



Rapid Research Pathway to Automation

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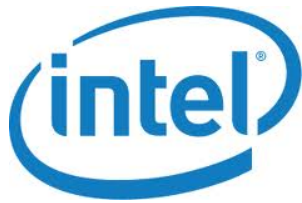
Presentation

- Transportation challenges have broader implications and higher stakes than ever before
- The new ecosystem for mobility
- Convergence of connected and automated technologies
- MTC's public-private partnership
- Beyond “research”: demonstrations, model deployments, initial deployments

America's Transportation System Opportunities

- Sustainability of our 20th Century transportation system – we need a systemic solution for transportation safety
- Connected and automated technologies are transformational – we need to understand commercial and societal issues
- At the same time:
 - Financial stability must be brought to the nation's transportation system and revenue options must be explored
 - FCC seeking to open up the 5.9 GHz band to unlicensed users, potentially interfering with Connected Vehicle signals

Companies Involved in Transportation are Changing

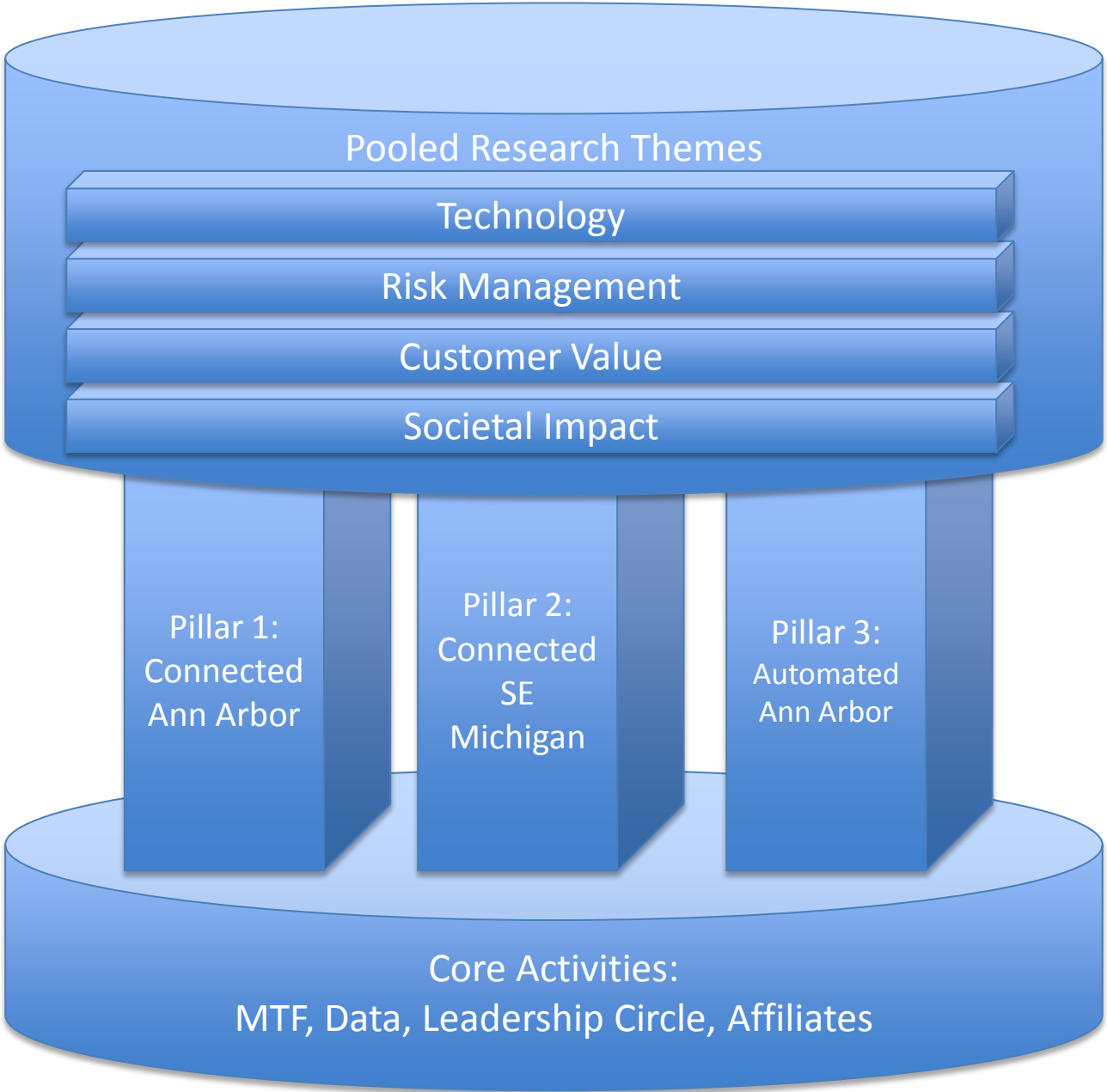


The MTC

A public/private R&D partnership that will lead a revolution in mobility and develop the foundations for a commercially viable ecosystem of connected and automated vehicles



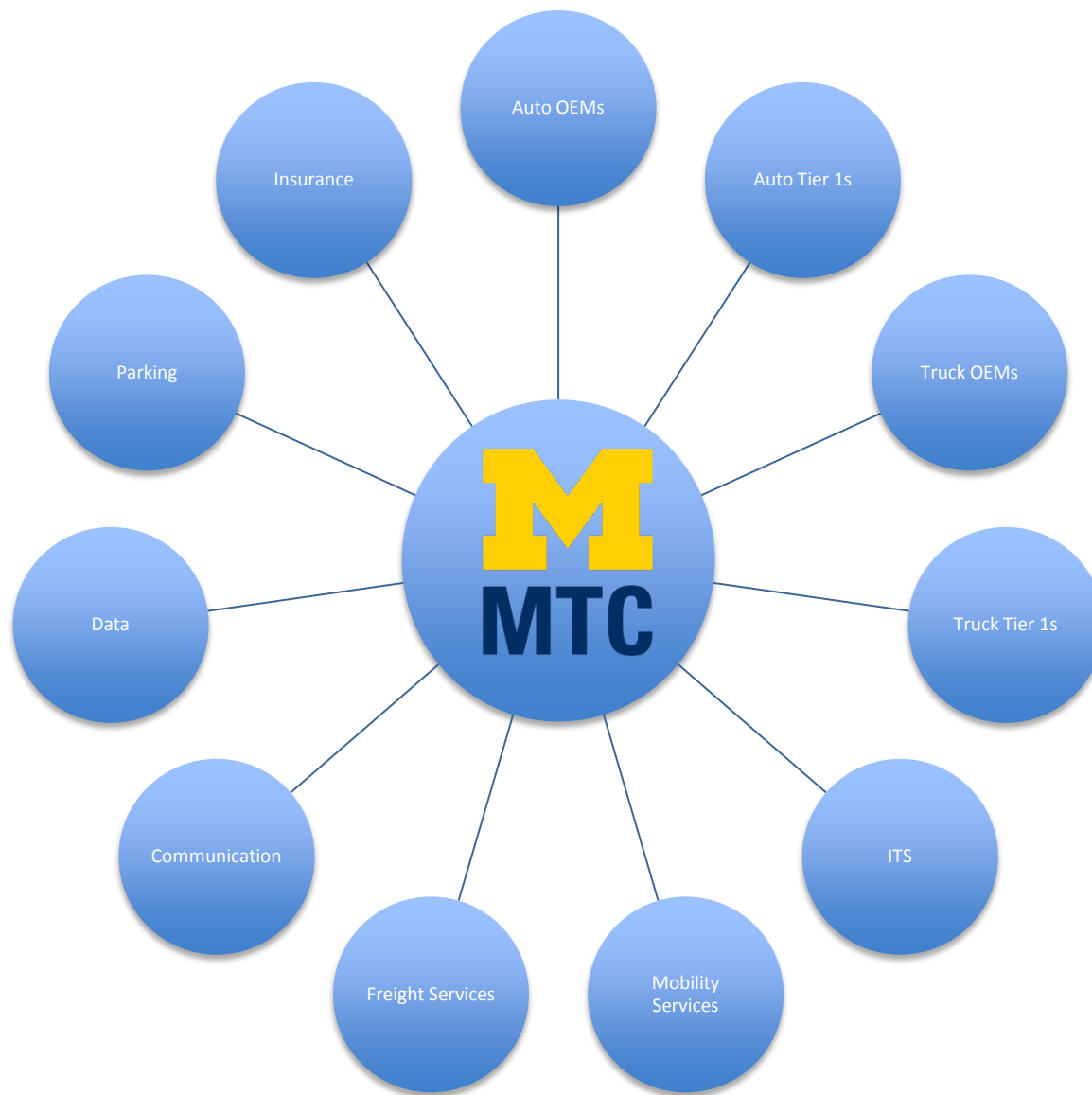
**developing an entire system of
connected and automated transportation
on the streets of southeastern Michigan
through 2021**



LEADERSHIP CIRCLE

- 10-15 companies from diverse sectors
- Federal, state and city agencies
- Academic partners
- MTC strategy
- Participate in 3 pillar deployment programs
- Formulate key research questions
- Conduct pooled and tailored research
- Formulate policy challenges

INDUSTRY SECTORS



INTRODUCTORY MEETING

- Need wide academic range
- Deal with broad range of issues, including legal, liability
- Collective opinion on the way forward
- Safe, off-roadway testing at MTF
- Federal and state engagement

MTC Platforms for Innovation

Three pillar programs, in collaboration with MDOT:

- 1. Ann Arbor Connected Vehicle Test Environment (2014+)**
 - 9,000 equipped vehicles
 - 27 sq. miles of equipped infrastructure
- 2. Southeast Michigan Connected Vehicle Deployment (2015+)**
 - 20,000 equipped vehicles
 - 500 equipped nodes, including highways and intersections
 - 5000 devices including nomadic seed devices, extending to vulnerable road users including pedestrians
- 3. Ann Arbor Automated Vehicle Field Operational Test (2016+)**
 - 2,000 connected and automated vehicles
 - Including Level 4 automated vehicles
 - 27 sq. miles of densely instrumented infrastructure

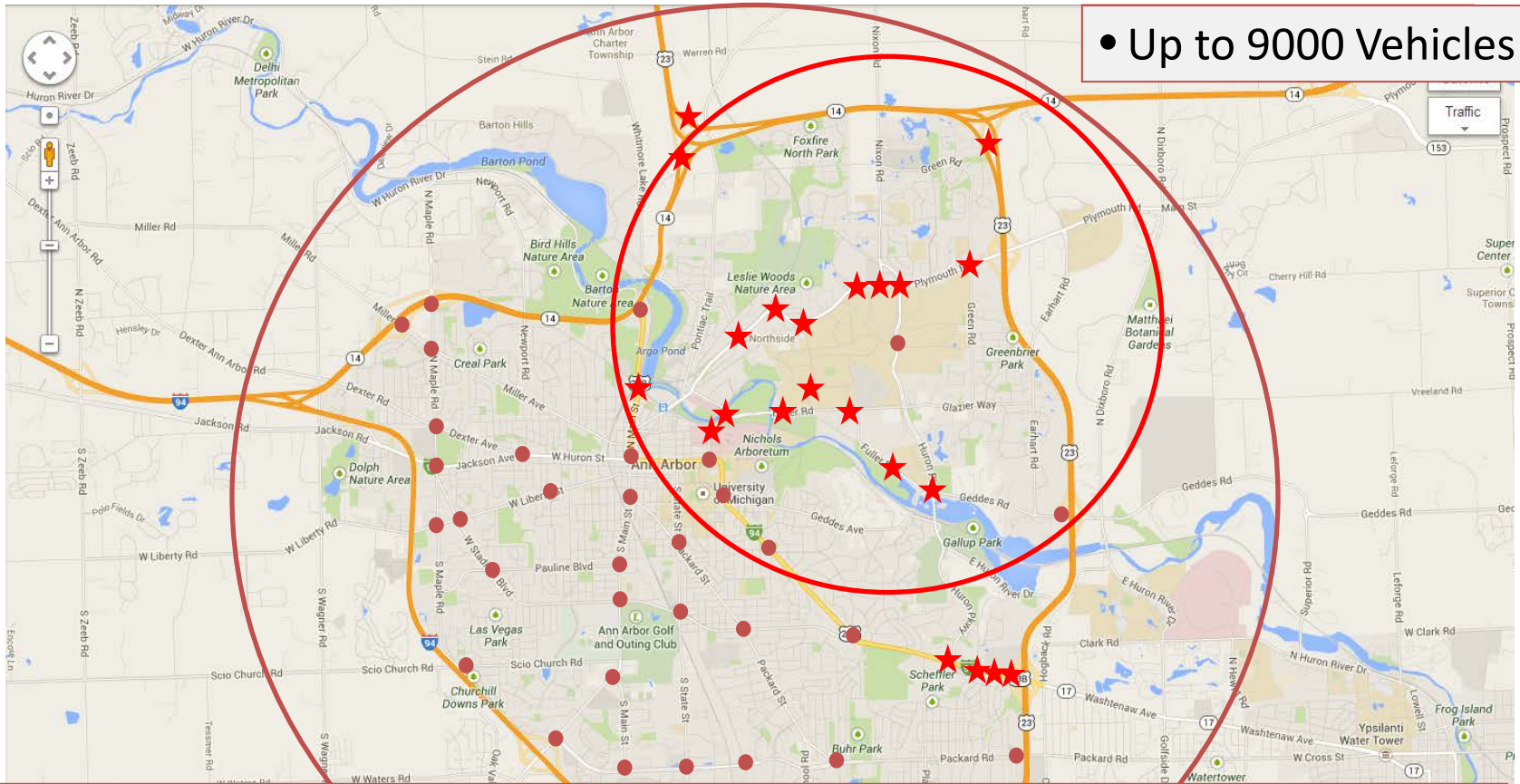
Safety Pilot Model Deployment

- 2836 vehicles equipped with DSRC wireless communication devices in a concentrated geographic area (Ann Arbor)
 - Cars, trucks, buses, motorcycles...and expanding
- One-year deployment commenced August 21, 2012; extended for 6 months; being extended for a further 3 years by USDOT
- 27 Billion messages collected
 - 3.5M trips, 21M miles, 740,000 hrs



PILLAR 1: CONNECTED ANN ARBOR

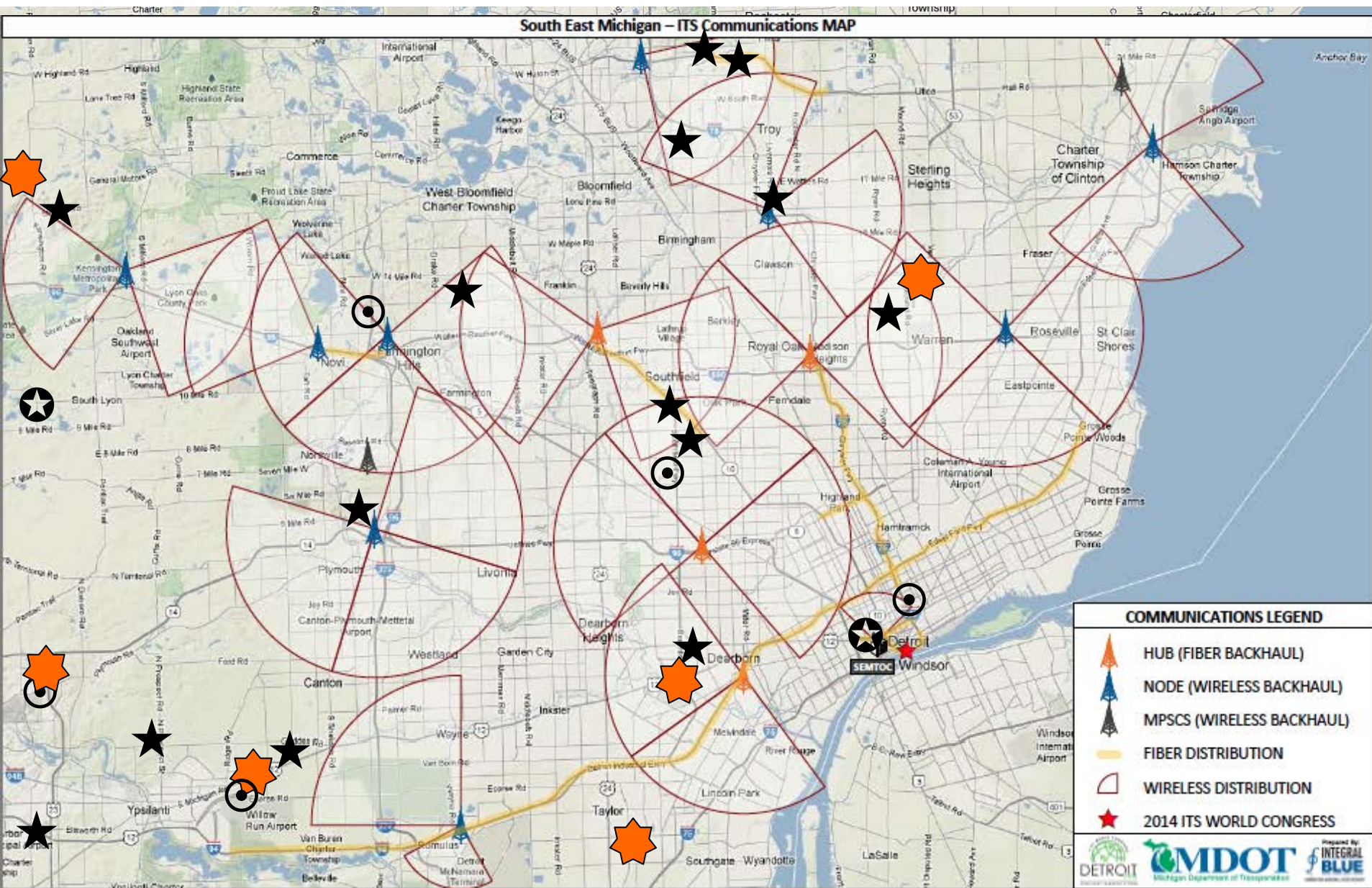
• Up to 9000 Vehicles



- 60 Intersections
- 3 Curve-related sites
- 12 Freeway sites
- Over-the-air security
- All DSRC communications logged
- Backhaul communication network
- Back-end data storage
- Will test selected V2I functions
- Include motorcycles, pedestrians, cyclists



PILLAR 2: CONNECTED SOUTHEASTERN MICHIGAN



PILLAR 2: RATIONALE

- Jump-start from research to regional deployment
- US has invested approximately \$1B over 10+ years
 - Significant progress has been made on V2V research for safety
- Positive NHTSA V2V decision announced by Secretary Foxx on February 3, 2014
 - Based on Safety Pilot data provided to Volpe Center by UMTRI
 - NHTSA will begin working on a regulatory proposal that will require V2V devices in new vehicles in a future year
- We also need a deployment strategy for V2I
 - Multiple stakeholders led by MDOT
 - Providing value to public on day-one: safety, mobility and efficiency
 - Including operating security model

PILLAR 2: SCOPE

- Equip 20,000 vehicles
 - Mostly company-owned, employee driven fleets
- Install 500 infrastructure nodes
 - Under MDOT direction
 - Located based on safety & congestion needs
 - Near OEM facilities
 - Includes some level of added backhaul
- Distribute and install 5,000 devices
 - Aftermarket Safety Devices
 - Retrofit Safety Devices
 - Pedestrian Safety Devices
- Operational 2016 – 2019
 - Fits with NHTSA rulemaking timetable

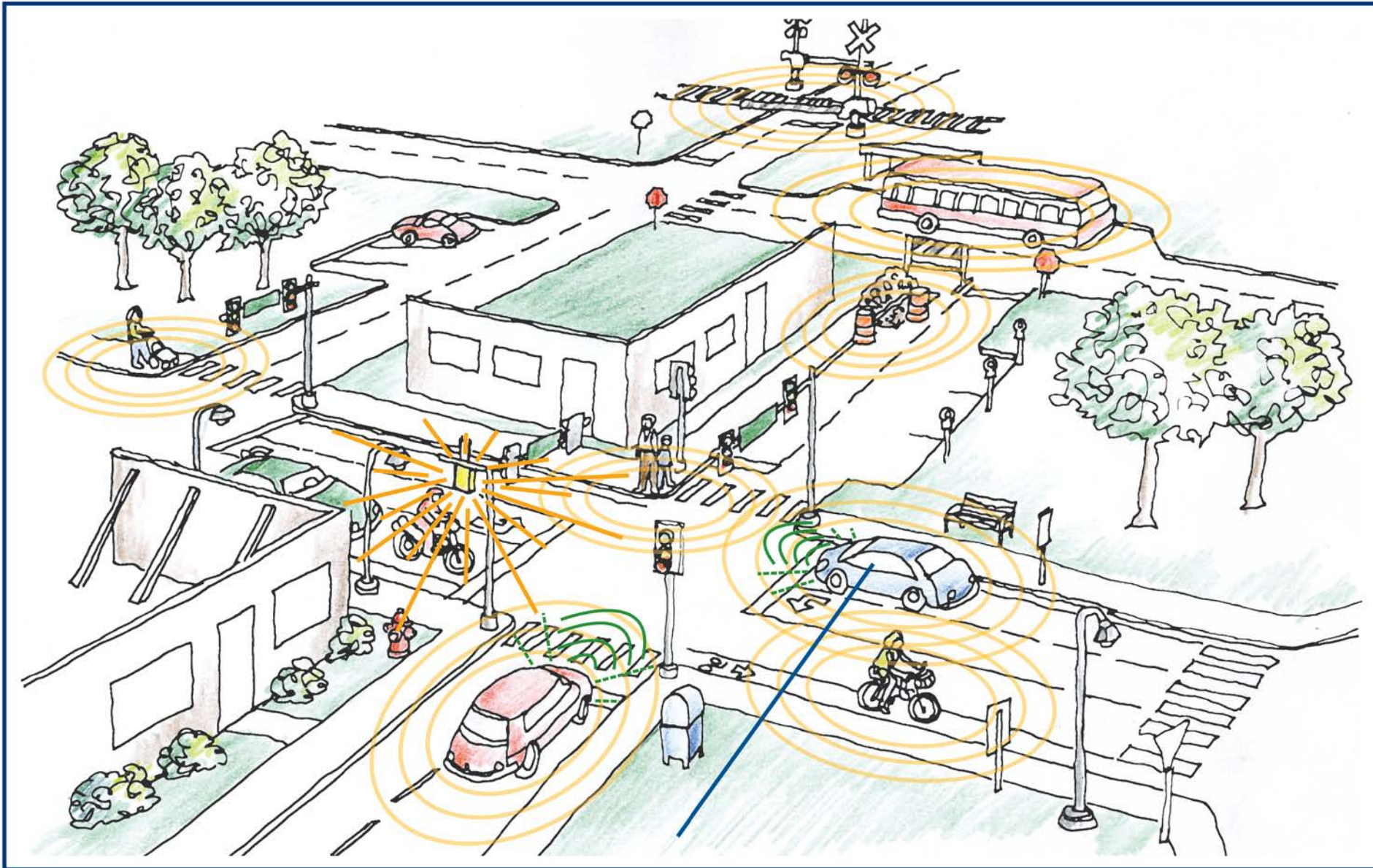
PILLAR 3: AUTOMATED ANN ARBOR

- Select group of industry and government partners
- High-volume, high-density connected vehicles & infrastructure
- Diversity of connected mobility: cars, trucks, buses, motorcycles, bicycles, pedestrians
- Smart city & infrastructure, data backhaul, security service
- Safe, off-roadway test environment for automated vehicles: simulated city (MTF)
- Deployment of a new mobility service for passengers and freight

PILLAR 3: RATIONALE

- Accelerated technological progress through stages of automation – including Level 4
- Automated, shared transportation deployment providing a service in Ann Arbor
- Technology development and certification at Michigan Mobility Transformation Facility (MTF)
 - \$6.5M project; \$3.0M funding from MDOT
 - Construction: summer 2014
- Join forces with industrial partners to create a company or non-profit organization for the operation
- 8-year project (2014-2021)

“fake downtown”



Mobility Transformation Facility (MTF) UM & MDOT

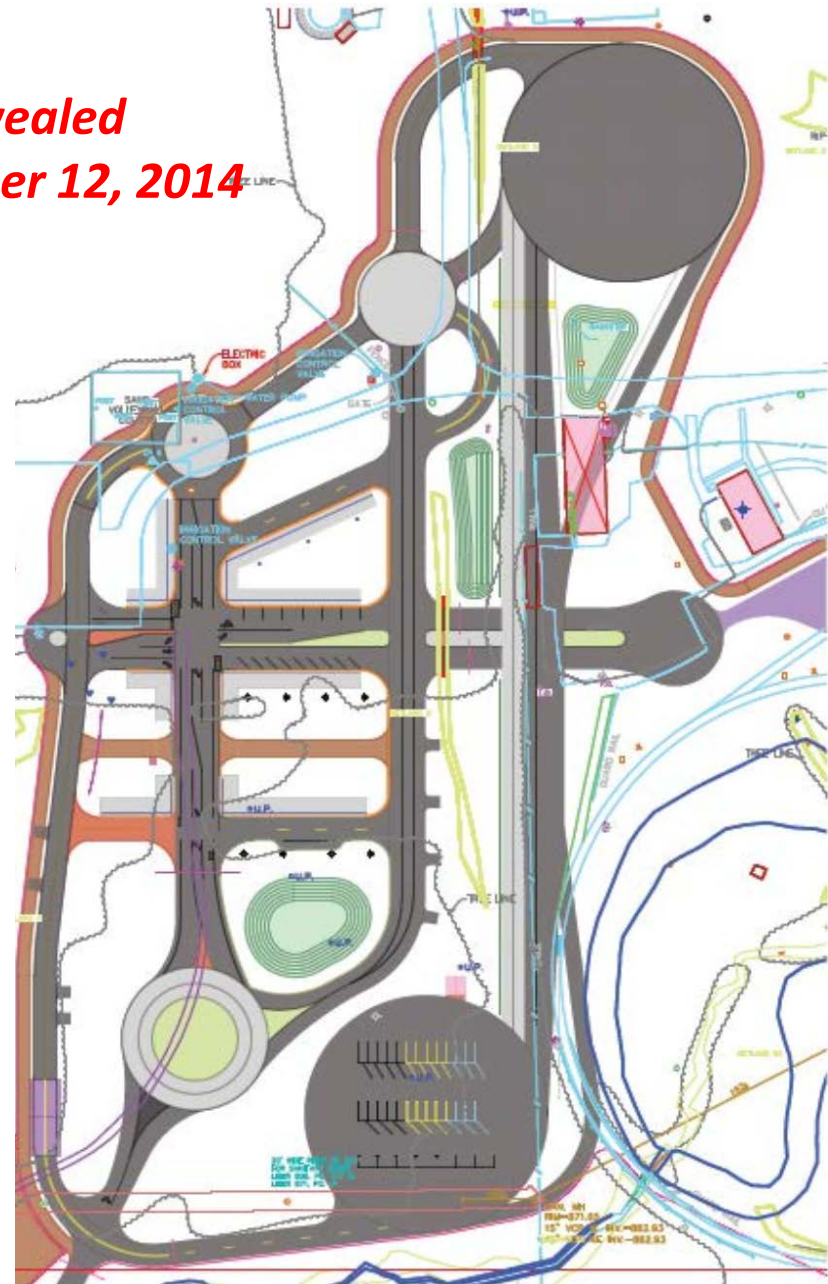
*To be revealed
September 12, 2014*

Roadway Attributes

- 13 signalized intersections
- 1000' North/South straight
- Various road surfaces (concrete, asphalt, dirt)
- Variety of curve radii, ramps
- Two, three, four and five-lane roads
- Round-about and “tunnels”
- Sculpted dirt and grassy areas

Road-side Attributes

- Variety of signage and traffic control devices
- Fixed, variable street lighting
- Cross walks, lane delineators, curb cuts, bike lanes, grade crossings
- Hydrants, sidewalks, etc.
- “Buildings” (fixed and movable)



MAJOR RESEARCH THEMES

To make MTC transformational.

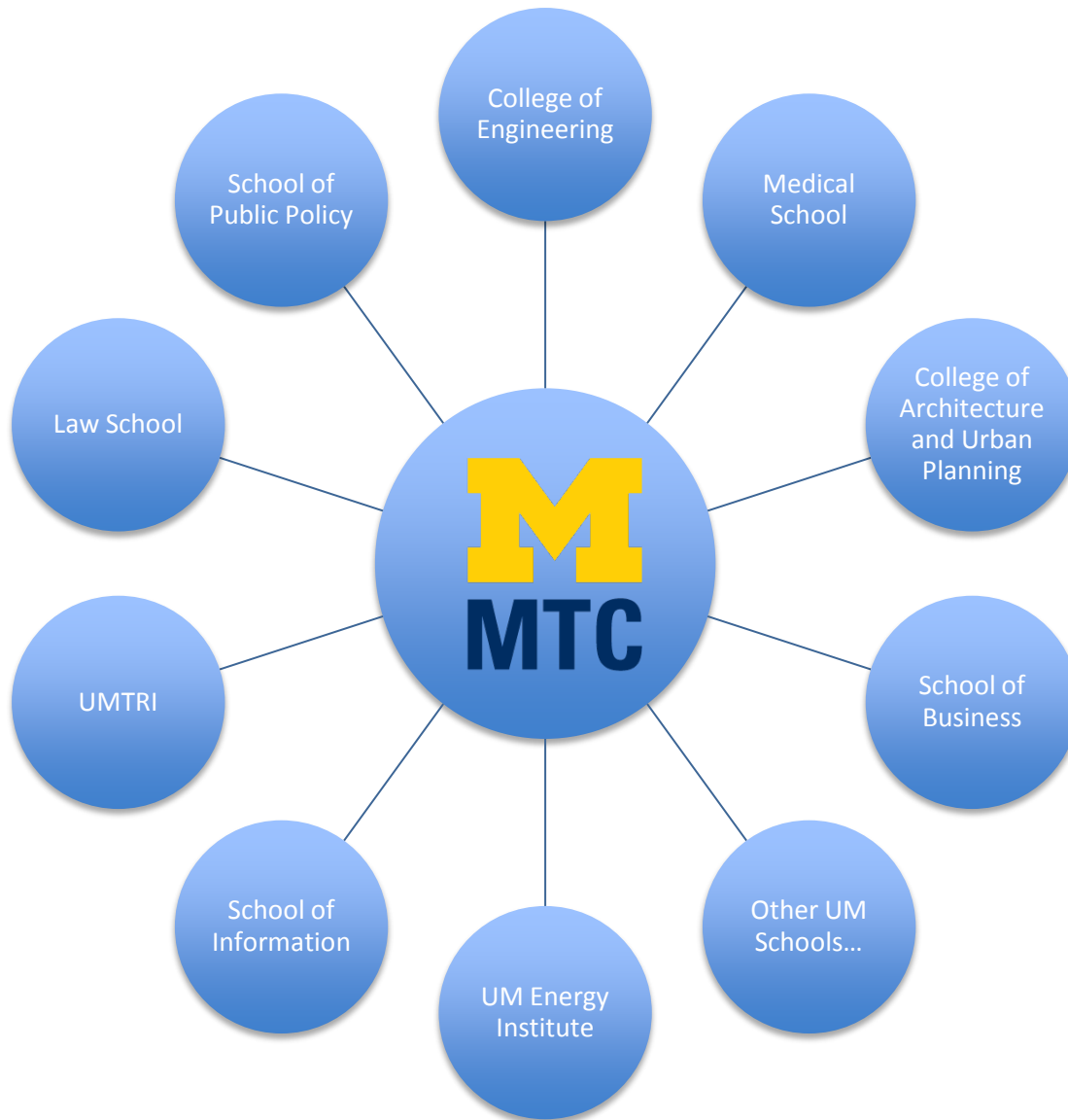
To utilize U-M strengths.

- Risk management
- Customer value
- Technology
- Societal Impacts

MTC Research Thrusts

- Connectivity (V2X)
- Automation
- Cybersecurity
- ITS Interoperability
- Analytics
- Human Factors
- Energy
- Public Policy
- Urban Planning
- Infrastructure Design
- Social Implications
- Standards
- Regulatory Issues
- Compliance
- Legal Issues
- Business Models
- Payment Methods
- Congestion Management

UNIVERSITY PARTNERS



KEY TRANSFORMATIONAL METRICS

- Fatalities and injuries
- Delay in traffic
- Energy consumption
- Carbon emissions
- Transportation start-ups

Partners

Industry

- Auto manufacturers
- Components and systems
- Telecommunications
- Big data management
- Freight
- Traffic control systems
- Insurance
- Public transportation
- Payment systems
- Smart parking

Government

- USDOT
- MDOT
- DOE
- MEDC-Automotive Office
- Other federal, state, and local agencies

Academia

- U-M
- TTI
- Other leaders

**research based on
deployment creates
rapid learning cycles**

Extrapolating to Other Regions



Source: USDOT