AASHTO “Connected Vehicle”
Infrastructure Deployment Analysis

JPO Webinar
June 24th, 2011
Jim Wright
American Association of State Highway and Transportation Officials
Agenda

• Purpose of Deployment Plan
• Developmental Approach
• Task Highlights
• Scenarios 2011 – 2029
• Strategies 2011 – 2014+
• Companion Activities
• Next Steps
Plan Purpose

• Address Goals in 2009 Strategic Plan
  ▪ Commitment to advance deployment readiness
  ▪ Commitment to better understanding deployment Issues
• Identify a practical approach for infrastructure deployment
• Provide insights into what the future holds for applications, vehicles and communications
• Identify a phased deployment strategy with regional deployments
• Establish a foundation to conduct benefit assessments and business model development
• Provide insights on agency deployment and operations
Plan Approach

• Set of building block tasks
  ▪ 1) Applications Defined (the benefits)
  ▪ 2) Market assessment of:
    ❖ Vehicles trends
    ❖ Communications infrastructure - what’s available
    ❖ After market devices - role and emergence
    ❖ Consumer devices presence - impact on AASHTO community
Plan Approach

• 3) Survey of state activities in “connected vehicle space”
  ▪ Actions demonstrate what is important
  ▪ Provides possible locations for phased deployment

• 4) DSRC Assessment
  ▪ What is current state of readiness
  ▪ What are deployment issues
Plan Approach

• 5) Controller Assessment
  ▪ Dimensions of upgrading nations controllers to DSRC operations

• 6) Deployment scenarios 2010 – 2035

• 7) Policy & Business Issues
Applications

- **Intersection Safety**
  - Collaborated with FHWA – accident analysis
  - 2020 time frame for OEM equipped vehicles - based on NHTSA timeline
  - Value of early infrastructure for first vehicles
- **Agency Operations**
  - Traffic Control, including emergency vehicles
  - Commercial vehicle transactions
  - Fleets, Transit
- **Mobility**
  - Travel information ~ public package
  - Travel information ~ private package
  - In-vehicle signing
Market assessment

- Embedded vehicle systems
  - Safety & Mobility ~ High potential ~ 200 million vehicles
  - Rollout curves
- After market vehicle systems
  - Primarily Mobility ~ unsure of market penetration?
    - New OnStar Offers
    - Ford Synch
    - New devices?
- Consumer electronics products ~ potentially big market?
  - Primarily mobility
  - smart phones ~ a lot
- Communications
  - Cellular
  - DSRC

Impacts of Distraction
Issue unknown
State Activities

• Emergency vehicles – AZ
• Intersection safety, mobility - CA
• Rural intersection safety, fuel taxes – MN
• Test beds, data management, infrastructure management – MI
• Commercial vehicles – NY
• Test bed ITSWC – FL
• Pooled fund study, SSOM Leadership – VA
• Rural corridors – ID
• Active traffic management - WA
DSRC Assessment

• How will a national program be implemented and operated
  • Only 16 states currently hold licenses for the frequency, and not all of these are held by the transportation agency within the state.
  • there are over 100 companies that have license to the frequency  The majority of companies are telecoms or television stations.
  • each state gets 1 license for the entire state. A county license covers the county and so on.
  • A commercial company would get a license for installation anywhere in the country.
  • The FCC didn’t see any problems as they feel individual licensees can address any interference issues between themselves and it also isn’t a problem because the range is so limited

• DSRC is one of the more ambiguous elements
## Controller Assessment

<table>
<thead>
<tr>
<th>Controller Type</th>
<th>Speed</th>
<th>Comm</th>
<th>OS</th>
<th>API</th>
<th>In Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ATC 5.2b</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>8,000</td>
</tr>
<tr>
<td>2 Model 2070LX</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>3 Model 2070E</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>4 Model 2070L</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>52,000</td>
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<tr>
<td>5 NEMA, Modern</td>
<td>Yes</td>
<td>Yes</td>
<td>33%</td>
<td>No</td>
<td>36,000</td>
</tr>
<tr>
<td>6 NEMA, Legacy</td>
<td>No</td>
<td>Adaptor</td>
<td>Yes</td>
<td>No</td>
<td>91,000</td>
</tr>
<tr>
<td>7 Type 170, Modern</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>12,000</td>
</tr>
<tr>
<td>8 Type 170, Legacy</td>
<td>No</td>
<td>Adaptor</td>
<td>No</td>
<td>No</td>
<td>102,000</td>
</tr>
<tr>
<td>9 Electromechanical &amp; Other</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>6,000</td>
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<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
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<td></td>
<td><strong>307,000</strong></td>
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# Controller Assessment

<table>
<thead>
<tr>
<th>Line</th>
<th>Controller Type</th>
<th>Upgrade Necessary for RSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ATC 5.2b</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>Model 2070LX</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Model 2070E</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Model 2070L</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>NEMA TS-2 Ethernet (modern)</td>
<td>Standard OS (33%): None Non-Standard OS (67%): Port App, Cross-compile, Test</td>
</tr>
<tr>
<td>6</td>
<td>NEMA TS-1 (legacy)</td>
<td>Replace Controller</td>
</tr>
<tr>
<td>7</td>
<td>Type 170 controllers (modern)</td>
<td>Port App, Cross-compile, Test</td>
</tr>
<tr>
<td>8</td>
<td>Type 170 controllers (legacy)</td>
<td>Replace Controller</td>
</tr>
<tr>
<td>9</td>
<td>Electromechanical controllers</td>
<td>Replace Controller</td>
</tr>
</tbody>
</table>
### Controller Assessment

<table>
<thead>
<tr>
<th>Controller Type</th>
<th>Replaced</th>
<th>Cost EA</th>
<th>Cost Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ATC 5.2b</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>2 Model 2070L</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>3 NEMA TS-2 Ethernet (modern)</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Standard OS (33%)</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Non-Standard OS (67%)</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>4 NEMA TS-1 (legacy shelf)</td>
<td>91,000</td>
<td>$1,350-$2,350</td>
<td>$122,850,000-$213,850,000</td>
</tr>
<tr>
<td>5 Type 170 controllers (modern)</td>
<td>0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>6 Type 170 controllers (legacy rack)</td>
<td>102,000</td>
<td>$2,200</td>
<td>$224,400,000</td>
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<tr>
<td>7 Electromechanical controllers</td>
<td>6,000</td>
<td>$900</td>
<td>$5,400,000</td>
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</tbody>
</table>

The cost estimate presented in this table includes only the direct costs for controller upgrade and additional costs could be significant!

Totals: $352,650,000-$443,650,000
Scenarios 2011
Setting the Direction

• Define a “General Concept for Deployment”
  ▪ No DSRC equipped vehicles until 2019
  ▪ Support applications on aftermarket & consumer devices
  ▪ Deploy RSE for selected applications and users
    ❖ Mobility & agency operations
    ❖ Commercial vehicle transactions
    ❖ Emergency Vehicle pre-emption
    ❖ Safety applications at isolated intersections
  ▪ Establish specific applications & desired outcomes
  ▪ Begin broadening coverage and use of RSE’s
  ▪ Share results with AASHTO community & others
Scenarios 2012
Showing Success

• Individual agency programs advancing
  ▪ Michigan – probe data from a controlled fleet of test vehicles
  ▪ California – major corridor demonstrating “green wave” in Palo Alto
  ▪ Minnesota – gathering User Fee data from public volunteers
  ▪ I-95 Coalition – demonstrating aftermarket device for road side inspection
  ▪ Florida – ITSWC Demonstrations

• USDOT Safety Pilot
Scenarios 2012 Showing Success

• Develop a “National DSRC Footprint Analysis”
  ▪ Provide more specific direction for RSE infrastructure
  ▪ Corridors Defined
  ▪ Intersections selected for safety
  ▪ Analysis of denser urban RSE pockets
    ❖ Signal control
    ❖ Safety
  ▪ Certificate management requirements
Scenarios 2013 – 2014
Jumpstarting Deployment

• USDOT
  ▪ NHTSA Agency decision
  ▪ Safety Pilot results
  ▪ Practitioner’s Toolbox

• AASHTO
  ▪ Definitive plan for infrastructure
  ▪ Policy and Funding statements
  ▪ Peer Deplorers' Forum
  ▪ Best practices workshops

• VIIC & OEM’s
  ▪ Closer AASHTO collaboration
2015 – 2019
Expanding the Field

• Light vehicles equipped with DSRC start to appear ~ 7% of fleet
• AASHTO begins to shift from commercial and agency emphasis to light vehicle emphasis for RES deployments
• Now RSE foot print shifts to a nation wide network
• Agency selected applications advancing
Scenarios 2020 – 2023
Taking Solutions to Market

- Model year zero for DSRC Vehicle Introduction
  - In four years 30% of vehicles equipped with DSRC safety
- Begin RSE expansion to prepare for early embedded vehicles
  - VIIC analysis – 5000 RSE initial for certificate management
  - High priority intersections, safety zones, commercial and emergency vehicle sites
- Applications supporting agency operations maturing
- AASHTO “Green Book” Design Guidelines used to guide installations and operations
- AASHTO Application store for agency applications?
Scenarios 2020 – 2023
Taking the Solutions to Market

• Widespread 4G (& newly available 5G) services increasingly widespread along with a large national DSRC infrastructure

• Variety of connected vehicle applications available through the public and private sector resulting in improved safety and agency operations
Scenarios 2024 – 2029
Growing to Meet Demand

- Vehicle fleet equipped with DSRC grows from 30% - 70%
- V2V & V2I benefits becoming apparent to all
- Agencies operating a large national infrastructure of DSRC communications
- DSRC infrastructure explicit part of design, construction, operations
- Applications fully integrated into agency operations
AASHTO Strategies 2011

- Information Exchange Program
  - Semi annual workshops through SSOM
  - Technical briefings – papers, web calls
- Advice Memorandums to USDOT
- Procurement Guidance phase 1
  - USDOT qualified product list
- Formal education & outreach program
- Establish Joint planning committee for national DSRC footprint
AASHTO Strategies 2012

• Broaden awareness through education & outreach program
• Joint AASHTO/VIIC Committee publishes national DSRC footprint requirements to prepare for initial deployments
• AASHTO policy on minimum infrastructure deployment levels by all members
• AASHTO develops formal “Connected Vehicle” Infrastructure Design Guides
AASHTO Strategies
2013 - 2014

- Adopt policy for minimum levels of deployments in each state
- To ensure above can be achieved AASHTO adopts a national funding approach
- Creation of a Deployment Support program
  - Peer Deployer’s program
  - Formal Association relationship for deployment
    - USDOT, VIIC, NACo, Etc
AASHTO Strategies Beyond 2014

• Prepare for national build out
  ▪ Reasonable to assume that the NHTSA agency decision will be combined with a national infrastructure decision?

• Update design guides

• Policies on public – private investments for capital and operations
Companion Activities

• Pooled Fund
  ▪ States – traffic ctrl, pavement assessment, SPaT
  ▪ DMA – FHWA; 1) SE, 2) Field test for traffic management & control
  ▪ Certification HW/SW
  ▪ OBE Aftermarket Device

• JPO Activities
  ▪ Safety Pilot - learn
  ▪ Regional pilots ~ 2014

• NCHRP G03 – (101) Benefit Assessment & DSRC

• VIIC Discussions & Collaboration
Next Steps

• AASHTO WG Meeting
  ▪ Report discussion
  ▪ Start on General Concept for Deployment
  ▪ Establish commitments

• Brief AASHTO/NACo committees

• AASHTO Annual meeting Session

• Executive Leadership Team briefing