Connected and Automated Vehicle at MTC

Peter Sweatman  Director
Huei Peng       Associate Director, Pillar 3 lead
Jim Sayer   Pillar 1 lead
John Maddox   Pillar 2 lead

April 22, 2014
Why Automated?

- 33,561 motor vehicle deaths in 2012

From pyramid to kite
Japan’s population by age group, in millions:

<table>
<thead>
<tr>
<th>Year</th>
<th>6</th>
<th>4</th>
<th>2</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>100+</td>
<td>80</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>4</td>
<td>2</td>
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<tr>
<td>2005</td>
<td>100+</td>
<td>80</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>4</td>
<td>2</td>
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By gender:
- Male
- Female

Sources: National Institute of Population and Social Security Research
Three Pillar Projects

1. Ann Arbor Connected (2014+)
   - 9,000 equipped vehicles
   - 27 sq. miles of equipped infrastructure

   - 20,000 equipped vehicles
   - 500 equipped nodes, including highways and intersections
   - 5000 devices including nomadic seed devices and pedestrian

   - 2,000 connected and automated vehicles
   - 27 sq. miles of densely instrumented infrastructure
Three Pillar Projects

- Testing & Demonstration
  - Ann Arbor Connected (2014+)
  - Ann Arbor Automated (2016+)

- Regulation & Certification

- Research & Development
## Pooled Research and Development Work

<table>
<thead>
<tr>
<th>Research Thrusts</th>
<th>Technology</th>
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<tbody>
<tr>
<td></td>
<td>Connectivity, Sensors, Automation</td>
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<tr>
<td></td>
<td>Vehicle design, Infrastructure design</td>
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<tr>
<td></td>
<td>Human factors, Standards</td>
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<tr>
<td>Risk Management</td>
<td>Cybersecurity, Regulatory issues</td>
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<td></td>
<td>Legal issues</td>
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<tr>
<td>Customer Value</td>
<td>Safety, Congestion reduction</td>
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<td>Business model and process</td>
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<td>Vehicle sharing, Parking, Accessibility</td>
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<tr>
<td>Societal Impacts</td>
<td>ITS interoperability, Public policy</td>
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<td></td>
<td>System modeling and analytics</td>
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<td></td>
<td>Energy and emission</td>
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</tbody>
</table>
MTC and UM researchers will work with industrial and government partners to develop required standards that help (and not impede) the transition to automated and connected mobility.
Resources and Joint Work Needed for Pillar 3

- **MTF**
  - Construction (April – October 2014)
  - Electrical/Mechanical/IT (by early 2015)
  - Direct Technical Staff (2)
  - Data and other operational support

- **“Ann Arbor Automated” environment**
  - A living laboratory to test the new driverless mobility system

- **Pooled research and development work**

- **Regulation and standards development**
“Ann Arbor Automated” environment

- Phase I: MTF
“Ann Arbor Automated” environment

- Phase I: MTF
- Phase II: UM campus or near-by highways
“Ann Arbor Automated” environment

- Phase I: MTF
- Phase II: UM campus or near-by highways
- Phase III: City/County
Outline

- Introduction of Mobility Transformation Center (MTC)
- Mobility Transformation Facility (MTF) for connected and automated vehicle research
March 20, 2014
Regents OK design for connected and automated vehicle test environment

http://record.umich.edu/articles/regents-ok-design-connected-and-automated-vehicle-test-environment
Mobility Transformation Facility

Roadway Attributes
• 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)
Functions for Connected/Automated Vehicle Testing

- Fully connected mobility environment (intersections, vehicles, motorized bicycles, motorized pedestrians, intelligent parking meters and space, etc.)
- Changeable building facades, lane markings, traffic signals, lighting, etc.
- Limited but expandable environmental control functions (e.g., water on road, fog)
- “Ground truth” data collection system
- Each test vehicle can keep its internal system and data private.
Example Capabilities To Be Developed at MTF

Pedestrian Testing design At VRTC (we will have something similar)

PRESCAN model of UofM Central Campus
Modeling of Mobility Transformation Facility