UNITED STATES
DEPARTMENT OF TRANSPORTATION

Applications for the Environment: Real-Time Information Synthesis (AERIS)

Incorporation of Stakeholder Input into the AERIS Program

2013-2014 AERIS Fall/Winter Webinar Series

December 4th, 2013

Purpose of the Webinar

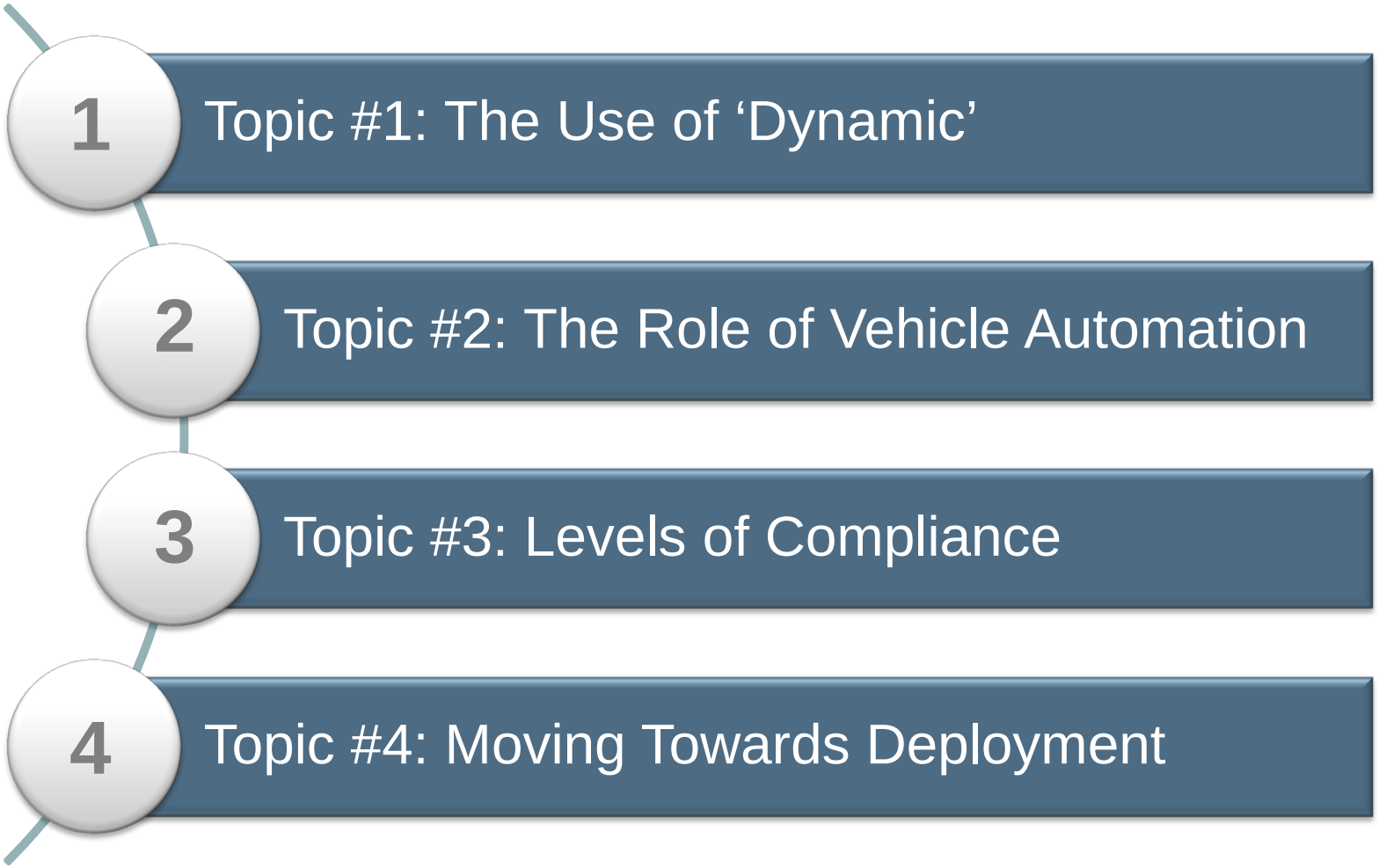
- The AERIS Program has engaged stakeholders in webinars, workshops, and other outreach activities. During these events, stakeholders provided input to the AERIS Team. In many cases, stakeholder input fell into major categories with patterns or topics emerging.

- The AERIS Team has been listening to stakeholders and has been considering their input in various forms. The AERIS Program has distilled this information and wanted to report back to stakeholders.

- The purpose of this webinar is to continue an open dialog with AERIS stakeholders to ensure that their inputs are being considered by the AERIS Program and to provide stakeholders with an opportunity to provide additional feedback.

- The webinar will be interactive, allowing participants to share their ideas on these topics with the AERIS Team.

Patterns or Topics that Emerged from Stakeholder Input



Interaction During Today's Webinar

The webinar is designed to facilitate open dialogue that will produce inputs and considerations for the AERIS Program by gathering various ideas and perspectives from stakeholders.

How to interact with the AERIS Team during today's webinar:

- A window will appear with questions and a place for you to answer questions using free form text.
- Keep your inputs brief to allow all participants to contribute their perspectives.
- Each person only gets one comment/answer – please incorporate all your thoughts into a single answer. The system will override your answer if you attempt to enter multiple comments/answers.
- Please avoid going to full screen mode (at least during the questions are being posed). Full screen mode it will disable the polls from popping up on the screen.

AERIS OPERATIONAL SCENARIOS & APPLICATIONS

ECO-SIGNAL OPERATIONS

- Eco-Approach and Departure at Signalized Intersections *(similar to SPaT)*
- Eco-Traffic Signal Timing *(similar to adaptive traffic signal systems)*
- Eco-Traffic Signal Priority *(similar to traffic signal priority)*
- Connected Eco-Driving *(similar to eco-driving strategies)*
- Wireless Inductive/Resonance Charging

ECO-LANES

- Eco-Lanes Management ***(similar to HOV/HOT Lanes)***
- Eco-Speed Harmonization ***(similar to variable speed limits)***
- Eco-Cooperative Adaptive Cruise Control *(similar to adaptive cruise control)*
- Eco-Ramp Metering *(similar to ramp metering)*
- Connected Eco-Driving *(similar to eco-driving strategies)*
- Wireless Inductive/Resonance Charging
- Eco-Traveler Information Applications *(similar to ATIS)*

LOW EMISSIONS ZONES

- Low Emissions Zone Management *(similar to Low Emissions Zones)*
- Connected Eco-Driving *(similar to eco-driving strategies)*
- Eco-Traveler Information Applications *(similar to ATIS)*

ECO-TRAVELER INFORMATION

- AFV Charging/Fueling Information *(similar to navigation systems providing information on gas station locations)*
- Eco-Smart Parking *(similar to parking applications)*
- Dynamic Eco-Routing *(similar to navigation systems)*
- Dynamic Eco-Transit Routing *(similar to AVL routing)*
- Dynamic Eco-Freight Routing *(similar to AVL routing)*
- Multi-Modal Traveler Information *(similar to ATIS)*
- Connected Eco-Driving *(similar to eco-driving strategies)*

ECO-INTEGRATED CORRIDOR MANAGEMENT

- Eco-ICM Decision Support System *(similar to ICM)*
- Eco-Signal Operations Applications
- Eco-Lanes Applications
- Low Emissions Zone s Applications
- Eco-Traveler Information Applications
- Incident Management Applications

P POLICY CONSIDERATIONS

E EDUCATIONAL TOOLS

Topic #1: The Use of “Dynamic”

- **What We Heard**
  - The use of the word dynamic in describing Eco-Lanes and Low Emissions Zones is confusing/misleading. Stakeholders noted that the word ‘dynamic’ implies constant change.
  - The word ‘responsive’ implies changes to an event, a condition, or a threshold and may be a better term to describe the AERIS Operational Scenarios.
  - Travelers expect a level of consistency in their trip. A system that is too dynamic will confuse the traveling public.
  - Reinforce that rules will not be changing frequently.
  - Consider thinking of the applications as responsive to certain events/conditions:
    - Special Events
    - Weather Conditions (e.g., Code Red Air Quality Day)
    - Real-Time Traffic Conditions

Topic #1: The Use of "Dynamic" *(cont'd)*

- **What We Did or Are Doing** ***(ideas we thought of to address this input)***
  - Removed the word 'Dynamic' from the title of the Eco-Lanes and Low Emissions Zones Operational Scenarios and associated applications.
    - Dynamic Eco-Lanes → Eco-Lanes
    - Dynamic Low Emissions Zones → Low Emissions Zones
  - Updated the Eco-Lanes and Low Emissions Zones Concept of Operations (ConOps) documents.
    - Revised language describing dynamic operations to state:
      - "…systems would be responsive to special events, real-time traffic conditions, and real-time weather conditions (e.g., code red air quality days)."
      - Emphasized that eco-lanes and low emissions zone rules would not be changing frequently as this may result in confusion to the traveling public.
      - Continued to include language that eco-lanes and low emissions zones must include public awareness and educational campaigns to be successful.
      - Continued to state the importance of real-time traveler information (pre-trip and en-route) to convey information to travelers – including travelers with and without connected vehicle technologies

Participant Interaction #1

1. Based on the feedback you gave the AERIS Program, do you still agree with the change?

Topic #2: The Role of Vehicle Automation

- **What We Heard**
  - The role of vehicle automation should be more heavily considered in future operational scenarios since the AERIS Program has a 30 year planning horizon.
  - Automation may make some of the applications more effective.
  - Consider describing the AERIS applications using the NHTSA (and/or SAE) Levels of Automation.

- **What We Did or Are Doing** ***(ideas to address this feedback)***
  - The AERIS Program recognizes that Vehicle Automation may support:
    - Lighter vehicles that are more fuel/energy efficient.
    - Modal-shift and new paradigms for car ownership and reservations for vehicles.
    - Vehicles that are more likely to eco-drive and more compliant/responsive to eco-driving recommendations than human drivers).
    - Vehicle platooning resulting in improved roadway efficiency and less aerodynamic drag for vehicles in the platoon.

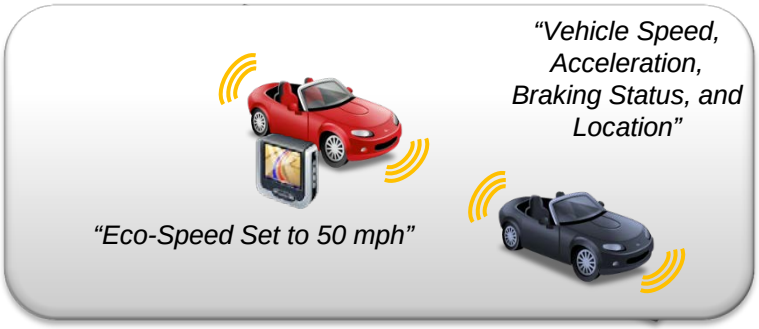
Topic #2: The Role of Vehicle Automation *(cont'd)*

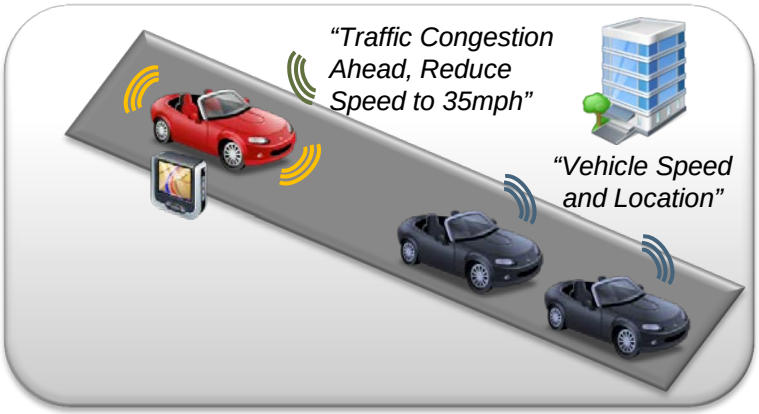
NHTSA Level of Automation	Description
No Automation (Level 0)	The driver is in complete and sole control of the primary vehicle controls – brake, steering, throttle, and motive power – at all times.
Function-specific Automation (Level 1)	Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alone.
Combined Function Automation (Level 2)	This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a Level 2 system is adaptive cruise control in combination with lane centering.
Limited Self-Driving Automation (Level 3)	Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The Google car is an example of limited self-driving automation.
Full Self-Driving Automation (Level 4)	The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles.

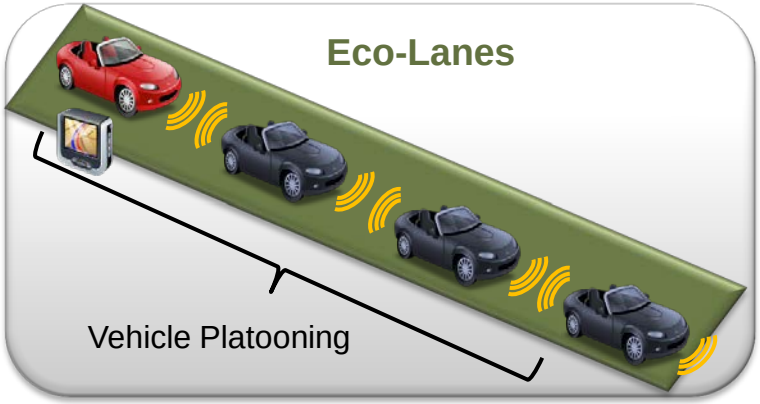
Source: NHTSA Policy on Automated Vehicle Development, May 2013

Topic #2: The Role of Vehicle Automation *(cont'd)*

Vehicle Automation on Freeways







Source: Noblis, September 2013

Cooperative Adaptive Cruise Control (CACC)

- Drivers have the convenience of setting their desired speed and having the vehicle safely maintain the speed.
- The CACC systems recognize the presence of a slower vehicle ahead and road grade and then automatically adjusts the speed to follow the other vehicle safely.

CACC and Eco-Speed Harmonization

- CACC systems may accept target speeds established by the traffic management centers (TMCs) that can optimize traffic performance for the environment.
- By having all CACC vehicles maintain the same speed that allows the best traffic/environmental performance, "speed harmonization" is achieved as the traffic stream moves smoothly and efficiently.

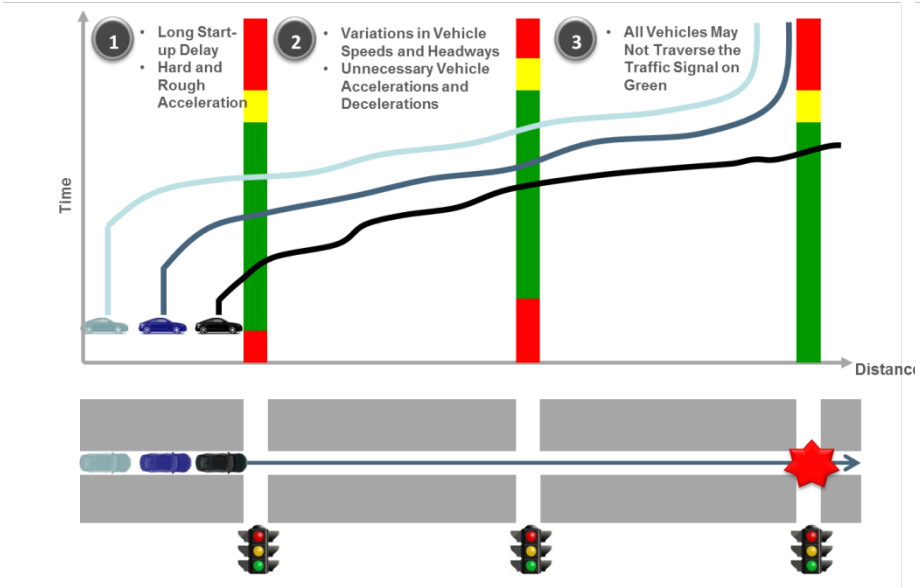
CACC/Vehicle Platooning and Eco-Lanes

- Eco-Lanes are specially managed and targeted at optimizing performance for the environment.
- TMCs can set target speeds and recommend closer following (shorter gaps) between CACC vehicles for which drivers can agree to accept ("opt-in").
- Eco-Lanes can support Vehicle Platooning.
- Shorter gaps, combined with speed harmonization can help minimize congestion and reduce emissions.

Topic #2: The Role of Vehicle Automation *(cont'd)*

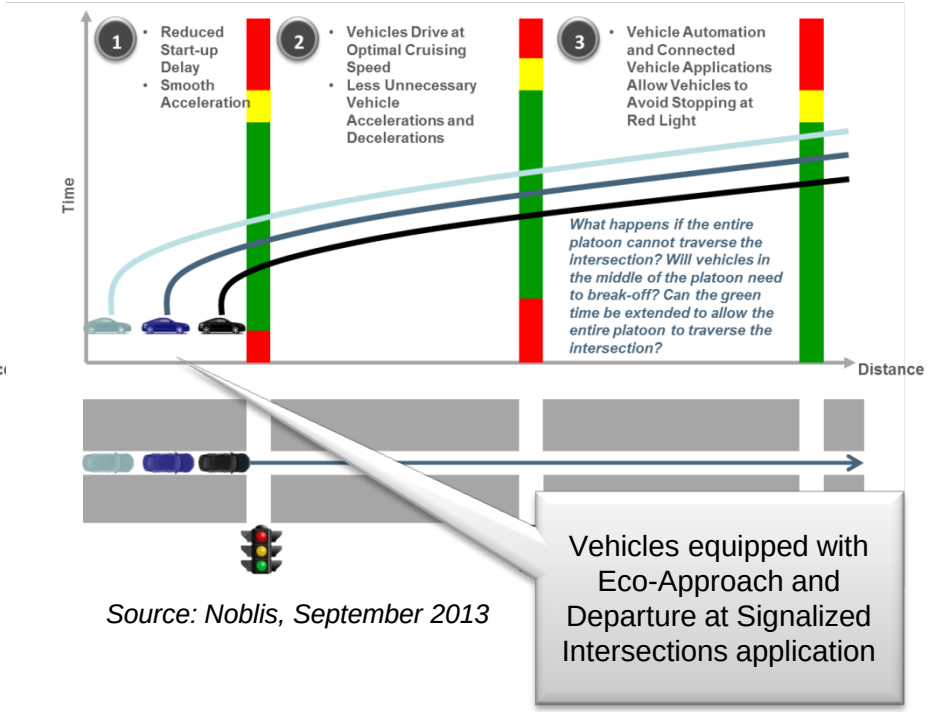
Vehicle Automation on Signalized Corridors

Vehicle Trajectories Without Automation



Source: Noblis, September 2013

Vehicle Trajectories With Automation



Source: Noblis, September 2013

Vehicle Automation on arterials can:

- Reduce start-up delay when the traffic signal turns from red to green;
- Reduce unnecessary accelerations and decelerations as vehicles drive between intersections;
- Support eco-driving strategies; and
- Improve on Eco-Approach and Departure at Signalized Intersections applications by improving speed advice compliance.

TRB's Second Annual Workshop on Road Vehicle Automation Energy and Environment Break-out Session

- **Rebound – induced demand?**
- Manipulation of policy, for example suppressed traffic, incentives for replacement of old vehicles
- **Electrification and automation**
- What are the possible transitions to vehicle automation and what are potential bottlenecks?
- Transformations - designing future scenarios including systems (ITS)/AV considerations
- **Will vehicle automation create incentives for non-petroleum fuels?**
- How do different stages of automation affect energy use?
- How light can vehicles get with automation?
- VMT impacts?
  - New demand (underserved)
  - More demand (elasticity)
  - Car sharing/occupancy & ownership models
- **How will automation affect vehicle ownership?**
  - **Right-sizing, fleets, ownership models**
- Impacts on energy, air quality, greenhouse gases
- Will range requirements/value grow for automated vehicles?
- **How will travel behavior/value of time change with vehicle automation?**
- How large will non CO_2 environmental benefits be? Are these strong drivers?
- **Transit**
  - Automated vehicles vs. transit?
  - Complementary options?
- **How might vehicle automation affect land use?**
  - Urban land use for transport
  - How does it interact with sprawl?
- How do people value their time as drivers (and how will it vary with vehicle automation)?
- Regional differences: "different global flavors"?
  - Rural vs. urban
- What are the potential pathways by which automated vehicles lead to energy and environmental effects?
  - Complementary, necessary pricing strategies to mitigate rebound or support deployment
  - Automating goods delivery (destruction of VMT demand?)
  - How does automation affect opportunities for pricing externalities
  - Different vehicle types for rightsizing/function
  - Are there categories of person-trips that can be eliminated by automation
  - New vehicle forms? (e.g., modular vehicles)
  - Lifecycle costs

Participant Interaction #2

1. What impact (positive or negative) do you see vehicle automation having on energy and environment?

Topic #3: Levels of Compliance

- **What Does this Mean?**
  - During the AERIS Benefit-Cost Analysis, several ‘known unknowns’ came up that were key variables to the BCA and to the AERIS modeling work.
  - Levels of Compliance similar to “Nested Dolls”
    1. Do you acquire the technology?
    2. Do you deploy the technology?
    3. Do you use the technology?
    4. How often do you use the technology? (e.g., 24/7 or only Code Red Air Quality Days)
    5. Does the level of use stay steady over time?
  - Levels of Compliance may include:
    - Choice for a driver to use an application (e.g., eco-driving, eco-routing)
    - Choice for transportation agencies to implement eco-strategies (e.g., eco-speed limits)
  - We cannot predict the future and there is no general agreement on values for these variables; however behavioral choices have a large impact on the magnitude of the potential benefits.
  - Behavioral choices are notoriously difficult to model.
- **What We Did or Are Doing** ***(ideas to address this feedback)***
  - Use an integrated modeling approach that includes: Transportation Demand Models, Dynamic Traffic Assignment Models, Microscopic Traffic Simulation Models, and Emissions Models.
  - Include sensitivity analysis as part of modeling and analysis.

Participant Interaction #3

1. The AERIS Program agrees that ‘level of compliance’ is an important, yet difficult variable for modeling. If you are aware of any resources that may be beneficial to the AERIS Program, please share those resources.
2. Please share your thoughts on how the AERIS Program can address compliance levels properly/effectively in the modeling and evaluation phase.

Topic #4: Moving Towards Deployment

- **What We Heard**
  - A lot can change in 30 years – we cannot predict the future.
  - Describe the AERIS Operational Scenarios and applications in a phased approach.
    - Near Term – low connected vehicle penetration rates
    - Connected Vehicle Build-up
    - Full Connected Vehicle Penetration
  - Stakeholders want to be able to see the AERIS Operational Scenarios and applications in a way that is applicable to them.

- **What We Did or Are Doing** ***(ideas to address this feedback)***
  - Defining clear timeframes for describing the AERIS applications.
  - Defining the AERIS applications in a phased approach to help stakeholders understand how they can begin deploying them in the near future.
  - Keeping a long term vision to encourage innovation.

Topic #4: Moving Towards Deployment *(cont'd)*

Assumptions

- Number/ Percentage of AFVs
- Number of AFV Charging/ Fueling Stations
- Fuel Prices and Impact on Behavior
- Deployment Levels of Conventional ITS
- OBE Penetration Rates
- RSE Penetration Rates
- Cellular Coverage and Smartphone Owners
- Levels of Automation

Today	Early Years of Connected Vehicles	Connected Vehicle Build-up	Connected Vehicles at Full Maturity
• Timing plans are broadcast using cellular communications.	• SPaT and GID messages are broadcast using DSRC or cellular communications at a few select locations.	• SPaT and GID messages are broadcast using a hybrid of DSRC and cellular communications at more locations.	• SPaT and GID messages are broadcast using a hybrid of DSRC and cellular communications for all traffic signals.
• No vehicles are equipped with In-Vehicle applications – applications reside on carry-in devices.	• In-Vehicle applications are included in less than 25% of vehicles.	• In-Vehicle applications are included in 50% or more vehicles.	• In-Vehicle applications are included in greater than 90% of vehicles.
• Applications do not consider interactions with other vehicles.	• Applications primarily use radar and other sensors to consider interactions with other vehicles.	• Applications primarily use other sensors (and V2V) to consider interactions with other vehicles.	• Applications primarily use V2V (and other sensors) to consider interactions with other vehicles.
• Speed recommendations are provided to the driver using a Driver Vehicle Interface (DVI).	• Speed recommendations are provided to the driver using a Driver Vehicle Interface (DVI).	• Speed recommendations are integrated into a vehicle's Adaptive Cruise Control (ACC).	• Speed recommendations are integrated with CACC and provide vehicle platooning capabilities.

Participant Interaction #4

1. What aspects of the AERIS applications (i.e., connected vehicle environmental applications that provide environmental benefits) could be deployed now or at low connected vehicle penetration levels?

Upcoming AERIS Webinars

Webinar #3: Preliminary Eco-Traffic Signal Timing Modeling Results

Wednesday, January 29th, 2013 at 1:00 pm ET

Webinar #4: Preliminary Eco-Traffic Signal Priority (for Transit and Freight) and Connected Eco-Driving Modeling Results

Wednesday, February 12th, 2014 at 1:00 pm ET

Webinar #5: A Comparison of US and EU Connected Vehicle Environmental Research Activities

Wednesday, March 12th, 2014 at 1:00 pm ET

Registration

Persons planning to participate in the webinar should register online at www.itsa.org/aerisfall2013

Contact Information

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