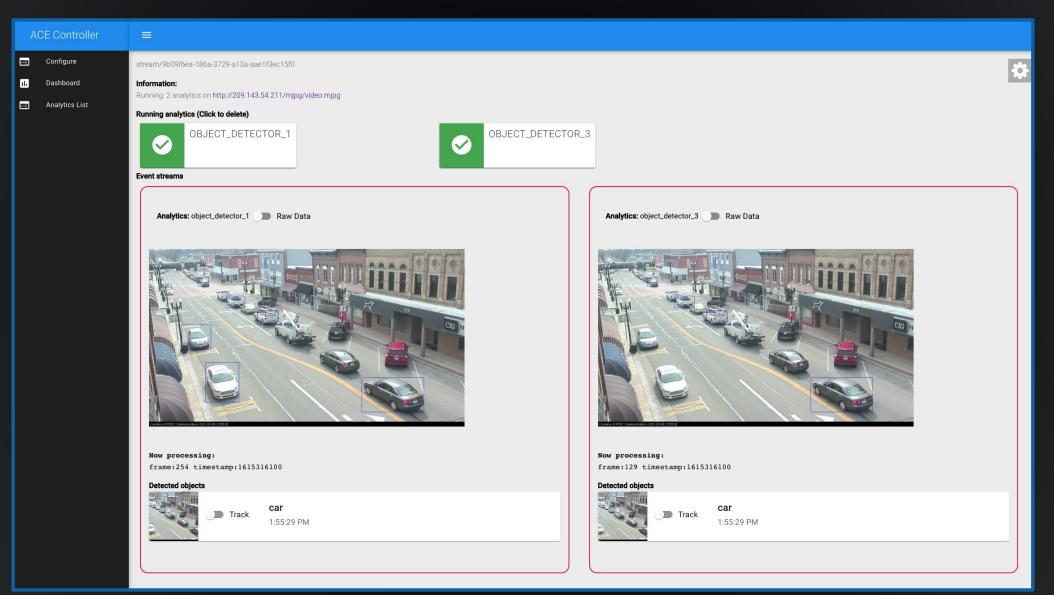
ACE Graphical User Interface
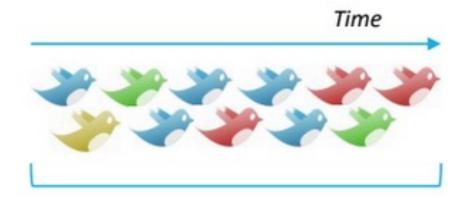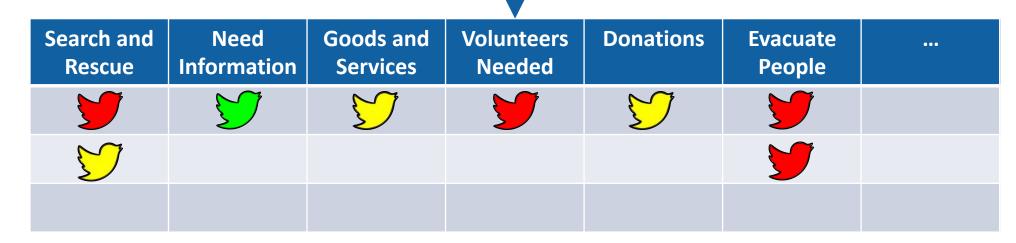
TREC SOCIAL MEDIA INCIDENT STREAMS

Time
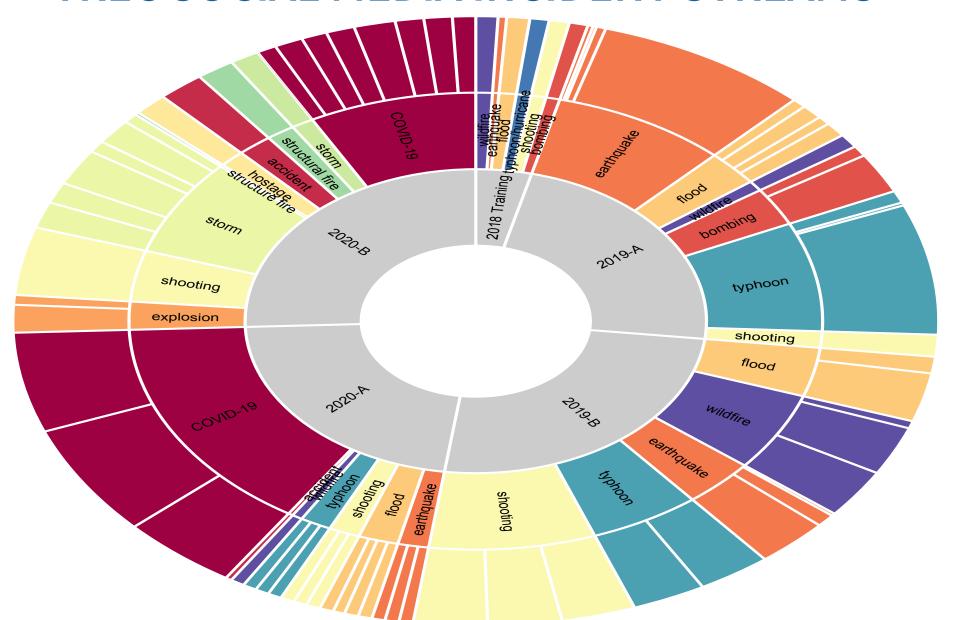
Filter
Prioritize
Route

Search and Rescue	Need Information	Goods and Services	Volunteers Needed	Donations	Evacuate People	...
🐦	🐦	🐦	🐦	🐦	🐦	
🐦					🐦	

Public safety agencies are record generators collecting valuable yet sensitive data.
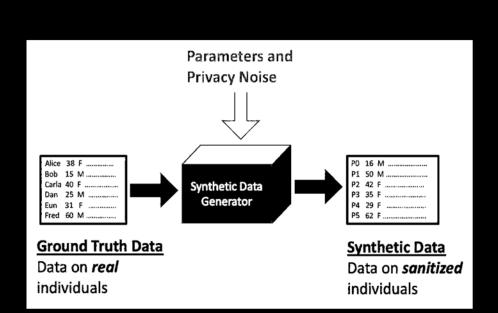
FIRST	LAST	ADDRESS
Josephine	Darakjy	4 B Blue Ridge Blvd
Art	Venere	8 W Cerritos Ave #54
Lenna	Paprocki	639 Main St
Donette	Foller	34 Center St
Simona	Morasca	3 Mcauley Dr
Mitsue	Tollner	7 Eads St
Leota	Dilliard	7 W Jackson Blvd
Sage	Wieser	5 Boston Ave #88
Kris	Marrier	228 Runamuck Pl #2808
Minna	Amigon	2371 Jerrold Ave
Abel	Maclead	37275 St Rt 17m M
Kiley	Caldarera	25 E 75th St #69
Graciela	Ruta	98 Connecticut Ave Nw
Cammy	Albares	56 E Morehead St
Mattie	Poquette	73 State Road 434 E
Meaghan	Garufi	69734 E Carrillo St
Gladys	Rim	322 New Horizon Blvd
Yuki	Whobrey	1 State Route 27
Fletcher	Flosi	394 Manchester Blvd
Bette	Nicka	6 S 33rd St
Veronika	Inouye	6 Greenleaf Ave
Willard	Kolmetz	618 W Yakima Ave
Maryann	Royster	74 S Westgate St
Alisha	Slusarski	3273 State St
Allene	Iturbide	1 Central Ave
Chanel	Caudy	86 Nw 66th St #8673
Ezekiel	Chui	2 Cedar Ave #84
Willow	Kusko	90991 Thorburn Ave
Bernardo	Figeroa	386 9th Ave N
Ammie	Corrio	74874 Atlantic Ave
Francine	Vocelka	366 South Dr
Ernie	Stenseth	45 E Liberty St
Albina	Glick	4 Ralph Ct

PSCR ANALYTICS

DIFFERENTIAL PRIVACY TEMPORAL MAP CHALLENGE

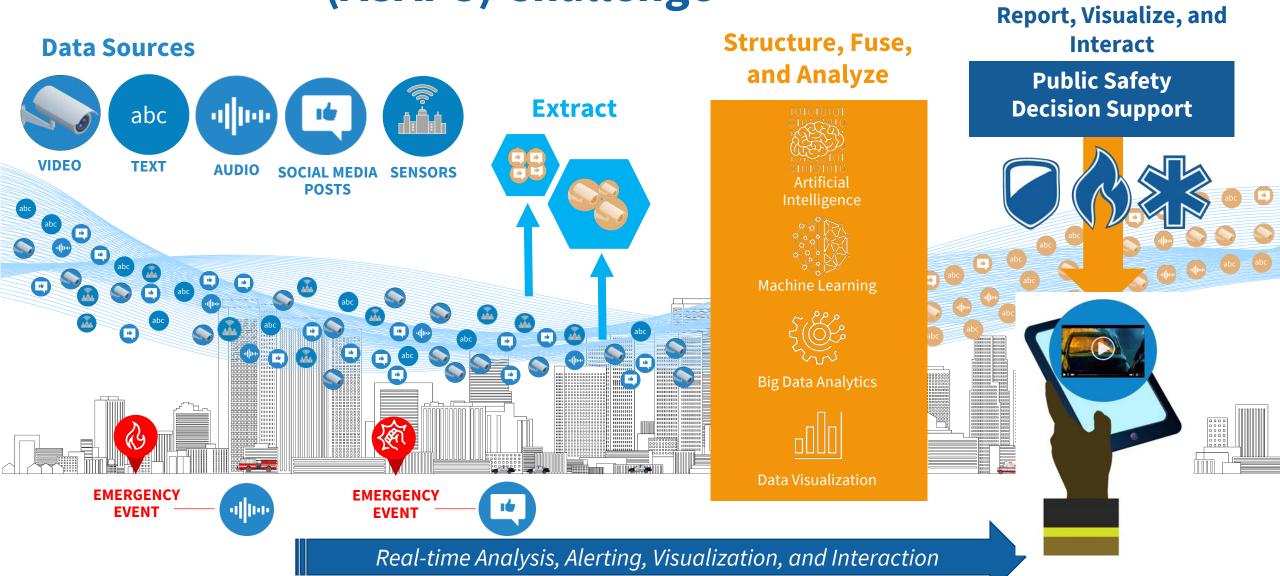Help public safety agencies share data while protecting privacy.

PSCR ANALYTICS

- 4+ new metrics
- 50+ novel algorithms
- Up to $247k in prizes

Parameters and Privacy Noise

| Ground Truth Data | Synthetic Data Generator | Synthetic Data |

Alice 38 F
Bob 15 M
Carla 40 F
Dan 25 M
Eun 31 F
Fred 60 M

P0 16 M
P1 50 M
P2 42 F
P3 35 F
P4 29 F
P5 62 F

Ground Truth Data
Data on *real* individuals

Synthetic Data
Data on *sanitized* individuals

See "Removing PII from Public Safety Datasets" on-demand session for more information.

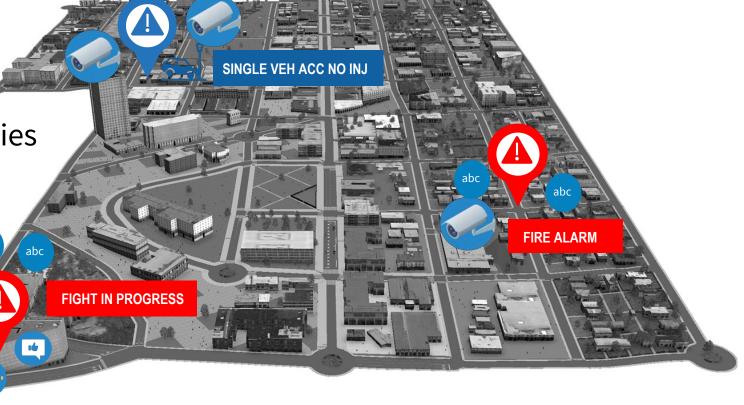# Automated Streams Analysis for Public Safety (ASAPS) Challenge

PSCR ANALYTICS

Data Sources

VIDEO · TEXT · AUDIO · SOCIAL MEDIA POSTS · SENSORS

Extract

Structure, Fuse, and Analyze

- Artificial Intelligence
- Machine Learning
- Big Data Analytics
- Data Visualization

Report, Visualize, and Interact

Public Safety Decision Support

EMERGENCY EVENT

EMERGENCY EVENT

Real-time Analysis, Alerting, Visualization, and Interaction

Automated Streams Analysis for Public Safety (ASAPS) Challenge

- 210-acre mock city

- 8 continuous hours of recordings

- 62 staged and simulated emergencies

- 42 multimodal data streams

SINGLE VEH ACC NO INJ

FIRE ALARM

FIGHT IN PROGRESS

AI3 Challenge: Bringing Situational Awareness Data Together

THANK YOU

#PSCR2021 • PSCR.GOV

PSCR ANALYTICS
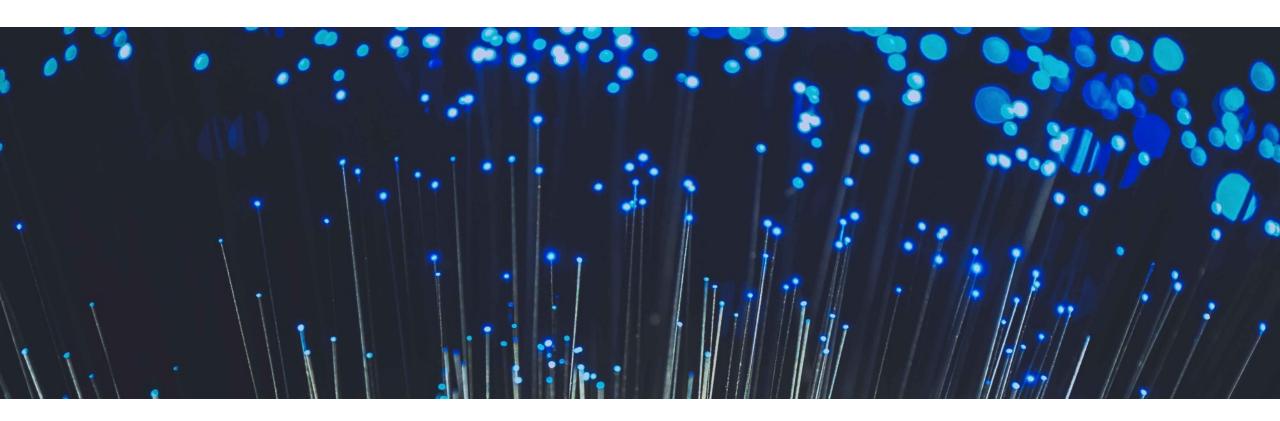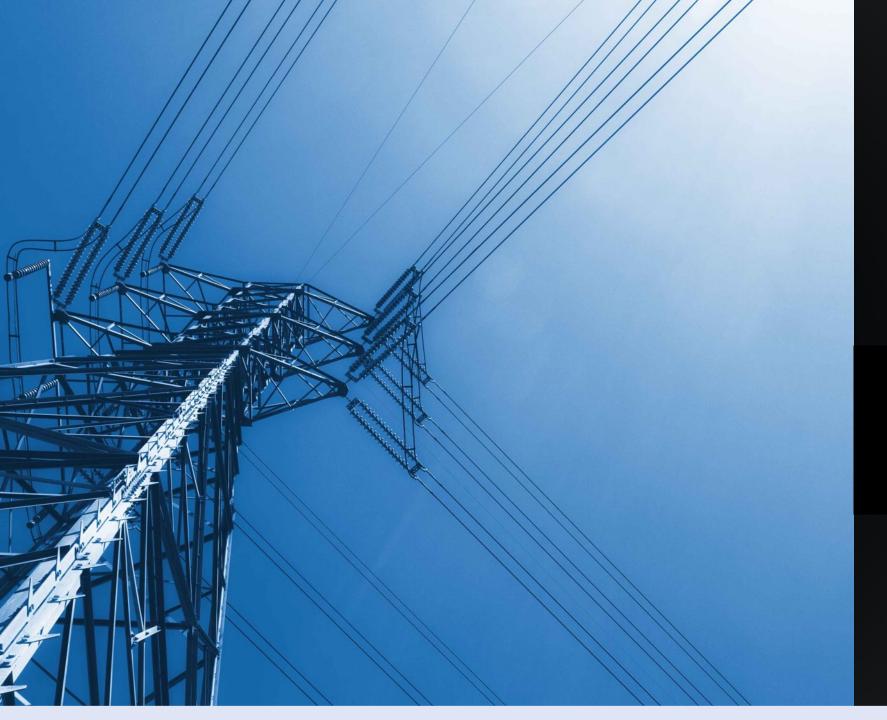
Security Overview
Pecha Kucha

John Beltz

Bill Fisher

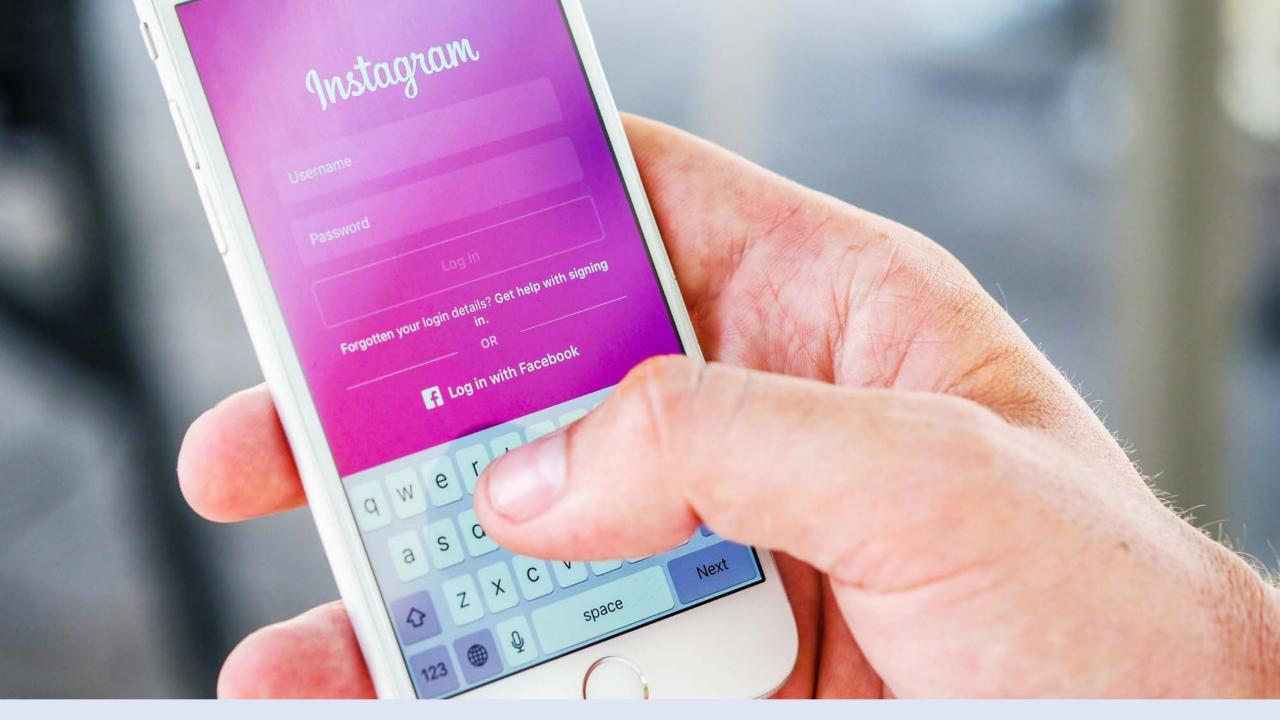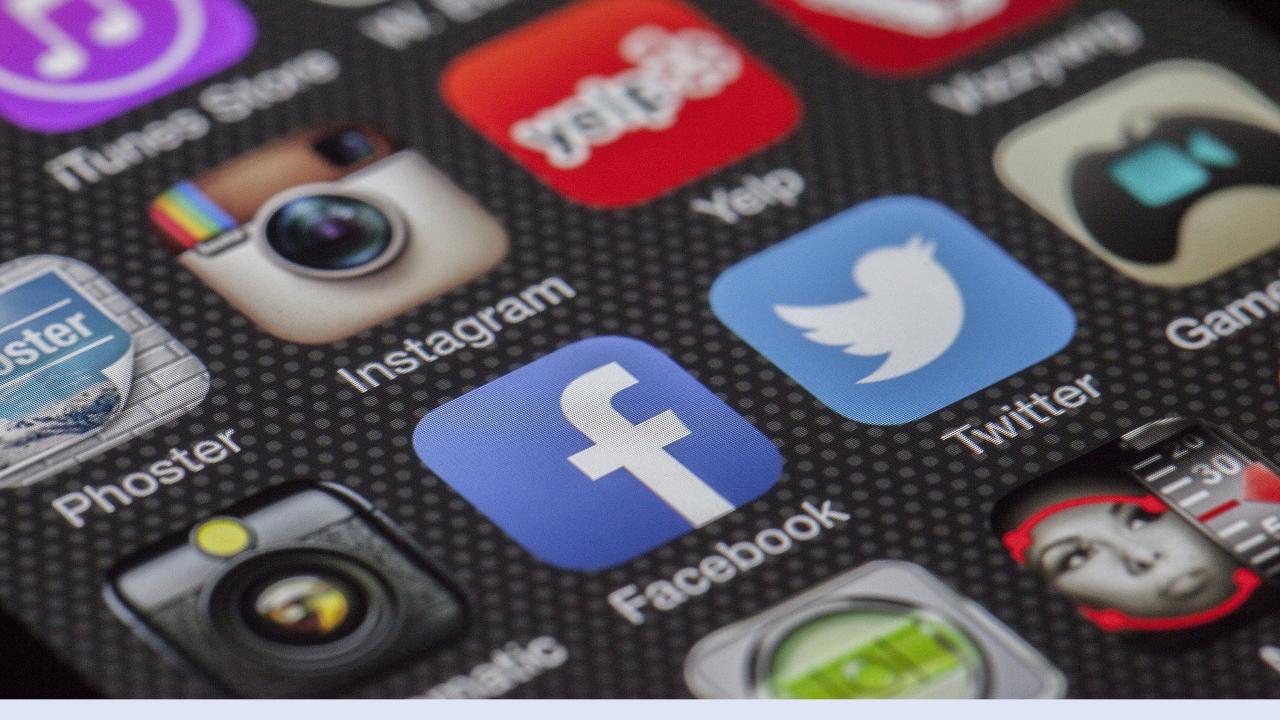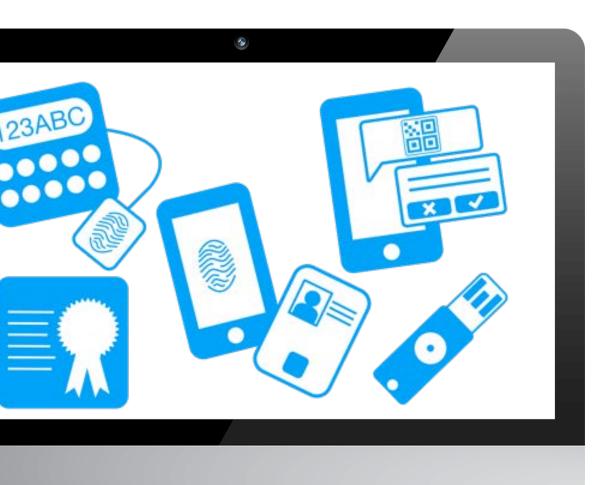Gema Howell

UAS Challenge

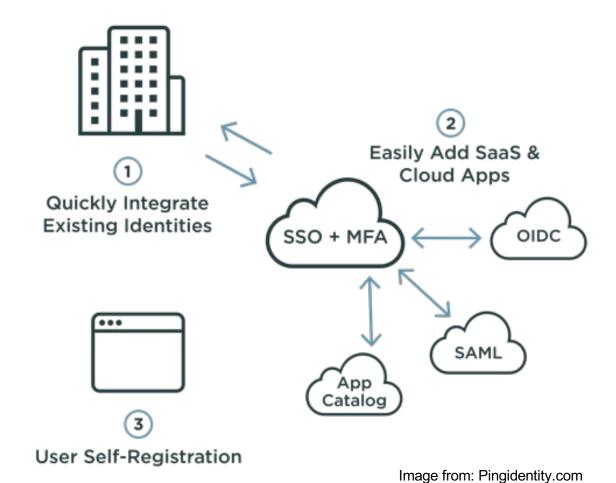**ICAM** - Identity, Credential and Access Management

Getting the **right data** to the **right people** at the **right time** with the **right protections** and only if it's for the **proper reason** and in an **efficient manner**

Quickly Integrate Existing Identities

Easily Add SaaS & Cloud Apps

SSO + MFA

OIDC

SAML

App Catalog

User Self-Registration

Image from: Pingidentity.com

THE FUTURE OF IOT MANAGEMENT FOR PUBLIC SAFETY

Gema Howell– Computer Scientist

Applied Cybersecurity Division

#PSCR2021

An estimated

25

Billion
IoT Connected Devices
by the year
2030
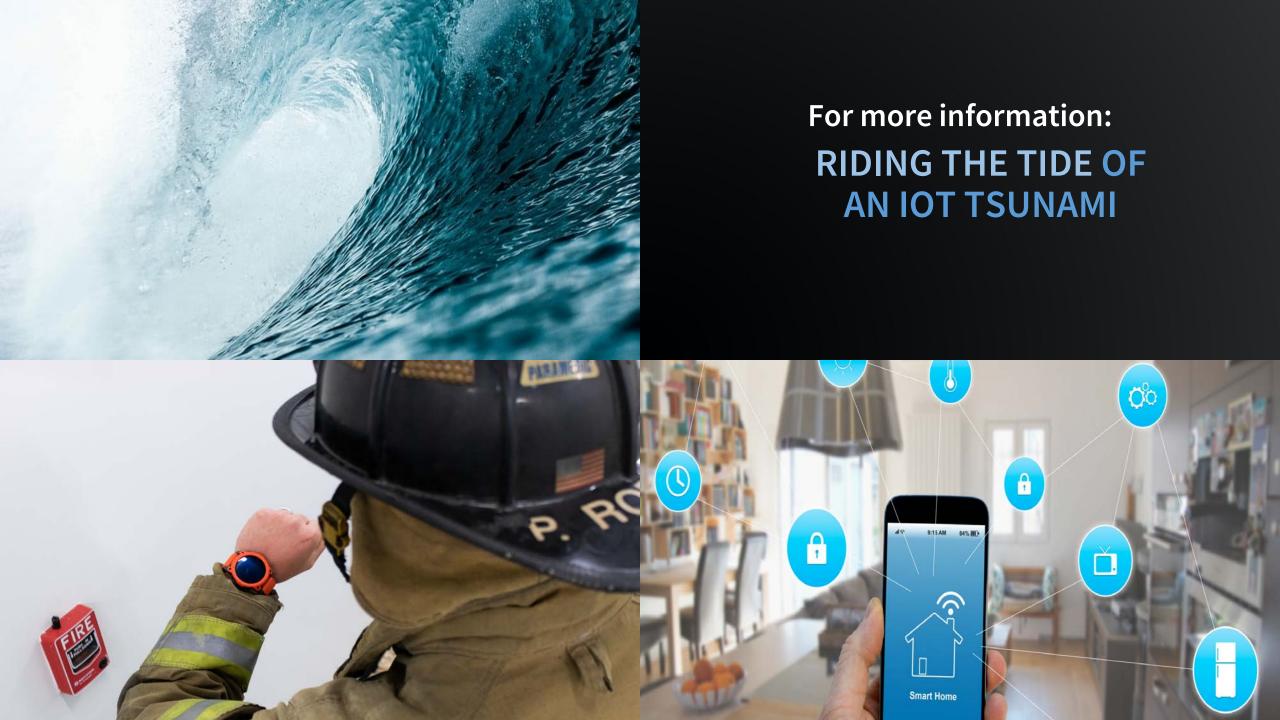
THREATS TO IOT DEVICES[1]
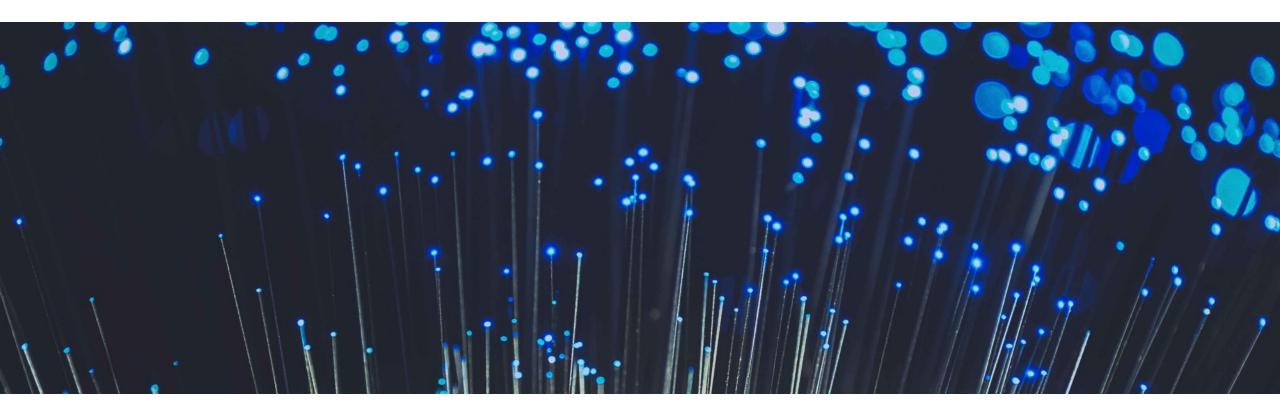
TECHNOLOGY CONSIDERATIONS

[1] https://www.csoonline.com/article/3297960/security-flaws-in-police-body-cameras-open-the-devices-to-attack.html

For more information:
RIDING THE TIDE OF AN IOT TSUNAMI

Resilient Systems Portfolio Overview

Roger Blalock

UAS Challenges

Award Recipient Research

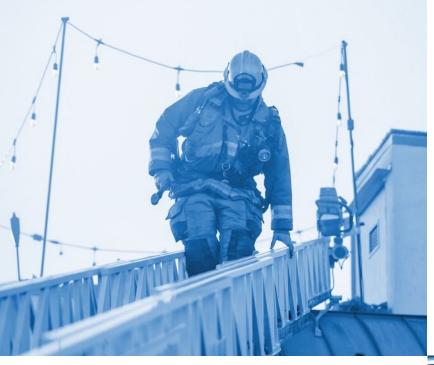# Unmanned Aerial Systems Challenges

RESILIENCE

SPEED

SECURITY

Challenge 3.1: FastFind – UAS Search Optimized

- Enhanced Spectral Imaging
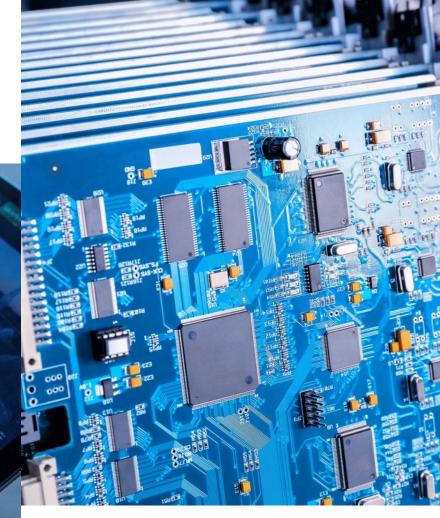- Optimized Search Patterns

Challenge 3.2: Lifelink – UAS Data Relay

Challenge 3.3: Shields Up! Securing Public Safety UAS Navigation and Control

Image source: nasa.gov

UAS Security

Image source: nasa.gov

Multi-Stage Competition

1. Concept paper
2. Design and build with video submission
3. In-person competition

Image source: Skydio

Registration and Challenge Information

✉ prizes@pscr.gov

🌐 www.uastriplechallenge.com

UAS 4.0 Challenge

SDR LTE Network RESPONS

130

DistressNet-NG

- Distributed Computing
- Distributed File Storage
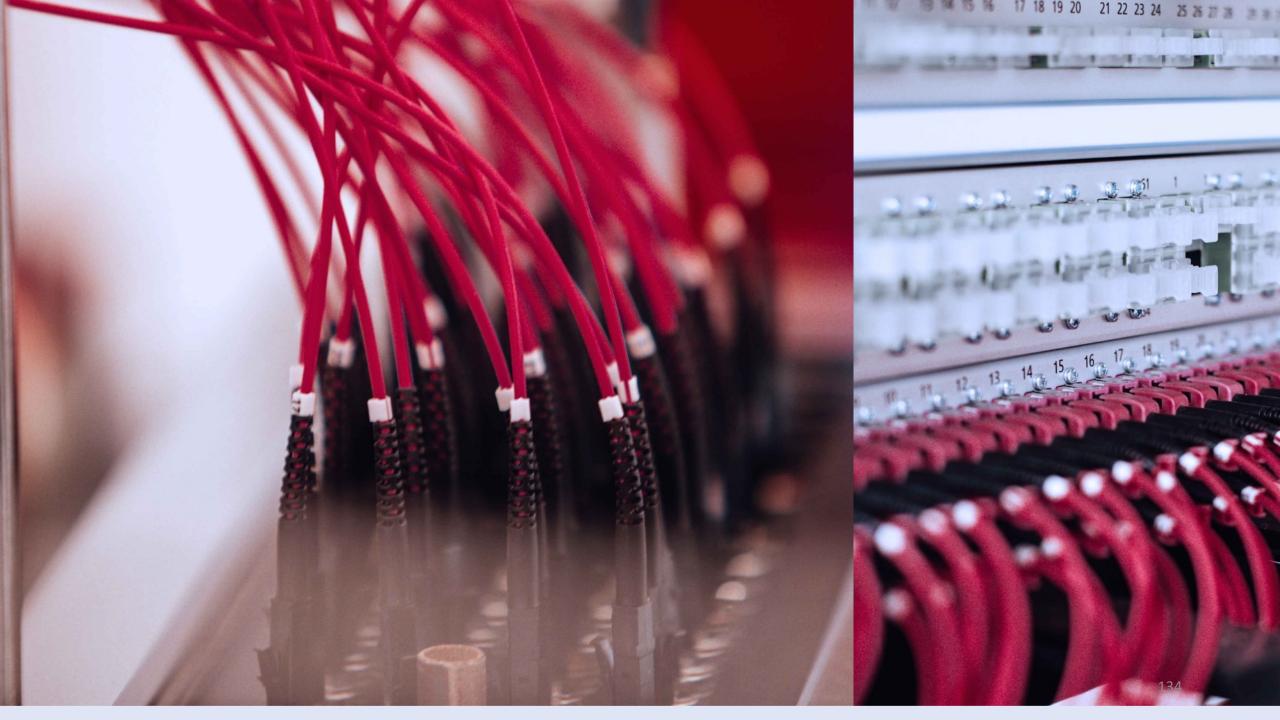- Real-time Video Analytics

131

LTE Band 14 Test Flights

ReDiCom

- Device-to-Device
- Distributed Computing
- Dynamic Routing

Wildland Data Logistics Network

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THE DIGITAL EXPERIENCE

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NIST

PSCR