Why CAV?

“The one thing that unites all human beings, regardless of age, gender, religion, economic status, or ethnic background, is that, deep down inside, we all believe that we are above-average drivers.”

- Dave Barry, American Humorist & Author
Why CAV? - Transportation Challenges

Safety
- 40,200 highway deaths in 2016
- 6,296,000 crashes in 2015
- Leading cause of death for ages 4, 11-27

Mobility
- 5.5 billion hours of travel delay
- $121 billion cost of urban congestion

Environment
- 2.9 billion gallons of wasted fuel
- 56 billion lbs. of additional CO$_2$
CAV – Maximizing Benefits

Autonomous Vehicle
Operates in isolation from other vehicles using internal sensors

Connected Vehicle
Communicates with nearby vehicles and infrastructure

Connected Automated Vehicle
Leverages autonomous and connected vehicle capabilities

Vehicle to Vehicle (V2V)
Vehicles communicating with each other

Vehicle to Infrastructure (V2I)
Vehicles communicating with infrastructure

Vehicle to Everything Technology (V2X)
Vehicles communicating to all technologies
SAE Levels of Autonomy

0. No Automation
- Driver has complete control

1. Driver Assistance
- Auto systems of either steering or acceleration/deceleration

2. Partial Automation
- Auto systems of both steering & acceleration/deceleration using information from surroundings

3. Conditional Automation
- Auto driving system of all aspects with the expectation that the human driver will perform when requested to intervene

4. High Automation
- Auto driving system of all aspects even without the human driver to intervene

5. Full Automation
- Full-time performance by an automated driving system of all aspects that can be managed by a human driver

Human driver monitors the driving
Automated driving system
Why DOTD CAV Technology Team?

T3 - Transformational Technologies in Transportation

The pace of change in how we see and use transportation has never been so rapid!
Why DOTD CAV Technology Team?

CAV Impacts

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Ranking*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation System Management &amp; Operations (TSMO)</td>
<td>1</td>
</tr>
<tr>
<td>Road Infrastructure</td>
<td>2</td>
</tr>
<tr>
<td>Transportation Performance</td>
<td>3</td>
</tr>
<tr>
<td>Data Systems and Needs</td>
<td>4</td>
</tr>
<tr>
<td>Travel Option (CAV, shared vehicle/ride services)</td>
<td>5</td>
</tr>
<tr>
<td>Legal/Regulatory</td>
<td>6</td>
</tr>
<tr>
<td>Land Use</td>
<td>7</td>
</tr>
</tbody>
</table>

What timeframe?
AV Legislation

States with Enacted Autonomous Vehicle Legislation

LEGEND
Enacted
Executive Order

06 March 2018
DOTD CAV Technology Team

30 Members, 25 Sections and Districts, Multidisciplinary

<table>
<thead>
<tr>
<th>Working Group</th>
<th>Members</th>
<th>Group Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway Technology &amp; Infrastructure</td>
<td>9</td>
<td>Erik Smith</td>
</tr>
<tr>
<td>Multimodal Transportation Technology &amp; Infrastructure</td>
<td>7</td>
<td>Joshua Duplantis</td>
</tr>
<tr>
<td>Agency Role Definition &amp; Policy Formulation</td>
<td>7</td>
<td>Steve Glascock</td>
</tr>
<tr>
<td>Departmental Applications</td>
<td>7</td>
<td>Kirk Zeringue</td>
</tr>
</tbody>
</table>
CAV Technology Team Mission

- Develop and maintain a working knowledge of advancements in CAV technology,
- Monitor and share industry activity,
- Determine state and local transportation agency roles in supporting CAV technology,
- Formulate DOTD policy,
- Advise local governments of what we believe their roles and responsibilities are, and
- Identify CAV applications for use within DOTD.
Retainer Contract for ITS System Design, Integration, and System Verification Services

- Technical & Planning Support Services
  - Connected & Autonomous Vehicle (CAV) Systems
  - Transportation Data Mining & Dissemination
  - Advanced Traveler Information Systems (ATIS)
  - Advanced Transportation Management Systems
  - (ATMS) Electronic Toll Collection (ETC) Systems
- 5-Year Contract
Scope of Services
CAV Technology Team Support TO

CAV Tech Team Support

Skype Meetings (4 meetings total, webinar/conference)

Meeting planning: Obtain and review weekly CAV updates from governments, industry, academia, organizations, international developments

Deliverables

Schedule, plan, and attend Skype team meetings

Develop CAV Technology Team meeting presentation

Prepare and submit CAV Technology Team meeting agenda, minutes
Scope of Services
CAV Technology Team Support

CAV Tech Team Support

Workshop Meetings (4 meetings total, in-person/conference)

Meeting planning: Obtain and review weekly CAV updates from governments, industry, academia, organizations, international developments

Deliverables

Schedule, plan, and attend team workshop meetings
Develop CAV Technology Team workshop meeting presentation
Prepare and submit CAV Technology Team workshop meeting agenda, minutes
Project Schedule

Kickoff 5/9/17

May
Jun.
Jul.
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.

Workshop 1 (6/28)
Workshop 2 (9/19)
Workshop 3 (2/07)

2017

Web Mtg 1 (8/15)
Web Mtg 2 (10/25)

2018

Workshop 4 (9/12)
Web Mtg 4 (12/5)

✓ Workshops: (4-hours, 8am - noon)
✓ Skype Web Meetings: (1-hour, 9am-10am)
7. What are 3 top needs that you think CAV technology could help solve for Louisiana?

Number of Responses

- Improve mobility - Reduce travel times: 14
- Improve mobility - Increase use of transit and other modes: 4
- Improve safety - Reduce single vehicle crashes: 11
- Improve safety - Reduce vehicle to vehicle crashes: 17
- Improve safety - Reduce fatalities: 20
- Improve environment - Lower emissions: 1
- Improve environment - Lower fossil fuel consumption: 0
- Improve economy - Create jobs in the CAV industry: 4
- Improve economy - Attract attention to Louisiana as an auto tech leader: 3
- Other (please specify): No other responses
10. How concerned (1-4) are you about the following issues related to CAVs?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Very concerned</th>
<th>Moderately concerned</th>
<th>Slightly concerned</th>
<th>Not at all concerned</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety consequences of equipment failure or system failure</td>
<td>14</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>3.36</td>
</tr>
<tr>
<td>Legal liability for drivers/owners</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>3.08</td>
</tr>
<tr>
<td>System security (from malicious hackers)</td>
<td>12</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>3.24</td>
</tr>
<tr>
<td>Vehicle security (from malicious hackers)</td>
<td>13</td>
<td>4</td>
<td>8</td>
<td>0</td>
<td>3.20</td>
</tr>
<tr>
<td>Data privacy (location and speed tracking)</td>
<td>9</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>2.72</td>
</tr>
<tr>
<td>Interacting with non-CAVs</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>0</td>
<td>3.00</td>
</tr>
<tr>
<td>Interacting with pedestrians and bicyclists</td>
<td>6</td>
<td>12</td>
<td>6</td>
<td>1</td>
<td>2.92</td>
</tr>
<tr>
<td>Learning to use CAVs</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>3.06</td>
</tr>
<tr>
<td>Increased distractions for drivers</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>2.54</td>
</tr>
<tr>
<td>System performance in poor weather</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>1</td>
<td>3.08</td>
</tr>
<tr>
<td>Drivers will rely too much on the technology</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>3.13</td>
</tr>
</tbody>
</table>
13. Please list up to 3 CAV related topics that you are particularly interested in learning more about

- **Pilots and implementations**: 8 responses
- **Financial cost and Economics**: 7 responses
- **Case Studies**: 5 responses
- **CAV data & security**: 5 responses
- **Ethics/Law**: 5 responses
- **CAVs safety**: 4 responses
- **Industry developments**: 1 response
- **Sustainability**: 1 response
CAV Technology Team Activities

Special Topics

- Surveys
- News & Updates

Surveys

13. Please list up to 3 CAV-related topics that you are particularly interested in learning more about.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilots and implementations</td>
<td>8</td>
</tr>
<tr>
<td>Financial cost and Economics</td>
<td></td>
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<td>Case Studies</td>
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<td>CAVs safety</td>
<td></td>
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<tr>
<td>Industry developments</td>
<td></td>
</tr>
<tr>
<td>Sustainability</td>
<td></td>
</tr>
</tbody>
</table>

News & Updates

News & Updates – October, 2017
http://www.govtech.com/uvic/Atlanta-Smart-Corridor-to-Serve-as-Living-Lab-for-Smart-Transportation.html

ATLANTA’S SMART CORRIDOR TO SERVE AS “LIVING LAB” FOR SMART TRANSPORTATION

- North Avenue Smart Corridor
- Improve safety, traffic congestion, and address environmental concerns
- City of Atlanta, Georgia Institute of Technology, and Georgia Department of Transportation
- “Living labs” for:
  - Internet of Things (IoT)
  - Data collection and analytics
  - Connected and Autonomous Vehicles (CAVs)
CAV Technology Team Activities

Guest Presenter

Fun Trivia!

Team Discussions

12. Which USDOT CV pilot program is currently providing field test data to the public?

- Wyoming I-80 Corridor: 62%
- New York Connected Streets: 15%
- Tampa Bay Downtown District: 23%
CAV Technology Team Workshops
Moving Forward:

5. Please rank (1-7) the objectives of the CAV Technology Team.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Score</th>
<th>Most Urgent</th>
<th>Least Urgent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain access to CAV industry resources and stay informed</td>
<td>4.7</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Outreach to potential CAV program partners and establish roles</td>
<td>3.3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Identify and prioritize CAV applications</td>
<td>4.8</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Develop a CAV Strategic Plan</td>
<td>5.8</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Establish CAV policy framework</td>
<td>5.1</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Provide CAV technology training</td>
<td>2.7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Develop a test deployment</td>
<td>1.8</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Moving Forward: CAV Strategic Plan

Policy & Planning Framework

- Identify current mobility needs
- Review current ITS infrastructure and architecture
- CAV industry initiatives
- CAV applicability
- Funding
- CAV readiness and action plan
Moving Forward: CAV Strategic Plan

Potential Goals of a CAV Strategic Plan for Louisiana?

• **Proactive** - Identify how and where Louisiana can utilize connected technologies to enhance system operations

• **Reactive** - Identify how LADOTD and local agencies need to prepare for growing use of automated vehicle technologies (use of road infrastructure, impacts on travel demand, etc.)
Moving Forward: Examples of Policy and Planning Strategies

- Increase public awareness of benefits and risks
- Invest in CV infrastructure
- Grant AVs and CVs priority access to dedicated lanes
- Grant signal priority to CVs
- Identify opportunities to partner with private-sector
Moving Forward:
ITS Architecture Updates

Connected Vehicle Reference Implementation Architecture (CVRIA)

• 2012 – 2017
• Built for CV standards analysis
• Supported CV pilot projects
• Used as input in new Version 8 of the National ITS Architecture – aka ARC-IT!
Moving Forward: ITS Architecture Updates

Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)

- Reference architecture for planning, defining, and integrating ITS
- ARC-IT provides a unifying framework that covers both CV and traditional infrastructure ITS capabilities
- ARC-IT merges the National ITS Architecture with CVRIA 2.2 in July 2017
Moving Forward: ITS Architecture Updates

ARC-IT Supported by new tools:

• RAD-IT – Regional Architecture Development for ITS (formerly Turbo Architecture). Used to support Transportation planning.

• SET-IT – System Engineering Tool for ITS. Used to develop project specific output.

• [www.ARC-IT.net](http://www.ARC-IT.net)
Moving Forward: Smart Corridor Testbed

Identify a suitable corridor for:

- CAV pilot projects
- SPaT challenge
- CAV data collection and analytics
- Developing partnership opportunities
- Improve safety, congestion, and mobility
Driving towards CAV Future

1. Expect a Long Transition
2. Be Patient/Flexible
3. Be Ready to Dialogue
Inspired by CAV?

It’s so beautiful!
(キレイな旅館)
Questions/Comments

Key Team Members
- Glenn Havinoviski – Iteris
- Paul Hsu - Arcadis
- David Binkley - Iteris

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