Why Connected Vehicle Technology?

Safety

40

- 42,939 roadway deaths in 2021
- 6.1 million crashes in 2021
- Leading cause of death for ages 5 - 24

Mobility

- 5.5 billion hours of travel delay
- $166 billion cost of urban congestion

Environment

- 2.9 billion gallons of wasted fuel
- 56 billion lbs of additional CO_2

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Connected**Environment**

Paving the way for safer, greener, and smarter roads

Since 2012, the U-M Transportation Research Institute has served as a leader in connected vehicle research, creating a one-of-a-kind testing environment for all.

Safety Pilot
$30.3M (2012)

Safety Pilot Model Deployment launched in August of 2012 as the world's first large-scale real-world deployment of CVs.

AACVTE/AACE1.0
$19.6M (2015)

The Ann Arbor Connected Vehicle Test Environment built upon SPMD to become the gold standard for a national deployment.

SIP
$19.9M (2021)

The Smart Intersections Project will deploy infrastructure-based technology to accelerate CAV deployment and build a roadmap for its commercialization.

AACE 2.0
$12.7M (2023)

The Ann Arbor Connected Environment 2.0 will convert the existing connected vehicle deployment to C-V2X.

Accidents We Can Avoid Using CV Technology

Accidents We Can Avoid Using CV Technology

- I-94, Western MI
- Jan 9, 2015
- Temp 16°F
- 0°F wind chill
- 193 vehicles
- 1 death
- 21 hospitalized
- Reopened after 2 days

Connectivity Provides Greater Situational Awareness

Drivers/Operators

Vehicles and Fleets

Connectivity

Infrastructure

Wireless Devices/ Vulnerable Road Users

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AACE2.0 Vision

The Ann Arbor Connected Environment 2.0 will be the national reference for Cellular Vehicle-to-Everything (C-V2X) technology, setting the benchmark for commercial deployment and large-scale adoption, and establishing a trusted framework for delivering certified infrastructure intelligence to all road users

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Applicable ATTAIN (USDOT) Program Goals

Advanced safety systems, including V2V and V2I communications, technologies associated with automated vehicles, and other collision avoidance technologies, including systems using cellular technology

Retrofitting DSRC technology deployed as part of an existing pilot program to C–V2X technology, subject to the condition that the retrofitted technology operates only within the existing spectrum allocations for connected vehicle systems

Reduction in the number and severity of traffic crashes and an increase in driver, passenger, and pedestrian safety

Accelerated deployment of V2V, V2I, vehicle-topedestrian, and technologies associated with automated vehicle applications and other advanced technologies
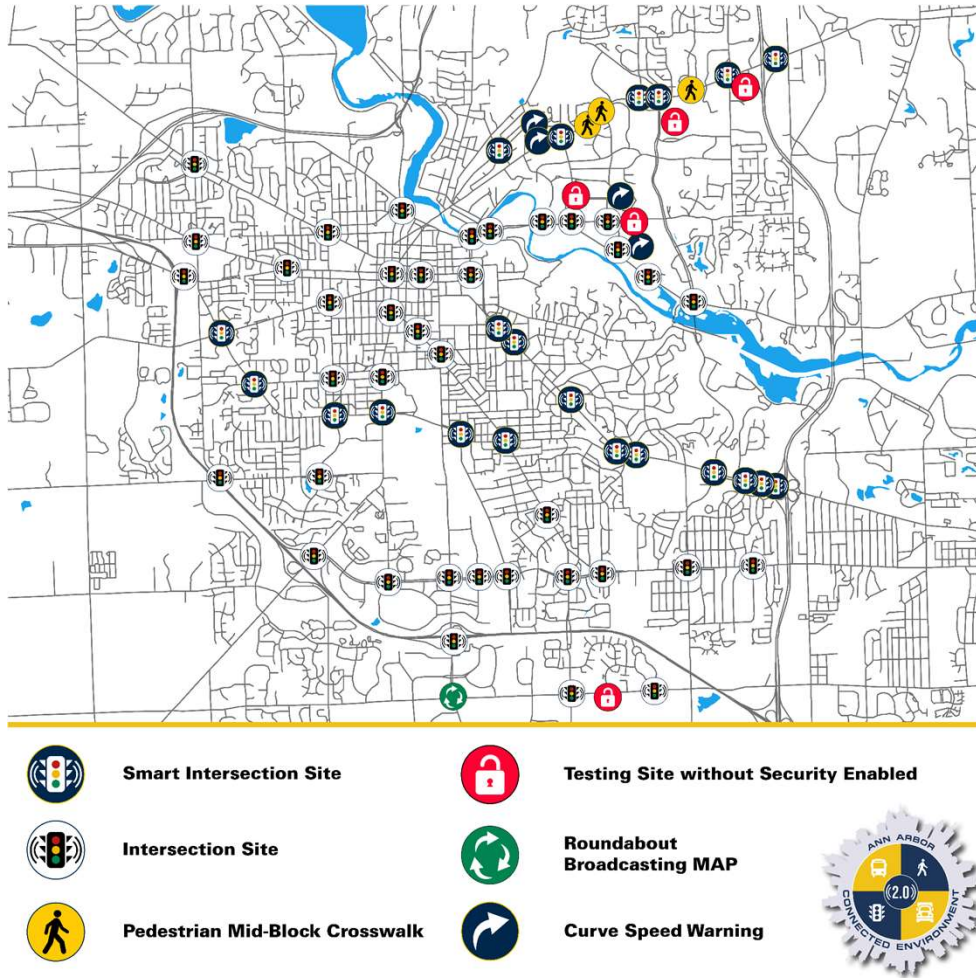
Reproducibility of successful systems and services for technology and knowledge transfer to other locations facing similar challenges

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AACE 2.0 Project Overview

- A 3-year, $12.7M project
  - $9,859,240 Federal Funds
  - $2,847,185 Cost Share
- High-level objectives
  - Replace the Dedicated Short-Range Communication (DSRC) devices in the Ann Arbor infrastructure with Cellular-V2X (C-V2X) equipment
  - Equip at least 100 vehicles with C-V2X radios
- Leverage the existing efforts – Smart Intersection Project (SIP)
  - Take advantage of the radio testing and development
  - 21 intersections equipped under SIP
  - Sensors, not just radios

AACE 2.0 Infrastructure

- Build from the Smart Intersections Project – 21 Intersections

- Return to former footprint
  - 70 production sites
    - 2 Curve Speed Warning Sites (4 RSUs)
    - 4 Pedestrian mid-block crosswalks (4 RSUs)
    - 61 Intersections (5 at freeway entrance/exit ramps)
    - 1 Roundabout
  - 5 staging/test sites (Wheeler [A/B]/UMTRI/Green B/Glazier B/Bonisteel)

Legend:
- Smart Intersection Site
- Intersection Site
- Pedestrian Mid-Block Crosswalk
- Testing Site without Security Enabled
- Roundabout Broadcasting MAP
- Curve Speed Warning

# OEMs use of Ann Arbor Connected Environment 2.0

- AACE2.0 will incorporate work from 5GAA, SAE, Utah and SCMS Manager to establish a verified, state-of-the art environment for certified vehicle and infrastructure messages.

- Automotive OEMs and others will be able to use this environment to test pre-production connected vehicle safety, mobility, sustainability and automation applications.

- AACE 2.0 will support the US DOT V2X Deployment Plan's goal of automotive OEMs deploying 5.9 GHz capable vehicles.
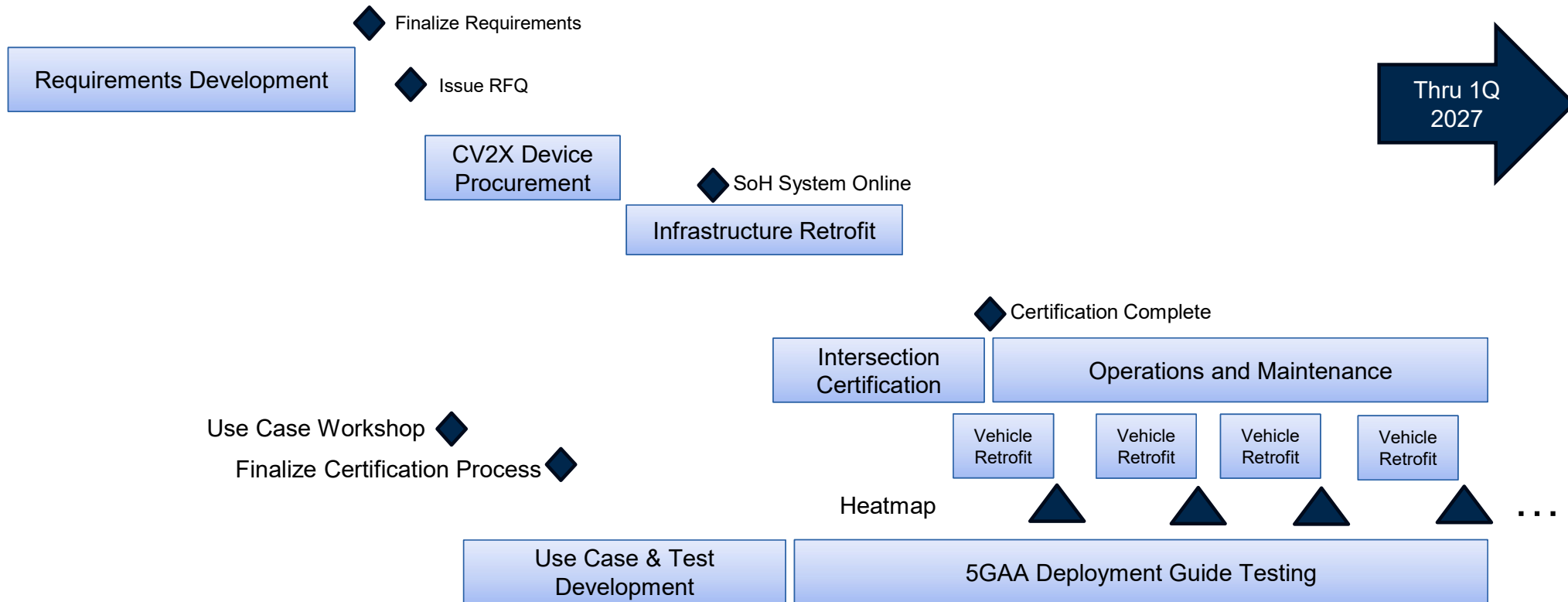

Courtesy Dr. Mike Shulman

Non-Line of Sight Test
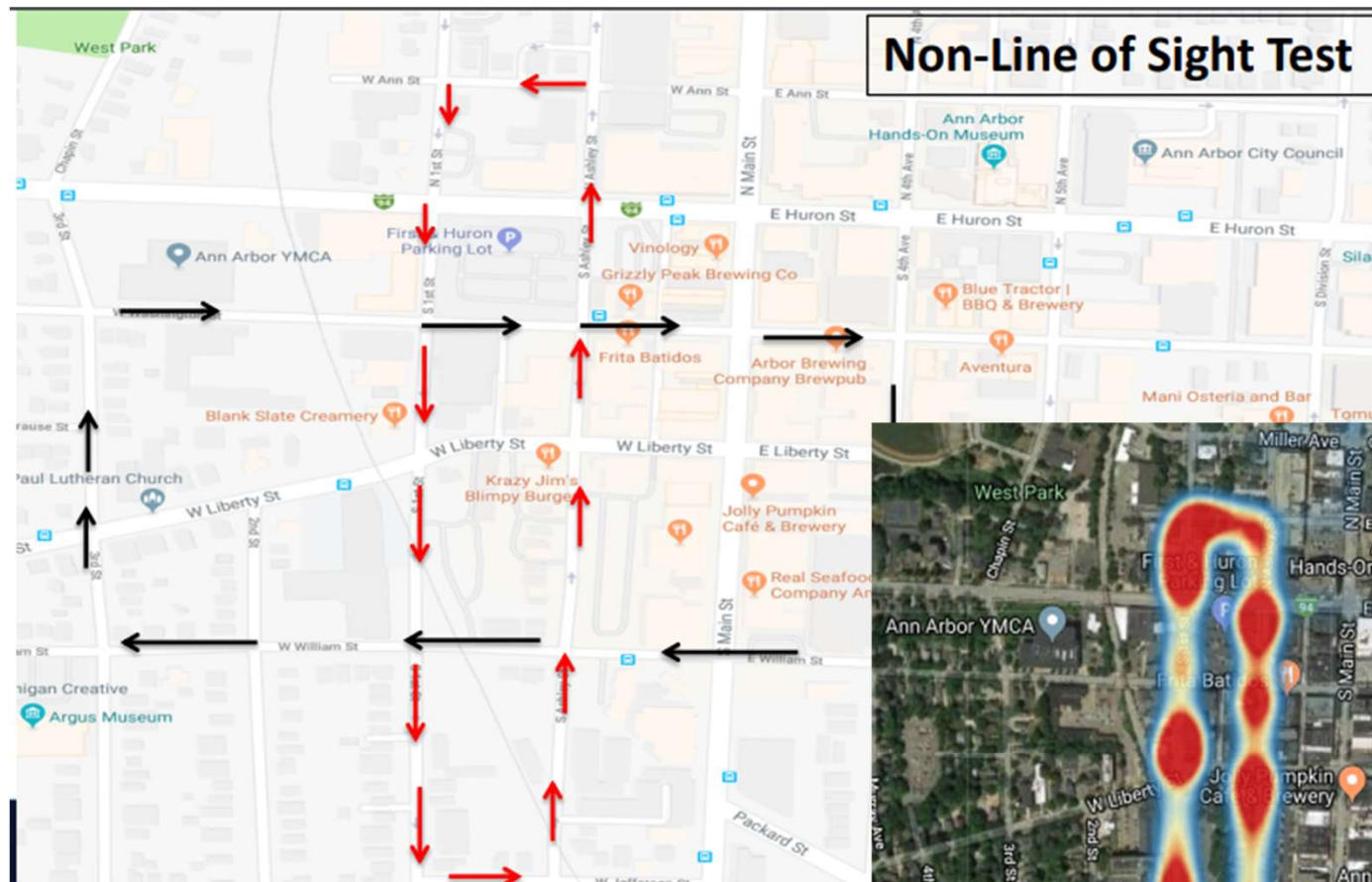
Heatmap V2V / V2I Data Collections – enhance equipped-vehicle interactions
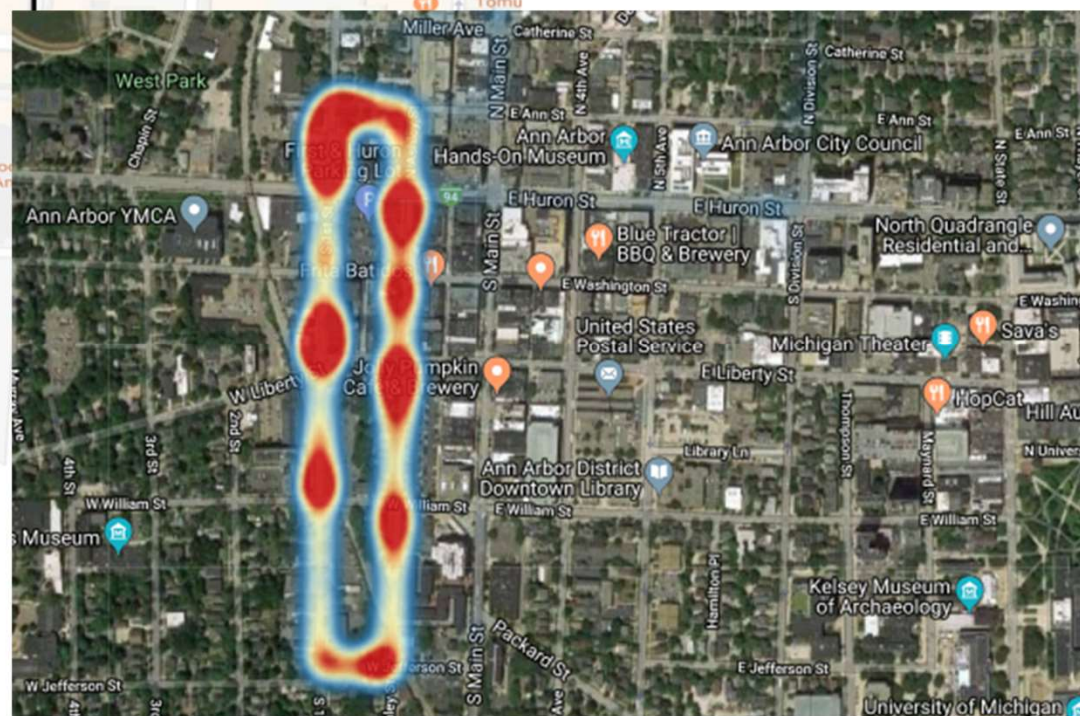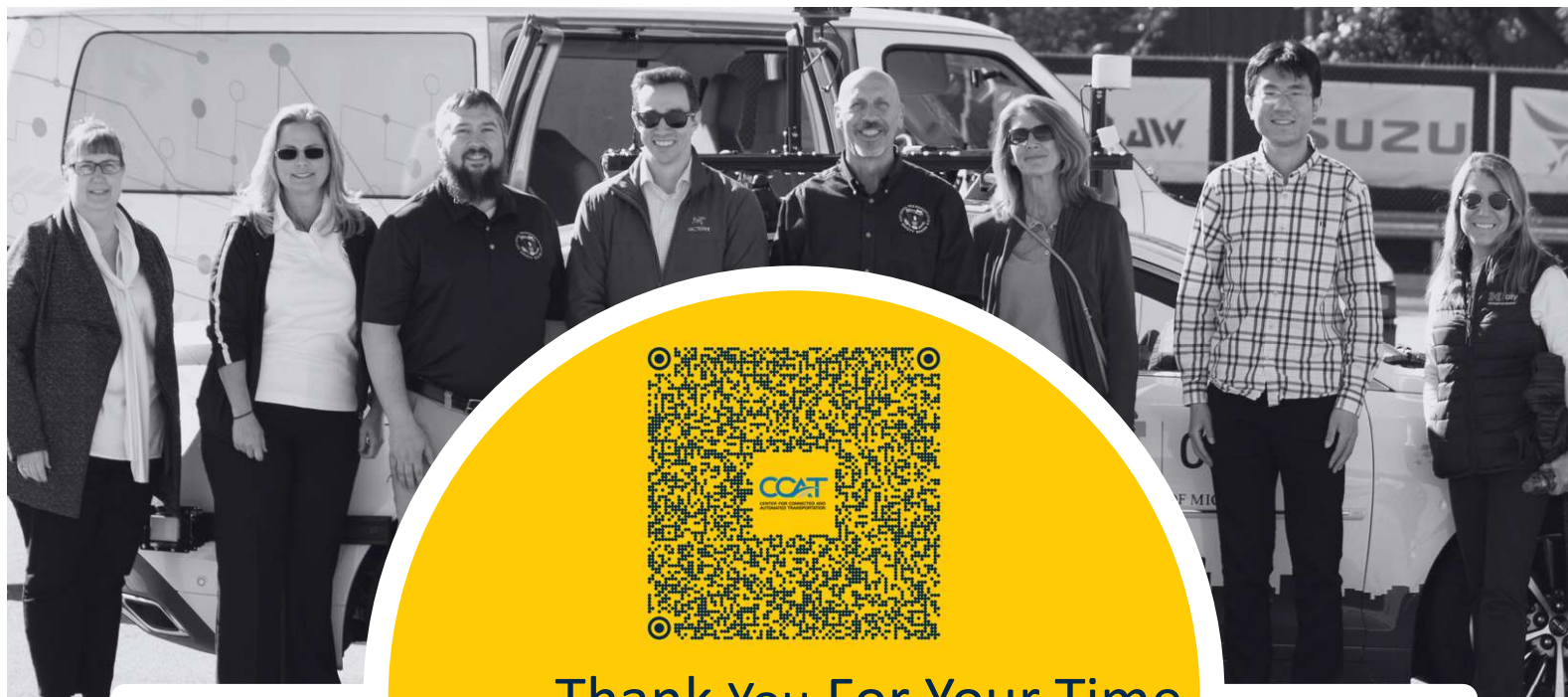
Challenges and Lessons Learned

- Interoperability is not just about device-level – ITS architecture must be designed around specific IOO architecture and constraints
- Systems Engineering matters – Technical Requirements, Use Cases, Non-functional requirements *from the User perspective*
- Shift Left on Security – Assess cybersecurity risk management maturity of your team, and build in resources to address risk at the outset – not an afterthought
- Sister Projects are your friend! Knowledge sharing especially around friction points and lessons learned are invaluable as national deployments accelerate and converge
- Trust is everything – Remember who we are building this for, and recognize that market forces and public opinion are key to accelerating adoption, not just technical readiness

Next Steps

- Align with CoAA Comprehensive Transportation Plan – Ann Arbor Moving Together Towards Vision Zero
  - #21: Expand adaptive signal technology and implement connected infrastructure
  - #22: Monitor advances in connected an automated vehicle technology and evaluate impacts on safety and street design
- Deploy systems and applications to support CoAA goals
  - Dedicated bus lane
  - Traffic congestion at central campus bus depot on North University
- Understand the CoAA wants and needs and build solutions together

Thank You For Your Time

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