



UNITED STATES
DEPARTMENT OF TRANSPORTATION

Applications for the Environment: Real-Time Information Synthesis (AERIS) Transformative Concepts Workshop: Day 1

Washington, D.C.

March 14, 2012



AERIS

"Cleaner Air Through Smarter Transportation"

WELCOME AND INTRODUCTIONS

(MARCIA PINCUS)



WORKSHOP OVERVIEW

(WILLIAM WIGGINS)

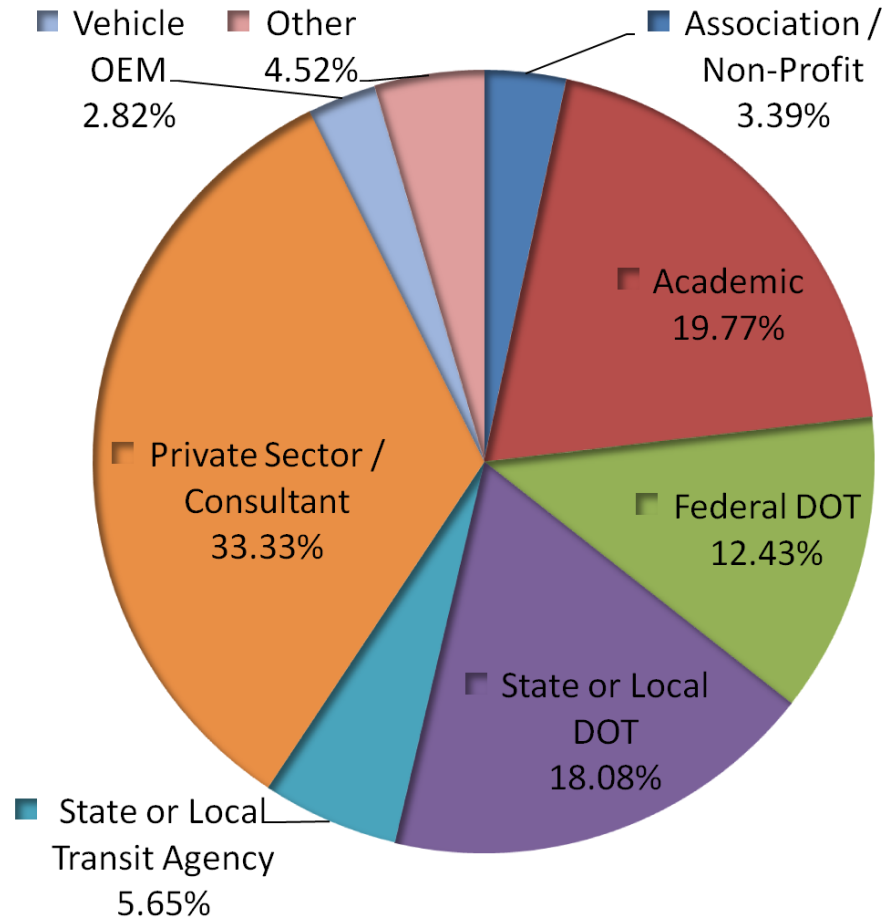


Meeting Guidelines and Housekeeping

- Webinar Participants
 - Your input and questions are important to the AERIS Team.
 - Please type your questions/provide feedback using the webinar tool
 - While we will not be able to address the questions during the workshop, we will review the questions afterwards.
- In-Person Attendees
 - When asking questions or providing comments, please speak into a microphone so that our webinar participants can hear you.
- Please Turn Your Cell Phones Off
- Lunch
- Restroom Locations



Who Is Here?



177 Total Participants

61 attending in-person

116 participating on webinar



Why Are We Here?

- The objectives of the AERIS Transformative Concepts User Needs Workshop are to:
 - Provide an update on the AERIS Program to the public.
 - Provide more detailed information to the public on the groups of applications, or Transformative Concepts, the AERIS Program intends to model.
 - Begin detailed discussions on Concepts of Operations for each Transformative Concept with a specific focus on user needs and data needs in the context of SAE J2735 message sets.



Workshop Overview – Day 1

- USDOT Connected Vehicle Research and AERIS Program Overview
 - Introduce workshop participants to the AERIS Program
 - Discuss the AERIS Program’s accomplishments
 - Introduce workshop participants to the AERIS Transformative Concepts
- SAE J2735 Message Sets and their Relevance to the AERIS Program
- Subject Matter Experts (SMEs)
 - The AERIS Team has brought together a diverse panel of Subject Matter Experts (SMEs) to participate in roundtable discussions to provide information on their activities, challenges, results, lessons learned, and future vision for transportation and the environment.



Workshop Overview – Day 1

- Roundtable Discussion #1 – Vision for the Future
 - Vision for the Future – City 2.0
 - What is your vision for a sustainable city of the future that incorporates the connected vehicle paradigm?

- Roundtable Discussion #2 – Technical Discussion
 - Focused on sharing of Subject Matter Expert (SME) experiences with respect to connected vehicle environmental applications, data needs, communication needs, and computing needs.



Subject Matter Experts

- **Matthew Barth**

Professor of Electrical Engineering and Director of the Center for Environmental Research and Technology, University of California (UC) Riverside

- **Andrew Chatham**

Senior Staff Engineer, Self-Driving Car Mapping Lead, Google

- **Petra Mollet**

Vice President – Strategy, American Public Transportation Association (APTA)

- **Hariharan Krishnan**

Technical Fellow, GM Global R&D

- **Jim Misener**

Executive Advisor, Booz Allen Hamilton

- **David Pickeral**

Global ITS Development Executive, IBM Worldwide Sales & Distribution

- **Hesham Rakha**

Professor at the Charles E. Via, Jr. Department of Civil and Environmental Engineering at Virginia Tech, and Director of the Center for Sustainable Mobility at the Virginia Tech Transportation Institute (VTTI)

What is your area of expertise and its application to connected vehicles and/or the environment/sustainability?



AERIS PROGRAM OVERVIEW AND STATUS

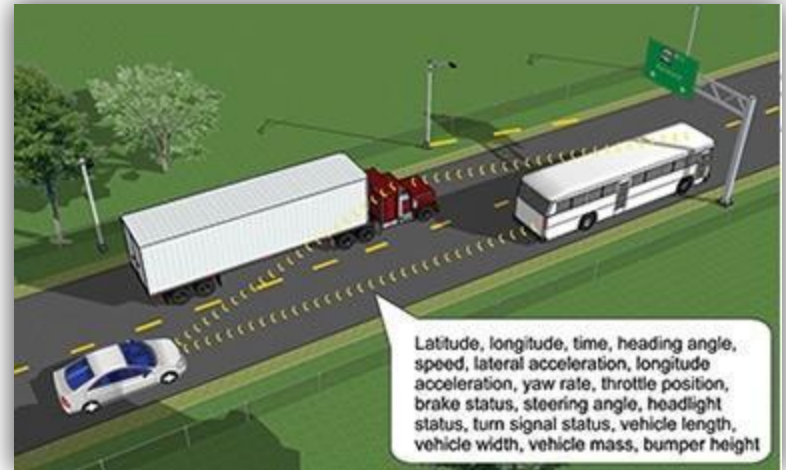
(ROBERT FERLIS)



What is Connected Vehicle Research?

Connected vehicle research is a suite of technologies and applications that use wireless communications to provide connectivity:

- Among vehicles of all types
- Among vehicles and roadway infrastructure
- Among vehicles, infrastructure, and wireless consumer devices



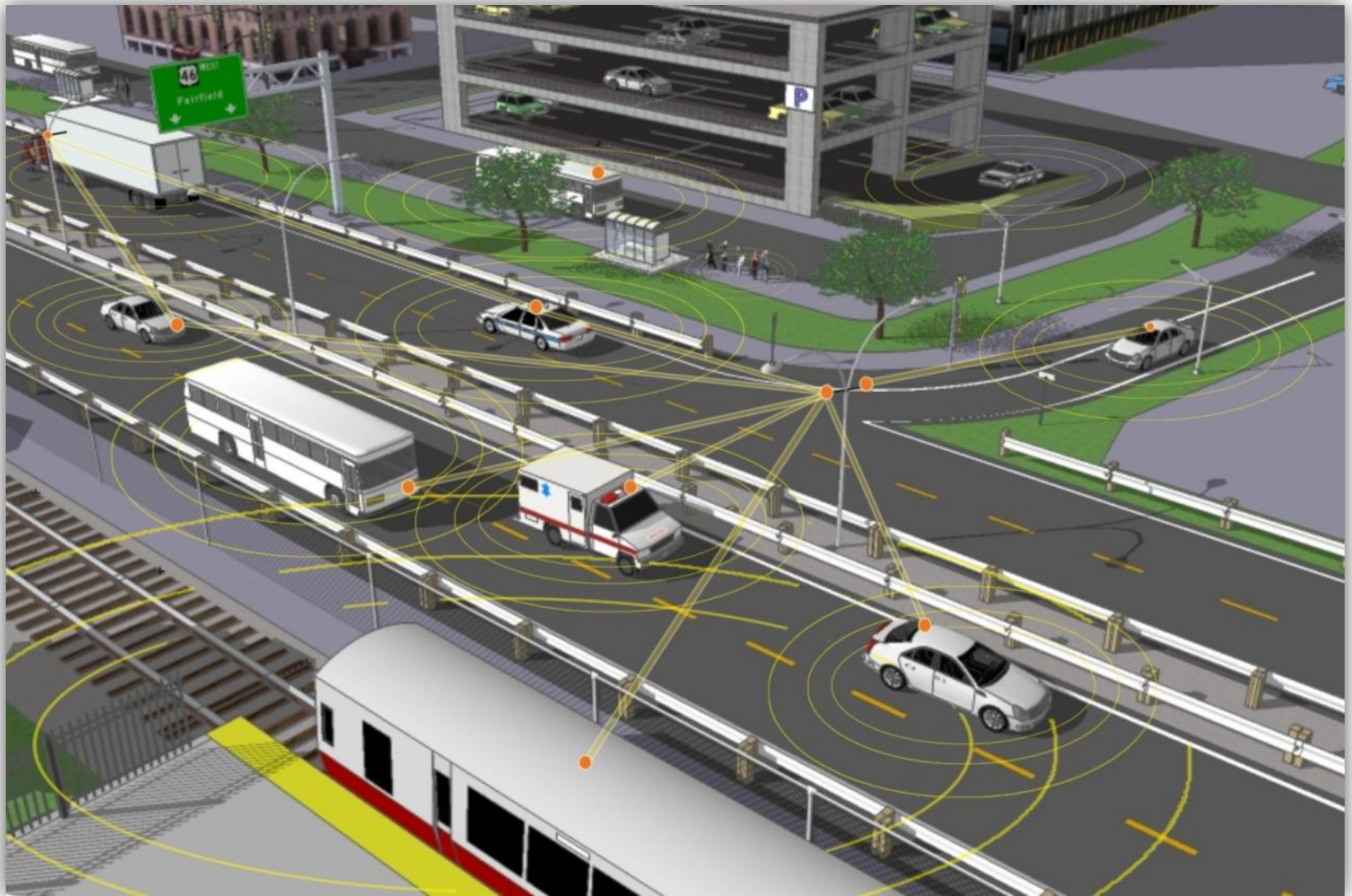
What is Connected Vehicle Research?

The vision for connected vehicle research is to transform surface transportation systems to create a future where:

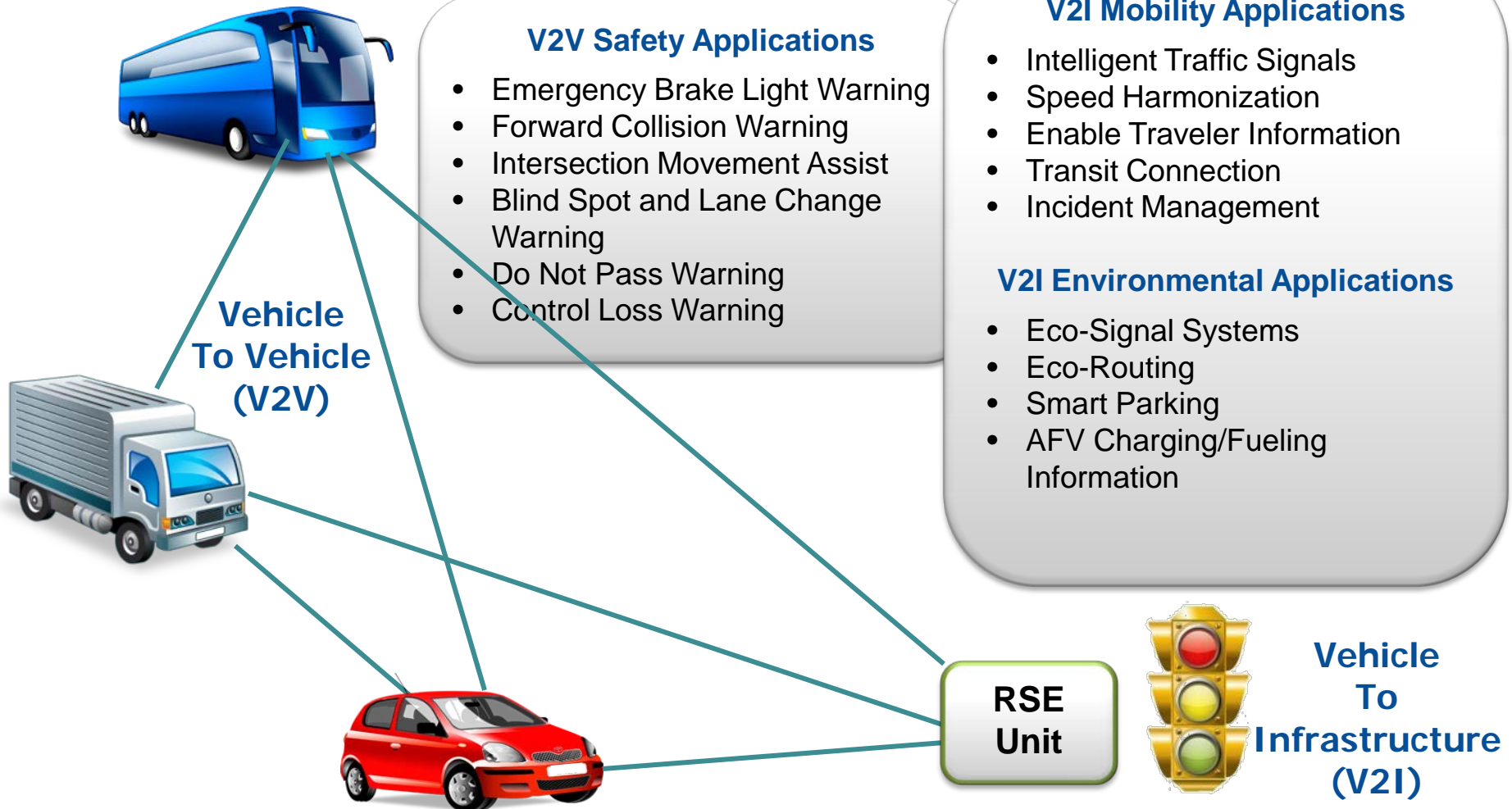
- Roadway crashes and their tragic consequences are significantly reduced.
- Traffic managers have data to accurately assess transportation system performance and actively manage the system in real time, for optimal performance.
- Travelers have continual access to accurate traveler information about mode choice and route options, and the potential environmental impacts of their choices.
- Vehicles and traffic signals can communicate to eliminate unnecessary stops and help drivers operate vehicles for optimal fuel-efficiency and emissions reduction.



Imagine: Connected Transportation



Connectivity in Transportation



Connected Vehicle Research Program

Applications



Safety

V2V

V2I

Mobility

Real-time
Data
Capture

Dynamic
Mobility
Apps

Environment

AERIS

Road
Weather
Apps

Technology



Harmonization of International Standards & Architecture

Human Factors

Systems Engineering

Certification

Test Environments

Policy



Deployment Scenarios

Financing & Investment Models

Operations & Governance

Institutional Issues



Why Is Connected Vehicle Research Needed?

Connected vehicle research aims to tackle some of the biggest challenges in the surface transportation industry, in the areas of safety, mobility and environment.

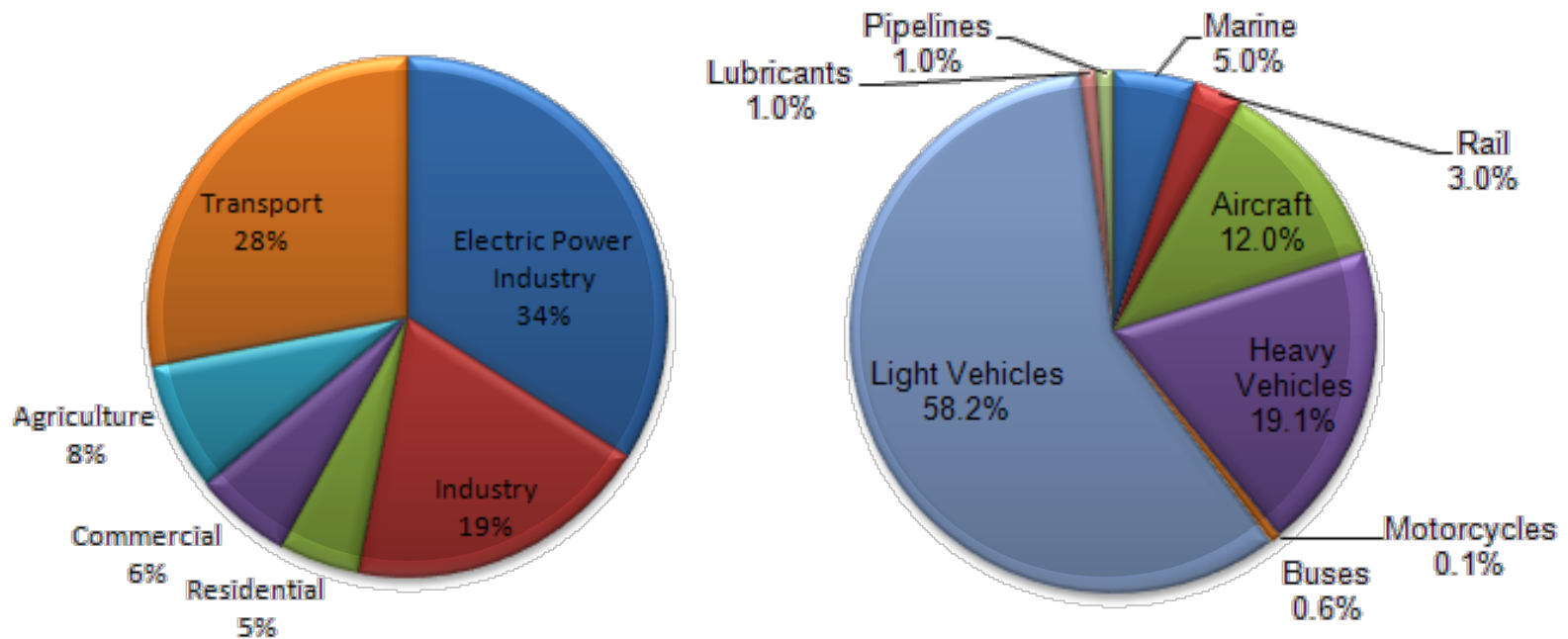
- **Safety** | In 2009, there were 5.5 million crashes, resulting in 33,808 fatalities and 2.2 million injuries. Motor vehicle crashes are the leading cause of death for people ages 3 through 34.
- **Mobility** | U.S. highway users waste 4.8 billion hours a year stuck in traffic – nearly one full work week (or vacation week) for every traveler. The overall cost (based on wasted fuel and lost productivity) reached \$115 billion in 2009 – more than \$808 for every U.S. traveler. Delays in truck operations alone resulted in \$33 billion in wasted fuel and lost productivity.
- **Environment** | The total amount of wasted fuel topped 1.9 billion gallons in 2010 according to the Texas Transportation Institute’s Urban Mobility Report.



Why Is the Environment a Part of Connected Vehicle Research?

Surface transportation has a significant impact on the environment:

- Transport sector accounts for 28% of GHG emissions in the US.
- Surface vehicles represent almost 80% of the transport sector GHG.



Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990 to 2006*. 2008.



AERIS Research Objectives

- **Vision** | Cleaner Air through Smarter Transportation
- **Objectives** | Investigate whether it is possible and feasible to:
 - Generate/capture environmentally-relevant real-time transportation data (from vehicles and the system).
 - Use these environmental data to create actionable information that can be used by system users and operators to facilitate “green” transportation choices for all modes.
 - Assess whether doing these things yields good enough environmental benefits to justify further investment by the USDOT.

TRANSFORMATIVE and INNOVATIVE



Guiding Principles

- Leverage existing and future research, data sets, and technologies to develop, enhance and, eventually, model and demonstrate Transformative Concepts that are proven to reduce the negative impacts of transportation on the environment.
- Explore how AERIS data sets may improve/validate assumptions of environmental and other models (such as EPA's MOVES).
- Explore a wide variety of communication technology options, not just one.
- Research will include all surface modes.
- Be undertaken in cooperation with international counterparts, as appropriate.



Basic Research Questions

Data

- What environmentally-relevant data is available, and what is its quality and validity? (Data from all vehicle types, roadside sensors and handheld devices)

Information/Connectivity

- How can this data be transmitted, integrated, and then used with existing transportation system operation and other data (such as road weather data, for example)?

Benefit

- What cross-modal applications/strategies are available, or could be developed, and what are their expected benefits?



The AERIS Program



- Five Years, Six “Tracks”
- Multimodal Approach
- Working with Data Capture and Management Program and Dynamic Mobility Applications Program
- 30 Year Planning Horizon

Track 1: Foundation

Establish the foundation by reviewing the state of the practice

Track 2: Identification

Identify initial candidate strategies, scenarios and applications that appear to improve decisions by public agencies and travelers

Track 3: Analysis

Analyze and evaluate candidate strategies, scenarios and applications that make sense for further development and evaluation

Track 4: Recommend

Recommend strategies, scenarios and applications

Track 5: Policy

Develop the facts and evidence needed to inform and respond to possible future policy and regulatory issues/needs

Track 6: Stakeholders

Engage stakeholders and foster technology transfer



AERIS Track 1 Findings

- AERIS State of the Practice (SOP) Reports
 - **Applications Assessment:** Identified applications that have demonstrated environmental benefits through use of ITS technologies.
 - **Evaluation Techniques:** Described methods of evaluating the benefits of AERIS applications.
 - **Behavioral and Activity-Based Modeling:** Examined how behaviors may be influenced to reduce negative environmental impacts of surface transportation.
 - **Environmental Models:** Assessed sensitivity and validity of environmental models in representing various environmental measures for evaluating ITS strategies.
 - **Data Acquisition Technology:** Determined what environmental data can be acquired or derived from vehicle-based and infrastructure-based sensors.



Broad Agency Announcement (BAA) Research Partners

1. An Evaluation of Likely Environmental Benefits of Lowest Fuel Consumption Route Guidance in the Buffalo-Niagara Metropolitan Area | [University at Buffalo](#)
2. Developing and Evaluating Intelligent Eco-Drive Applications | [Virginia Tech](#)
3. Eco-Speed Control Using V2I Communication | [Virginia Tech](#)
4. Preliminary System Development Plan for an AERIS Data Capture and Management System | [Mixon Hill](#)
5. Eco-ITS | [University of California at Riverside \(UCR\)](#)
6. Assessment, Fusion, and Modeling of Commercial Vehicle Engine Control Unit Data | [Calmar Telematics and UCR](#)
7. Engaging the International Community | [University of California Partners for Advanced Transit and Highways \(PATH\) Program](#)



Examples of the BAA Research Projects

▪ University at Buffalo's Eco-Routing Project

- Successfully integrated TRANSIMS with EPA's MOVES model.
- Results indicate that 'green routing' could result in significant reductions in fuel consumption and emissions, but this may come at the expense of an increased travel time.

▪ Virginia Tech's Research Projects

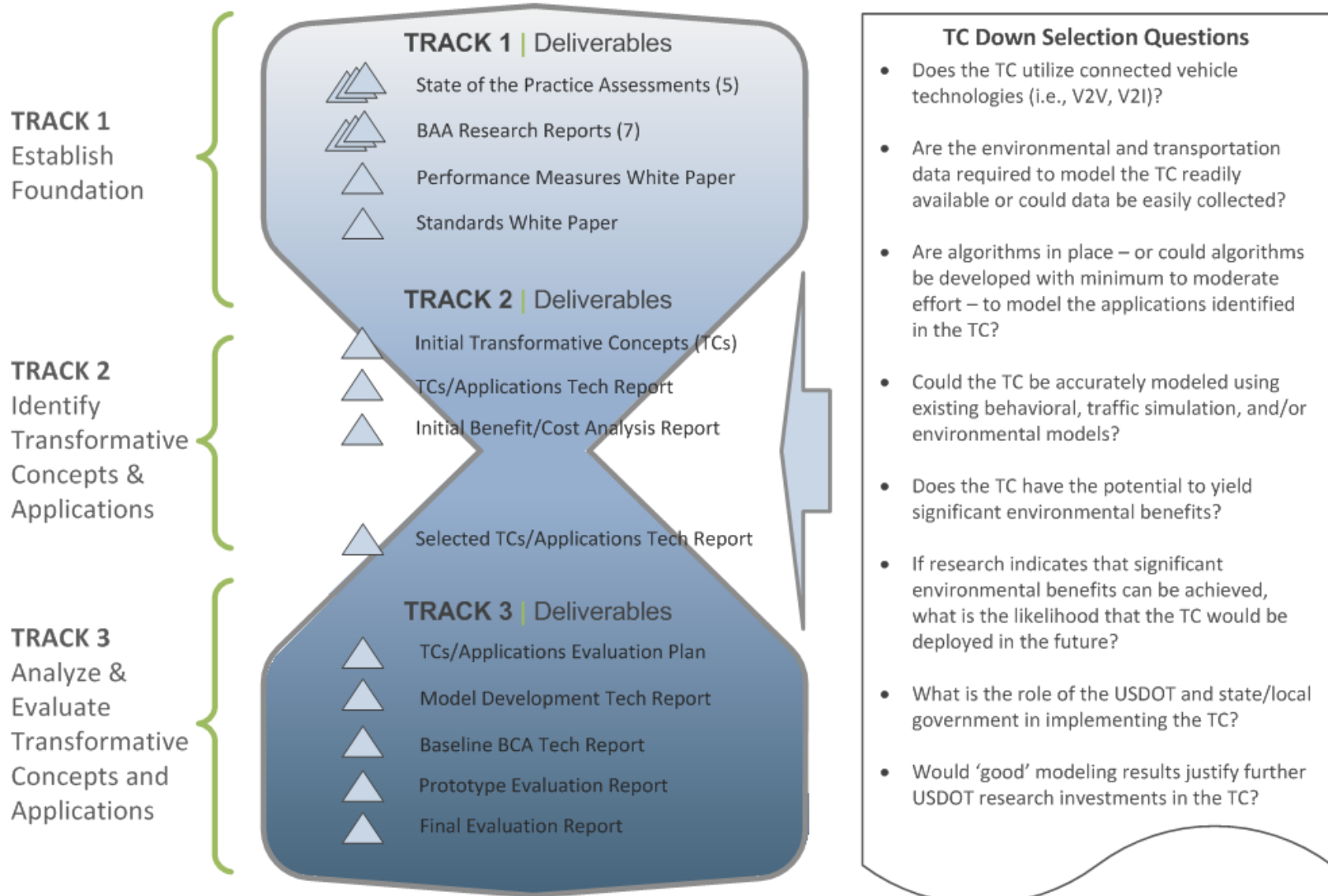
- Developed an algorithm for adjustments in vehicle speed as the vehicle approaches a "smart" intersection to achieve fuel efficiency.
- Developed a predictive eco-cruise control algorithm for optimum vehicle acceleration and deceleration controllers with car-following models.

▪ UCR's Eco-ITS Project

- Developed a method for estimating vehicle emissions in real-time using data from the vehicle's data bus in conjunction with the Comprehensive Modal Emissions Model (CMEM).



Next Steps



IMAGINE THE FUTURE – AERIS TRANSFORMATIVE CONCEPTS

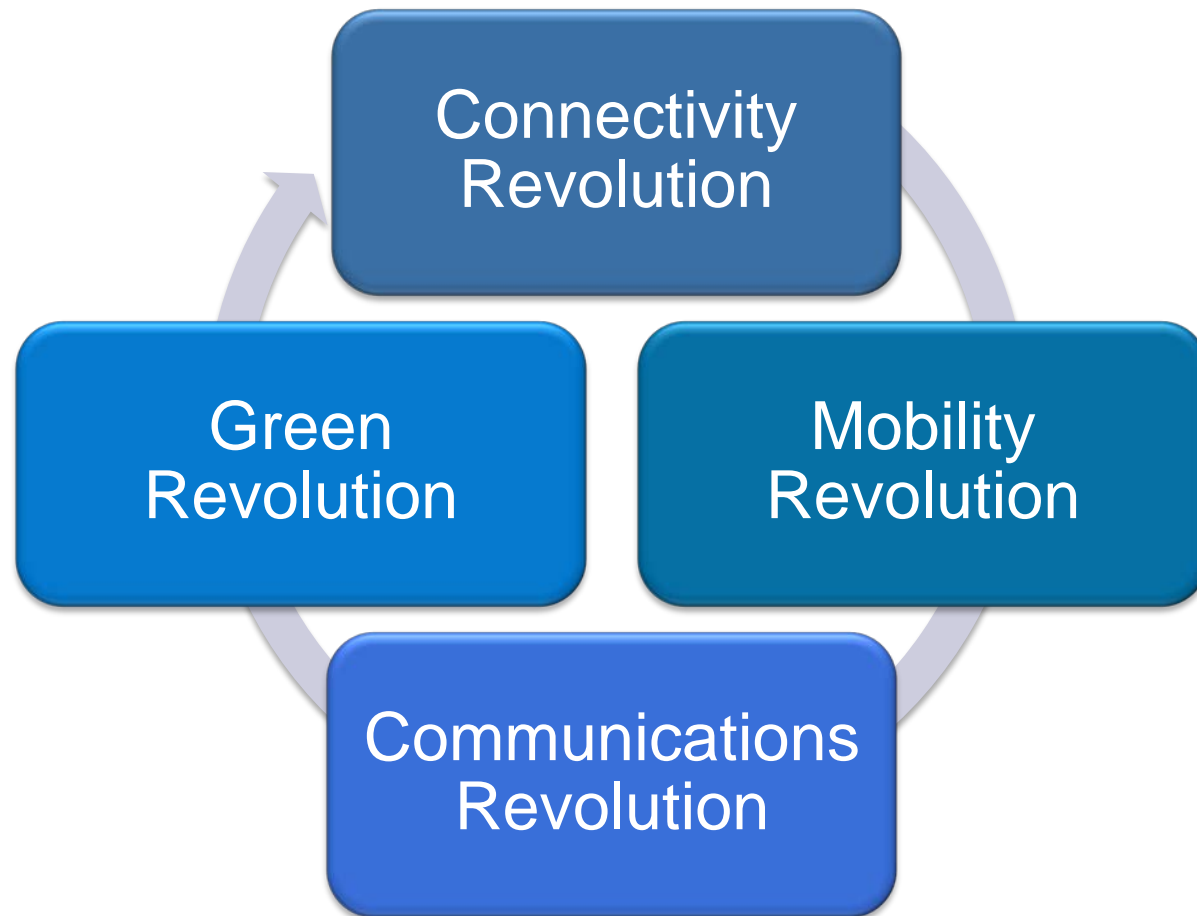
(MARCIA PINCUS)



Revolution and Evolution: “Society 2.0”

- Intelligent
- Integrated
- Networked
- Connected

EVOLUTION:
Meet the needs of
“**Society 2.0**” with the
“**City 2.0**”



Connectivity is a future societal imperative



What Does This Have to Do With Us?

“Now is the time for all of us to be looking at vehicles on the road the same way we look at smartphones, laptops and tablets: as pieces of a much bigger network.”

- Bill Ford, Chairman, Ford Motor Company

- **Radically different mobility landscape** where pedestrian, bicycle, car, truck, and bus traffic will be woven into a **single connected network** to save time, improve safety, and reduce emissions
- A true network of mobility solutions with personal vehicle ownership augmented/complimented by **use of connected and shared services**, with **new business models and public/private partnerships** contributing to improved individual and network mobility.
- **Vehicle to cloud, vehicle to vehicle, and vehicle to infrastructure**



Source: Ted Prize

<http://www.tedprize.org/announcing-the-2012-ted-prize-winner>



The “City 2.0”



The Evolution of the Car: A Connected Vehicle

(a networked computer on wheels)

Data Sent from the Vehicle

Real-time location, speed, acceleration, emissions, fuel consumption, and vehicle diagnostics data



Data Provided to the Vehicle

Real-time traffic information, safety messages, traffic signal messages, eco-speed limits, eco-routes, parking information, etc.

Improved Powertrain

More fuel efficient powertrain including; hybrids, electric vehicles, and other alternative power sources



Transportation Data's Role in the "City 2.0"

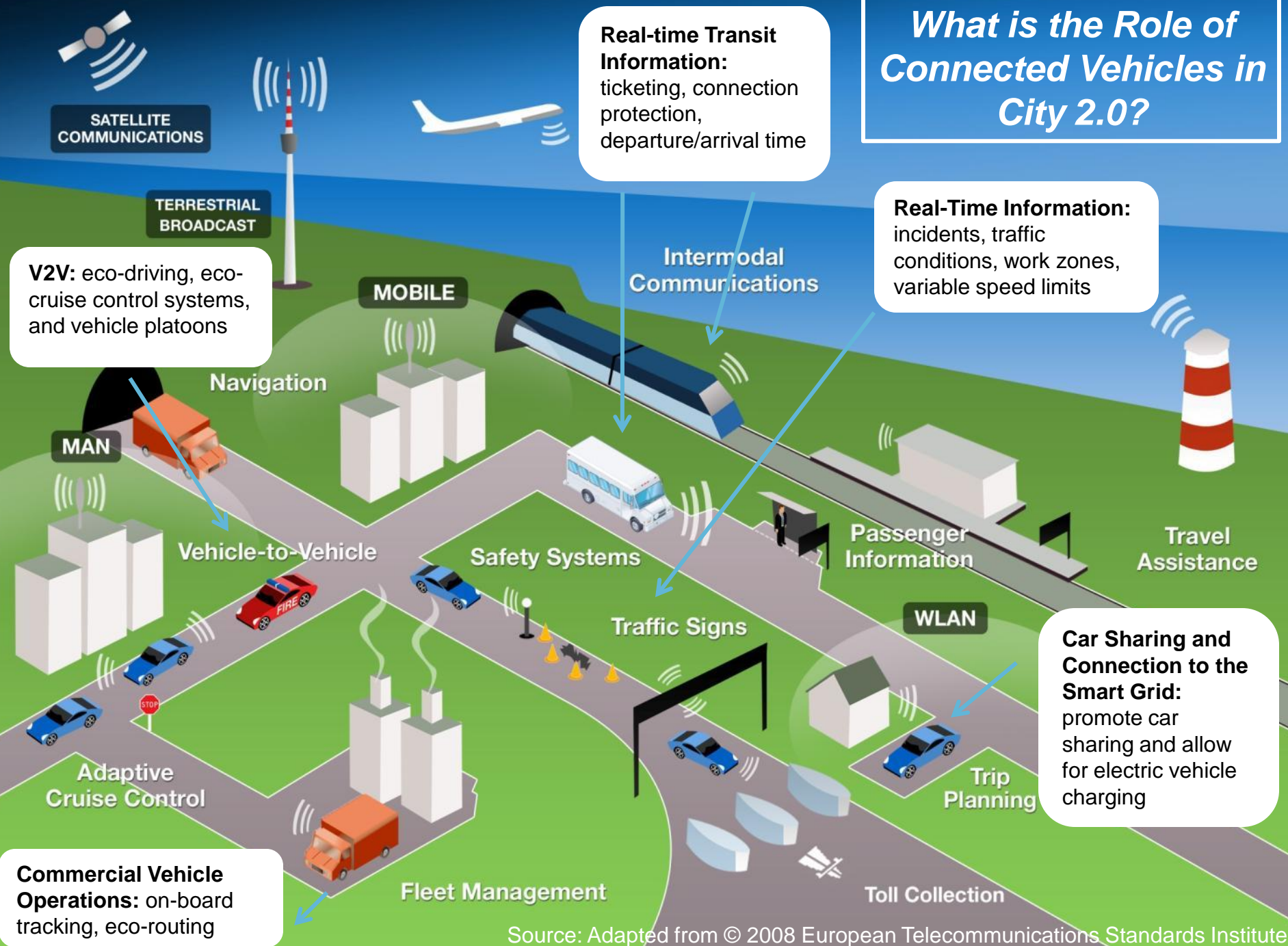
- The future of transportation is door-to-door mobility for people and goods
 - Integration and convergence – information technology industry/smartphones/vehicles
 - Sustainability is key to "City 2.0" – safety, mobility and environment converge to allow people and organizations (public and private sector) to make better decisions.
- It all begins with **data**.
- Different types of data need to be connected to make smarter transportation decisions.
 - Traffic / Transit
 - Public Safety / Security
 - Weather / Air Quality
 - Public Works and the Smart Grid
 - Social Media
- Access to data, management of data, integration of data ("mobility internet"??)



*"Mission Control, Built for Cities:
I.B.M. Takes 'Smarter Cities' Concept to Rio de
Janeiro,"
New York Times, Sunday, March 3, 2012*



What is the Role of Connected Vehicles in City 2.0?

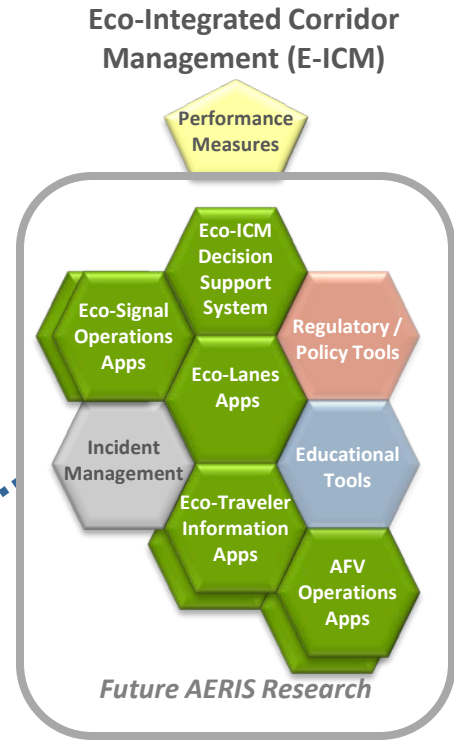
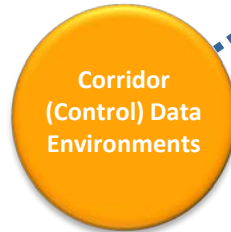
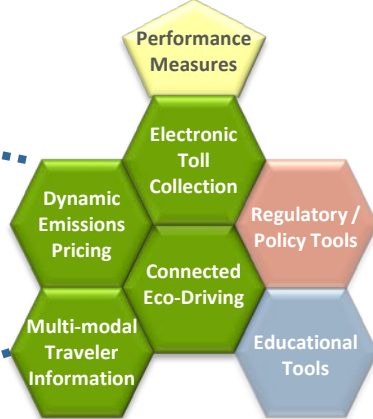
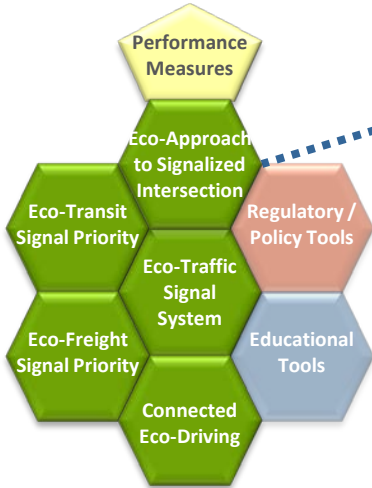
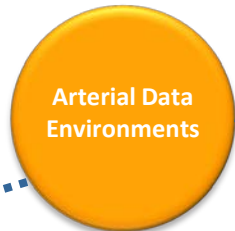


Source: Adapted from © 2008 European Telecommunications Standards Institute

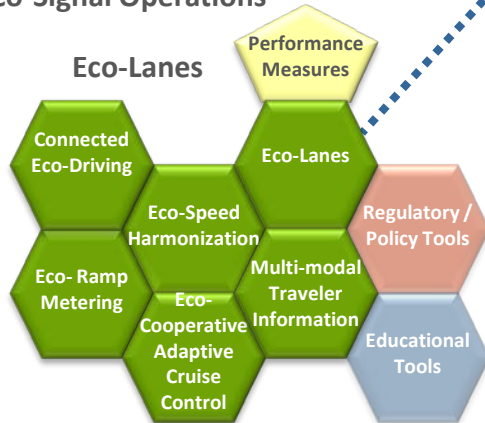


AERIS TRANSFORMATIVE CONCEPTS

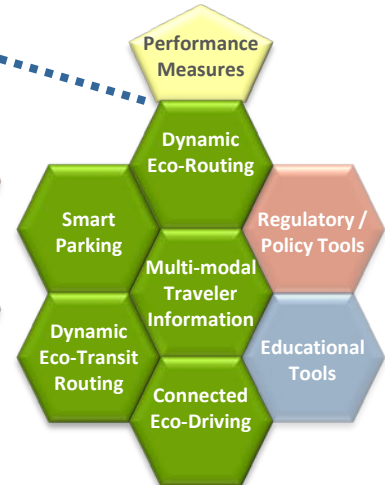
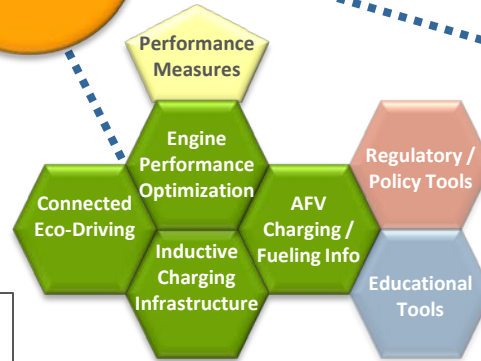
Cleaner Air Through Smarter Transportation



Eco-Signal Operations



Eco-Traveler Information



Support Alternative Fuel Vehicle Operations

LEGEND



AERIS Application



Performance Measures



Applications Supported with AERIS Data (R&D by Others)



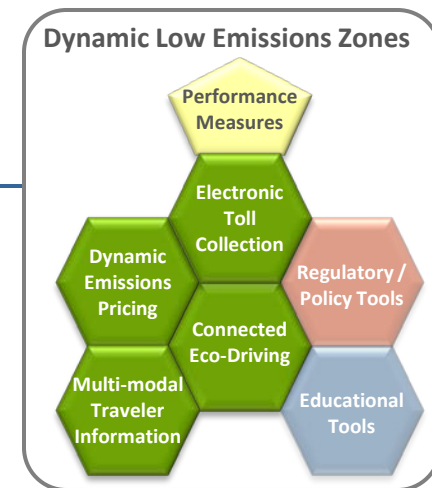
Regulatory / Policy Tool



Educational Tool

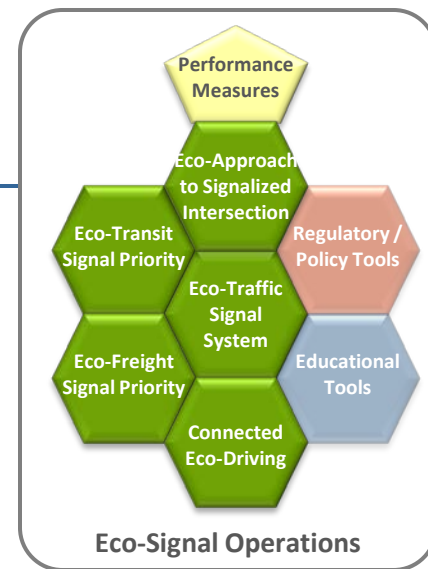
Dynamic Low Emissions Zones

- **Similar to today's ITS:** cordons with fixed infrastructure (e.g., London's Congestion Pricing)
- **Imagine tomorrow's connected vehicle:**
 - Connected vehicle technology allowing for Low Emissions Zones that can be:
 - Scalable and moveable (e.g., pop-up for a day, removable, flexible)
 - Not dependent on conventional ITS infrastructure
 - Dynamic based on real-time vehicle emissions data collected from vehicles and other sources
 - Dynamic Low Emissions Zones that provide incentives to drivers who practice "eco-driving" within the Low Emissions Zone.
 - Dynamic Low Emissions Zones that encourage "green" transportation choices, including transit options and freight operations.



Eco-Signal Operations

- **Similar to today's ITS:** adaptive traffic signal systems and traffic signal priority applications
- **Imagine tomorrow's connected vehicle:**
 - Broadcasting signal phase and timing (SPaT) data to vehicles where in-vehicle systems perform calculations to provide speed advice to the driver of the vehicle, to reduce queuing, starts, stops, idling, and to support speed management.
 - Adaptive traffic signal systems optimized for the environment using data collected from vehicles, such as vehicle location, speed, GHG and other emissions data using connected vehicle technologies.
 - Inductive charging infrastructure located at the stop bar enabling electric vehicles to charge while stopped at a traffic light.
 - Transit signal priority based on emissions, transit vehicle occupancy, and schedule adherence.

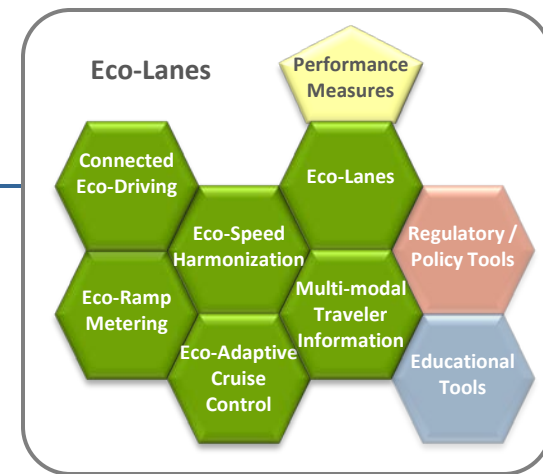


Eco-Lanes

- **Similar to today's ITS:** high occupancy vehicle (HOV) lanes

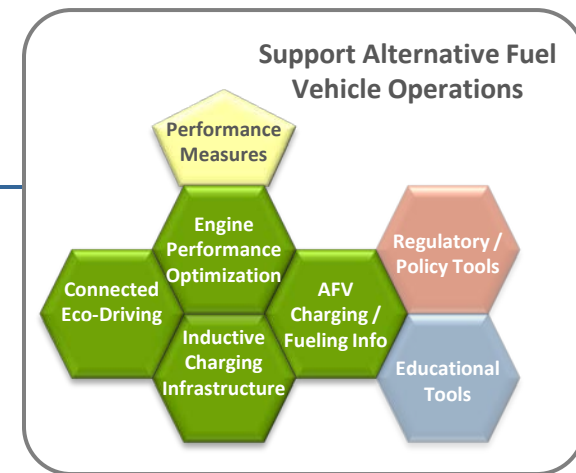
- **Imagine tomorrow's connected vehicle:**

- Dedicated eco-lanes on freeways optimized for the environment that encourage use by low emission, high occupancy, freight, transit, and alternative fuel or regular vehicles operating in eco-friendly ways.
- Speed optimized for the environment based on data collected from vehicles. Eco-speeds would be implemented to help to reduce unnecessary vehicle stops and starts by maintaining consistent speeds, thus reducing GHG and other emissions.
- Cooperative eco-adaptive cruise control applications where individual drivers may elect to opt-into applications that provide cruise control capabilities designed to minimize vehicle accelerations and decelerations for the benefit of reducing fuel consumption and vehicle emissions.
- Inductive charging infrastructure that charges electric vehicles moving at highway speeds.



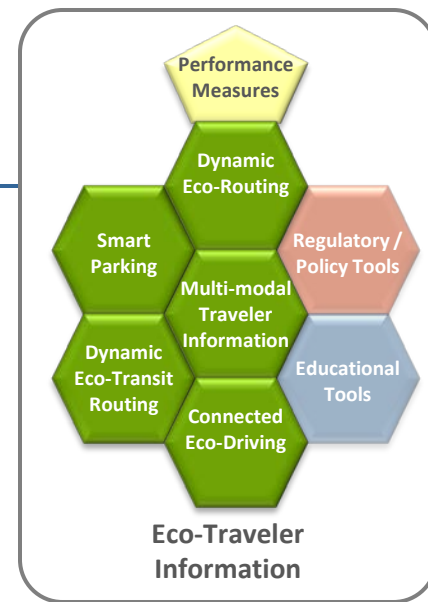
Support Alternative Fuel Vehicle Operations

- **Similar to today's ITS:** hybrid vehicle engine optimization
- **Imagine tomorrow's connected vehicle:**
 - Applications that enhance engine performance in real-time based on vehicle, weather and external factors. This includes an AFV:
 - Switching power sources as it approaches an Eco-Lane or Low Emissions Zone
 - Turning off its engine as it waits at a red light at a traffic signal upon communication from a traffic signal
 - Applications that provide users with information about the locations of charging/fueling stations and allow users to make reservations from their vehicles considering traffic conditions and distance to the station.
 - Infrastructure that enables inductive charging of electric vehicles including cars, trucks, and buses. This infrastructure would support:
 - Static charging capable of transferring electric power to a vehicle parked in a garage or on the street and vehicles stopped at a traffic light
 - Charging vehicles moving at highway speeds



Eco-Traveler Information

- **Similar to today's ITS:** 511 and traveler information websites, navigation systems, and traffic related phone applications
- **Imagine tomorrow's connected vehicle:**
 - Applications that provide instantaneous feedback to drivers on their driving behavior to encourage drivers to drive in a more environmentally efficient manner.
 - Dynamic Eco-Routing that uses real-time data collected from vehicles to provide drivers with the eco-route. Special cases may also apply to transit and freight.
 - Multimodal Real-Time Traveler Information – applications that convey real-time pre-trip and en-route information to encourage green choices.
 - Smart Parking applications targeted at providing real-time parking information to reduce unnecessary emissions and fuel consumption searching for a parking space.
 - New paradigms for car sharing and car ownership.



Eco-ICM



- **Similar to today's ITS:** Integrated Corridor Management for mobility
- **Imagine tomorrow's connected vehicle:**
 - Partners from various transportation modes working together to achieve the maximum environmental benefit transportation system.
 - A Code Red Air Quality Day where an imaginary "switch" is flipped that maximizes operations within an entire corridor or region to achieve a maximum environmental benefit on that day.
 - Traffic signals could be optimized to reduce emissions
 - Speed limits on the highways could be changed to eco-speed limits
 - Fare structures could be changed to encourage transit usage, even transit fares could be changed
 - Low Emissions Zones could pop up
 - More lane conversions to eco-lanes



City 2.0 Questions

General

- What is your vision for a sustainable city of the future (“City 2.0”) that incorporates the connected vehicle paradigm?
- What transportation-oriented information infrastructure do you expect to be in place in 2020? 2030? Who do you think will provide transportation-oriented information infrastructure and why?
- How do you expect private firms will partner with public agencies in future traffic management?
- How do you expect the shape and density of urban areas to evolve?
 - What role will transportation technology play in that evolution?
 - What about non-transportation IT, what role do you think it will play?
- What types of vehicles will become more or less predominant in cities of the future and why? What kinds of connectivity will they offer?
- What assumptions are you making about the future?
- What are the priority research questions to enable a connected vehicle future for the environment?



BREAK





ROUNDTABLE DISCUSSION #1: “CITY 2.0”

(SUBJECT MATTER EXPERTS AND AUDIENCE)



City 2.0 Questions

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AERIS Data Needs

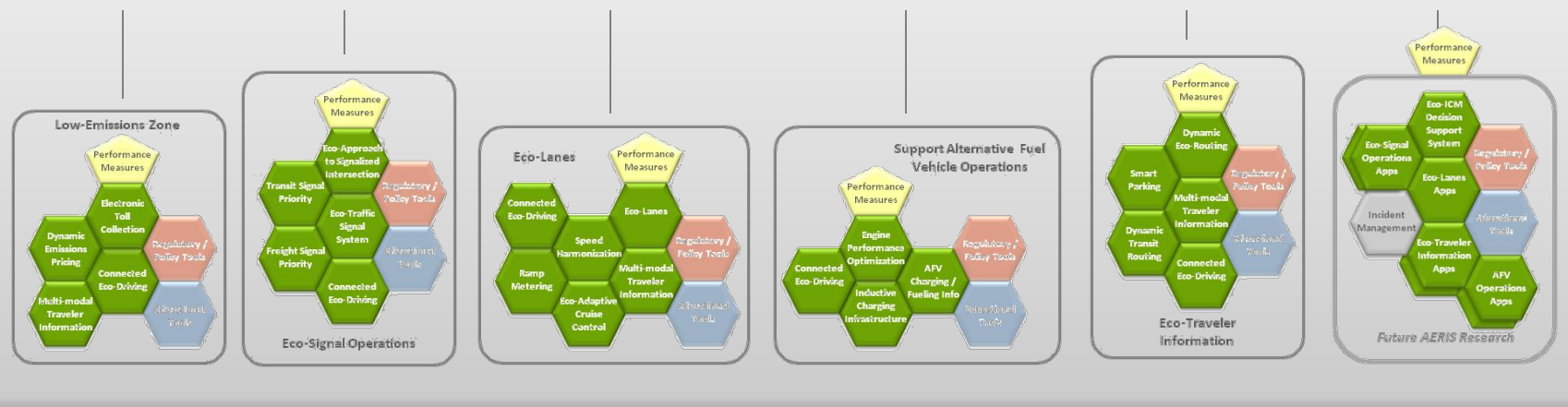
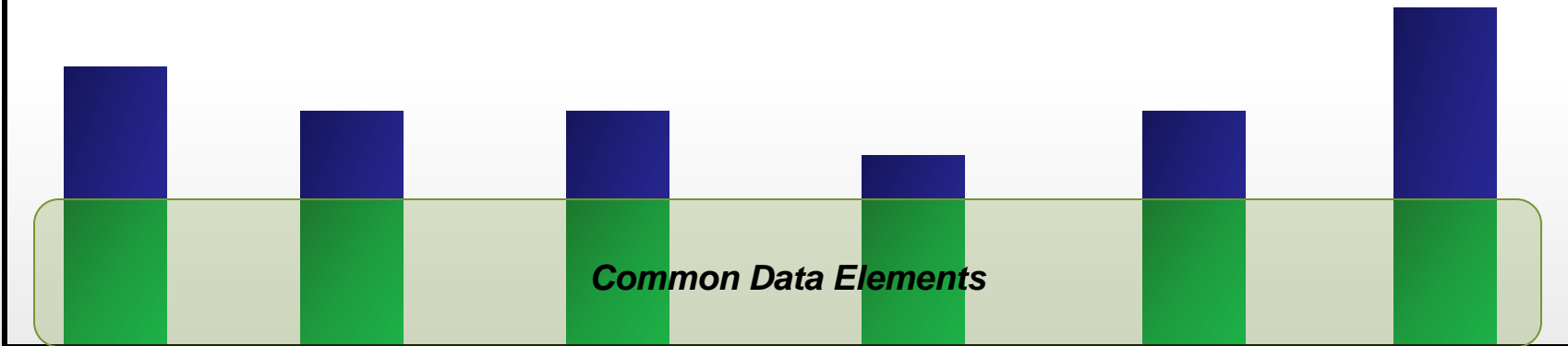
- To make the AERIS Transformative Concepts happen, various types of **data** need to be transmitted among:
 - Vehicles of all types
 - Vehicles and roadway infrastructure
 - Vehicles, infrastructure, and wireless consumer devices
- At each step of a transformative concept there are data being exchanged between actors.

- **Who are the actors?**
- **What are they doing?**
- **What information is being exchanged?**
- **How is it being exchanged?**



Data Elements for the AERIS Transformative Concepts

Number of Data Elements

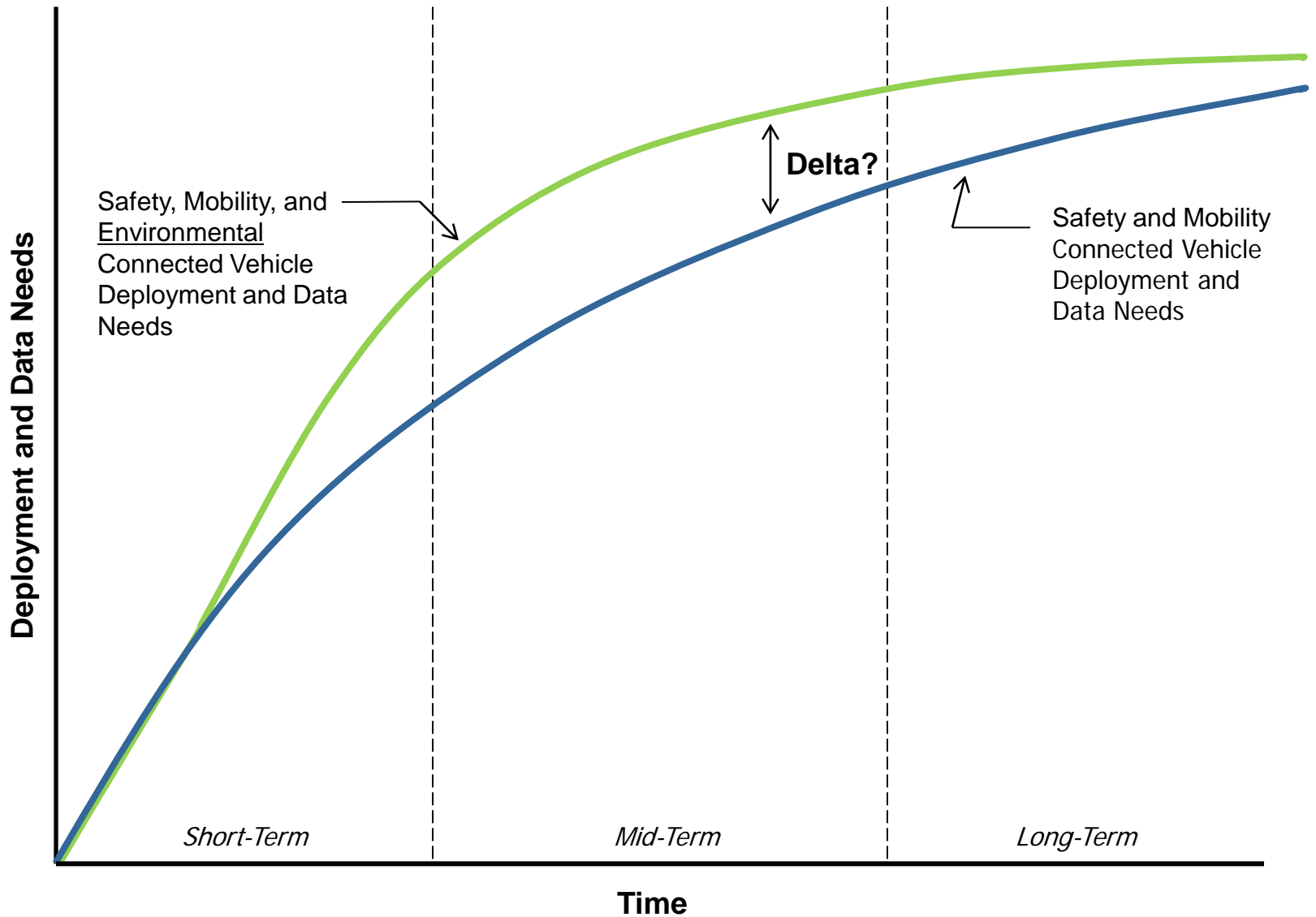


Are there common data elements that will enable these Transformative Concepts to work at a basic level?

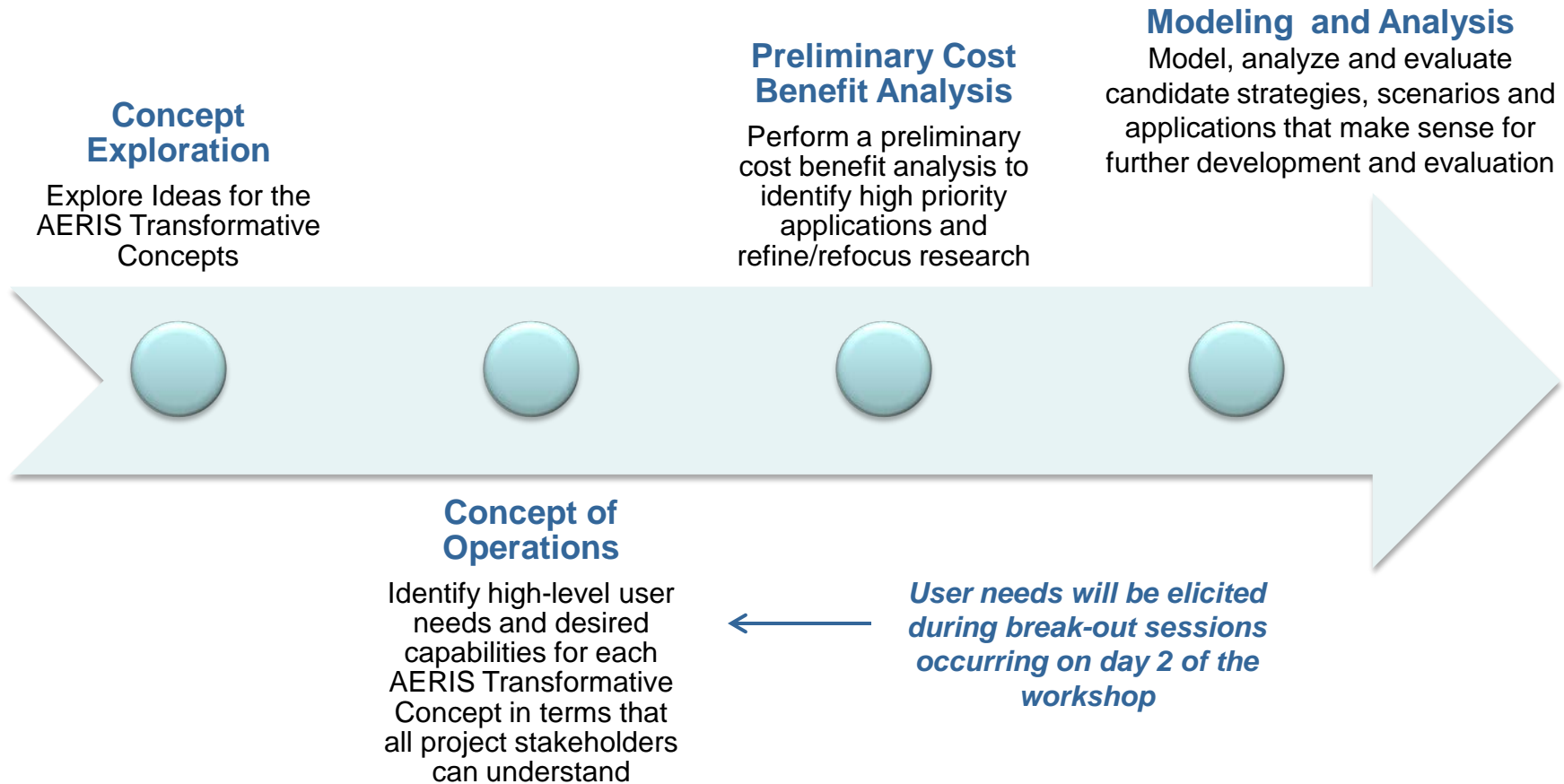
Is there a need for a Basic Environmental Message (BEM)?



ENVIRONMENTAL NEEDS COMPARED WITH SAFETY AND MOBILITY



The AERIS Approach



LUNCH



SAE J2735 MESSAGE SETS

(RICK GLASSCO)



SAE J2735 Overview

- Society of Automobile Engineers (SAE) J2735
 - The purpose of the standard is to support interoperability between vehicles and roadside devices through the use of standardized message sets, data frames and data elements.
 - The standard supports transferring information between vehicles and roadside devices as well as between vehicles themselves.
 - Provides the foundation for a variety of applications including vehicle safety, emergency vehicle notification, automated tolling, enhanced navigation, traffic management and many others.
 - The focus is on 5.9 GHz Dedicated Short Range Communication (DSRC), but message sets are not constrained to DSRC. It is designed (to the extent possible) to be deployable with other wireless technologies.

AERIS applications will use the SAE J2735 Standard for V2V and V2I Communication



SAE J2735 Overview

- The current version of the standard includes the following messages:

- A la Carte (ACM)
- Basic Safety Message (BSM)
- Common Safety Request (CSR)
- Emergency Vehicle Alert (EVA)
- Intersection Collision Avoidance (ICA)
- Map Data (MAP)
- NMEA Corrections (NMEA)
- Probe Data Management (PDM)
- Probe Vehicle Data (PVD)
- Road Side Alert (RSA)
- RTCM Corrections (RTCM)
- Signal Phase And Timing Message (SPAT)
- Signal Request Message (SRM)
- Signal Status Message (SSM)
- Traveler Information Message (TIM)

Focus of today's discussion, although other messages may be used to support AERIS Transformative Concepts

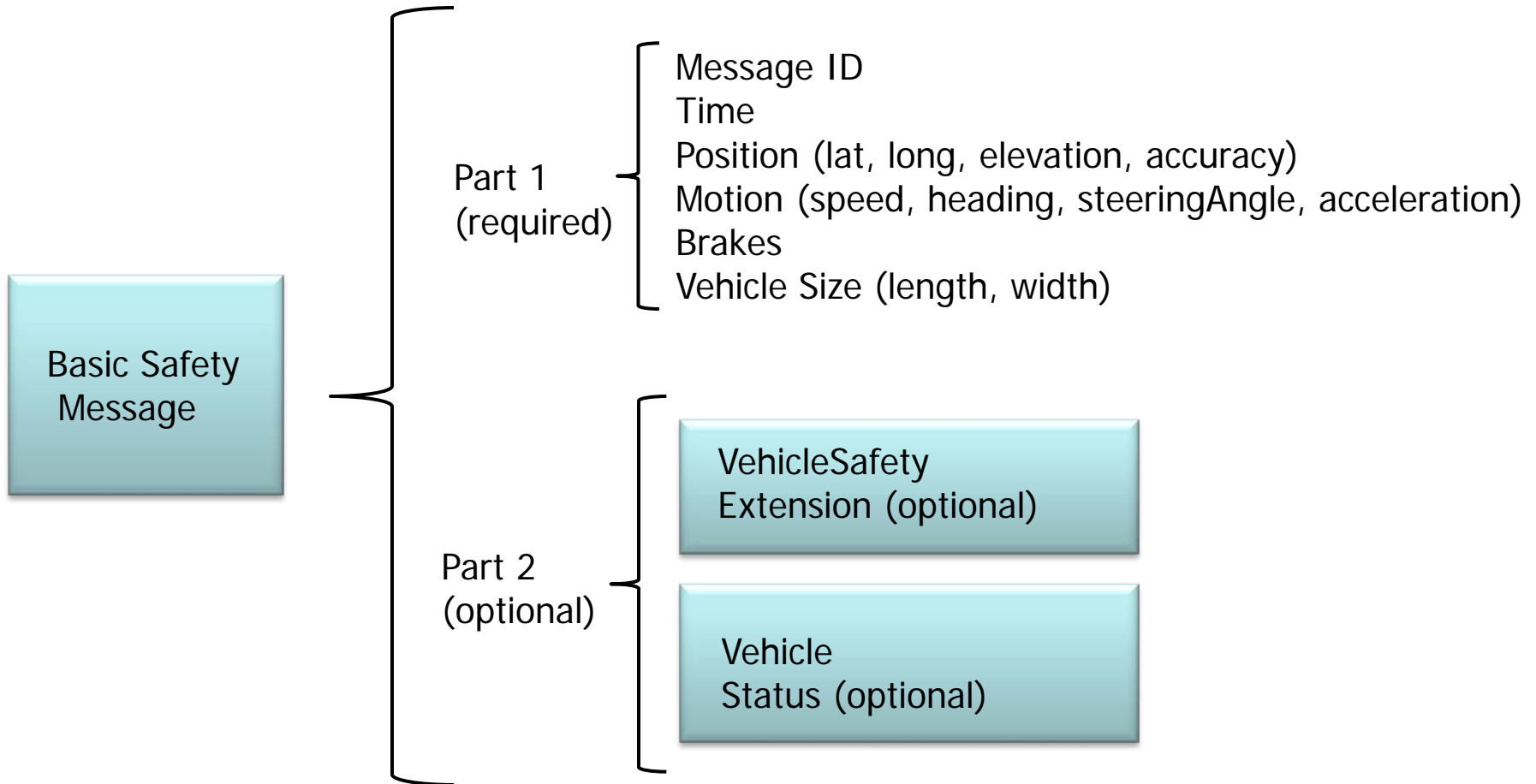


Basic Safety Message (BSM)

- Part of J2735 Standard
- The current version is 2nd Edition, published December 2009
- Basic Safety Message (BSM)
 - The message is broadcast at a rate of 10 times per second to surrounding vehicles
 - Part I data shall be included in every BSM
 - Part II data are optional for a given BSM and are included as needed



J2735 Basic Safety Message (BSM)



Components of Basic Safety Extension and Vehicle Status

Vehicle Safety Extension

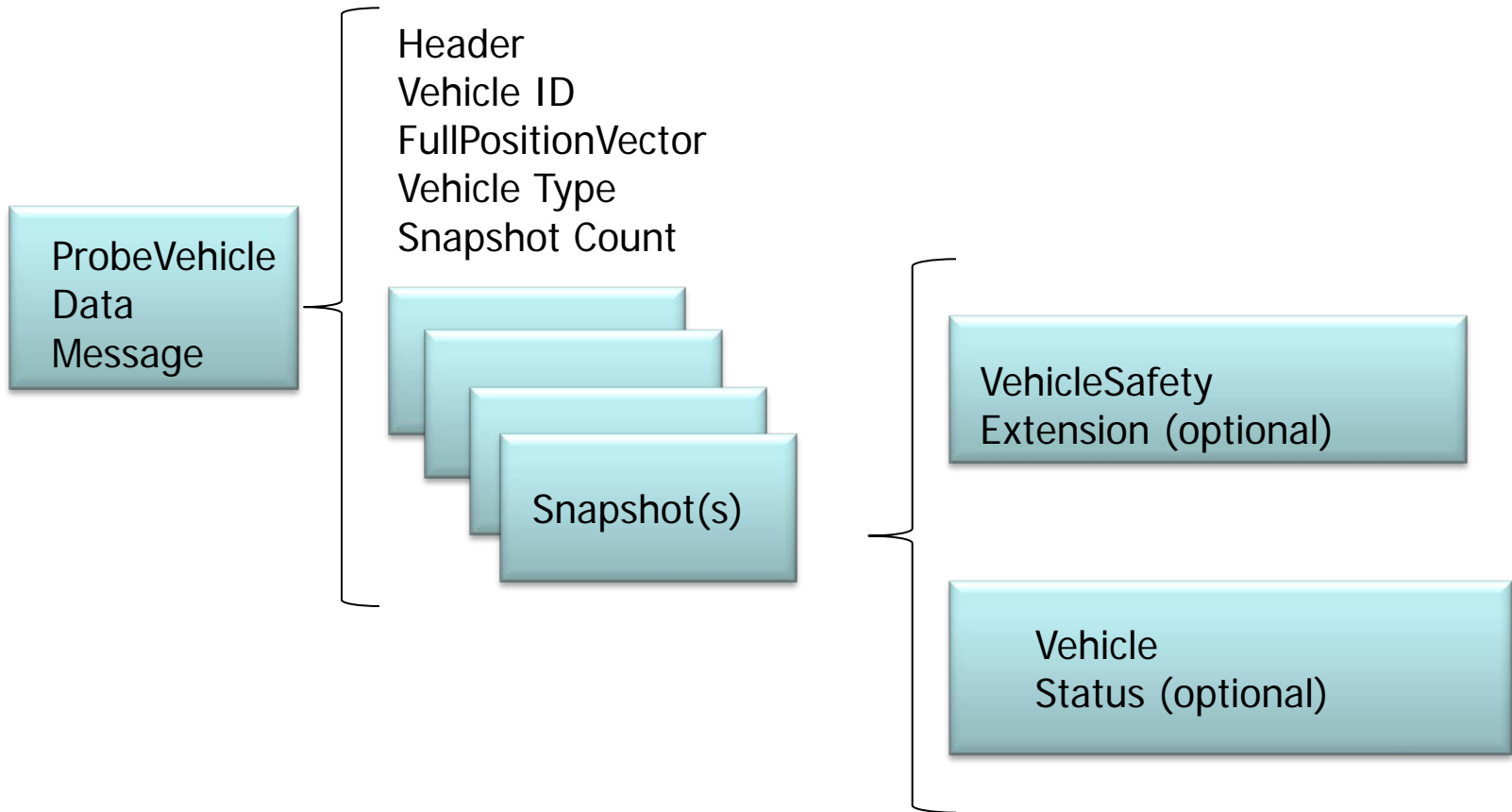
- Vehicle Events
- Vehicle Path History
- Vehicle Path Prediction
- Vehicle Relative Positioning

Vehicle Status

- Time, date
- Vehicle position (latitude, longitude, elevation)
- Vehicle motion (speed, heading, acceleration, etc.)
- Vehicle system status (brakes, lights, wipers, tire pressure, etc.)
- Vehicle safety system status (ABS, traction control, stability control, etc.)
- Sensor info (temperature, air pressure, rain, coefficient of friction, etc.)
- Confidence in these values



J2735 ProbeVehicleData Message



Safety Pilot Model Deployment Data

- The Safety Pilot Model Deployment will take place in Ann Arbor, MI August 2012 – August 2013.
- Vehicles participating in the Safety Pilot Model Deployment will send Basic Safety Messages (BSMs) defined by the current SAE J2735 standard.
- The Dynamic Mobility Applications (DMA) Program, the FHWA Road Weather Management Program (RWMP), and AERIS are interested in obtaining BSM data from the model deployment.
- The Data Capture Management (DCM) program intends to assemble, document and provide BSM data from the model deployment in support of mobility and environmental application research and development.
- DCM does **not** need to obtain the BSM data in real time. Archives of data from the test will be sufficient.



Role of Safety Pilot Data for Mobility and Environmental Research Efforts

- BSM data collected by the Safety Pilot have a role in supporting Mobility, Road Weather Management, and AERIS research.
 - Obtain a better understanding of fundamental vehicle data from a variety of vehicle platforms (light vehicles, trucks, transit)
 - Better characterize DSRC-related communications capabilities, both V2V and V2I
- Safety Pilot data will be a helpful addition for some applications, but cannot satisfy all research data needs for all non-safety programs.
 - The safety pilot experimental design is a safety-related test, not an environmental test, conducted in one specific location: Ann Arbor, MI
 - Mobility or environment-focused field tests and simulated data from coordinated experiments will provide the bulk of data needed for Mobility, Weather, and AERIS application development



J2735 Systems Engineering Project Overview

- The USDOT is in the process of undergoing a Systems Engineering Process to update the J2735 Standard.

- There is a need for:
 - A clear definition of the standard's scope
 - Definition of user needs and requirements mapped to data concepts, dialogs, messages, data frames and data elements
 - Traceability from needs through data concepts
 - Additional input from the transit and freight communities and other stakeholders

- The USDOT wants to:
 - Create a complete and correct standard, which includes creating a set of verifiable requirements.
 - Support International harmonization
 - Apply a structured approach and deliver a draft J2735 SE standard document to SAE as a “comment”

It is important for AERIS to provide input into the J2735 Standard to ensure environmental needs are captured in the standard.

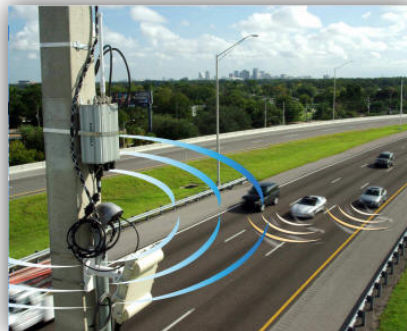
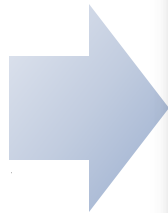


List of Additional AERIS Data Elements

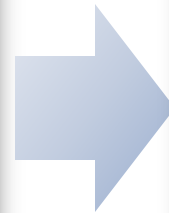
- Emissions data collected from the vehicle:
 - Current fuel consumption
 - Average fuel consumption
 - Current emissions
 - Average emissions



Emissions data collected from the vehicle



Roadside equipment (RSE) unit passes emissions data to TMC



TMC receives emissions data

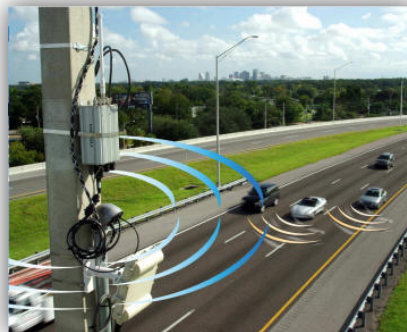
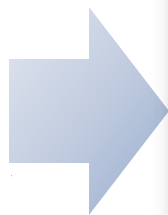


Initial List of AERIS Data Needs

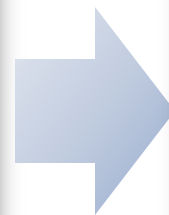
- Engine performance parameters that allow the infrastructure to compute these values, such as:
 - Vehicle type
 - Engine and fuel type
 - Second-by-second speed and acceleration
 - Accessory use (such as air conditioning)



Engine Performance
Parameters



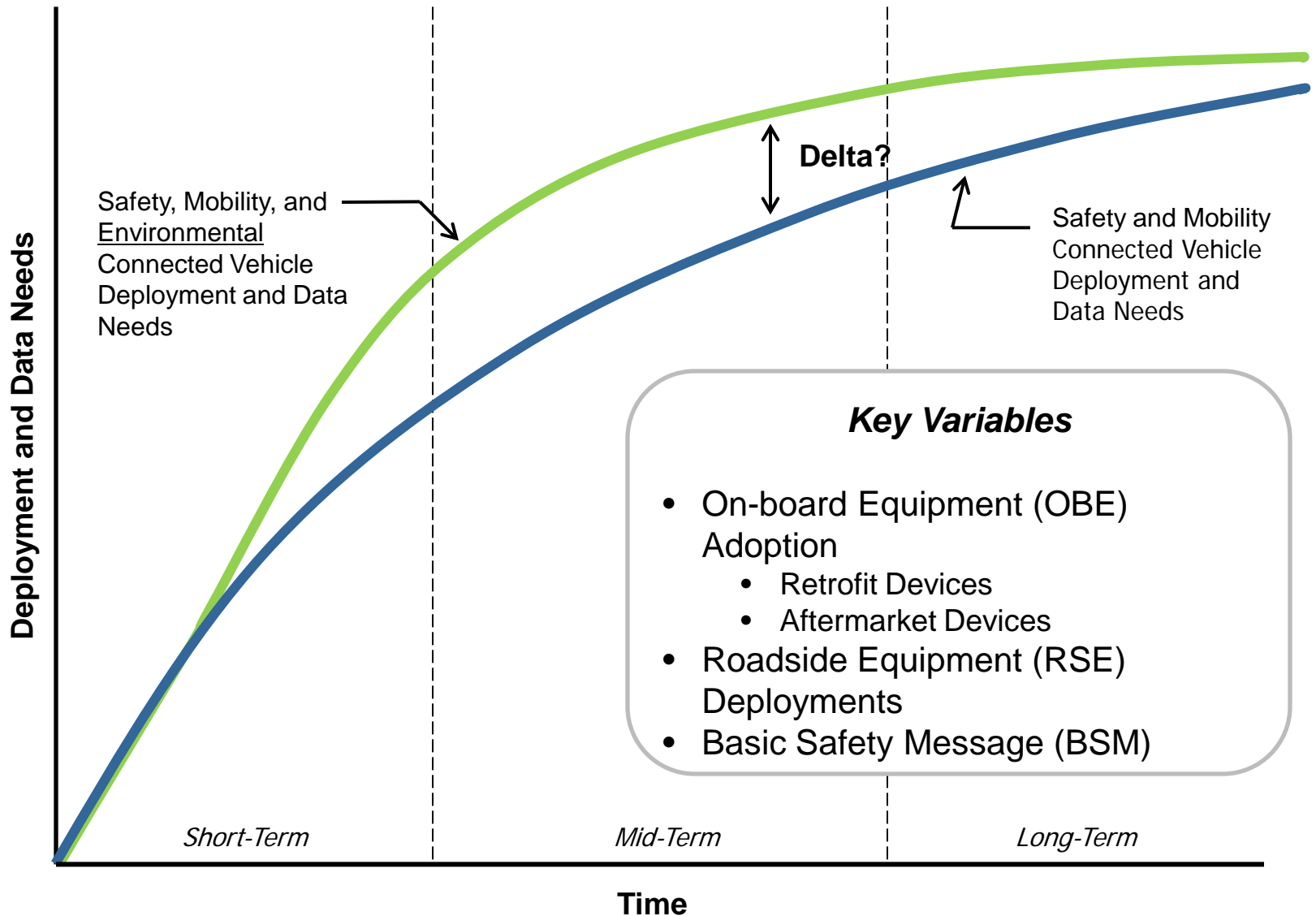
Roadside equipment
(RSE) unit passes
engine performance
parameters to TMC



Emissions data post
processed at TMC



ENVIRONMENTAL NEEDS COMPARED WITH SAFETY AND MOBILITY



Discussion Questions

- To what degree is a DSRC-based BSM Part 1 message critical to realizing benefits from AERIS Transformative Concepts?
- What key elements of BSM Part 2 might be needed?
- What (if anything) is missing from BSM Parts 1 and 2? Is there a need for a “Basic Environmental Message”?
- To what degree does transmission of BSM data elements over non-DSRC media support the AERIS Transformative Concepts?
- What role might a DSRC-based BSM play in enabling AERIS Transformative Concepts when combined with other data (vehicles, travelers, and fixed sensors) to enable applications?





ROUNDTABLE DISCUSSION #2

(SUBJECT MATTER EXPERTS AND AUDIENCE)



Data and Communication Needs Questions

- Is the concept of a Basic Environmental Message (BEM) a valid idea? If yes, what data elements should be in the BEM?
- How frequently should the BEM be sent or under what conditions?
- What data are you currently using to support your work? What additional data would you want in the future to support connected vehicle applications? Where do you expect to get this data from in the future?
- What if you couldn't get this data? How would you work around that?
- What are the communication requirements needed to support these applications?
- What are the opportunities for transit and freight? As their operational characteristics differ from passenger vehicles, how do we take these differences into account with respect to environmental benefits? Are there specific data needs for transit and freight?
- Where do you see convergences or divergences between mobility objectives and environmental objectives?



DAY 2 OVERVIEW AND CLOSING REMARKS

(MARCIA PINCUS)



The Charge for Tomorrow

- The purpose of tomorrow's workshop is to focus on "*Engineering the Future*"
 - Leverage what was discussed today and apply it to the AERIS Transformative Concepts
 - The AERIS Team will be eliciting input for the following AERIS Transformative Concepts:
 - Eco-Signal Operations
 - Eco-Lanes
 - Dynamic Low Emissions Zones
 - Input will be elicited through two rounds of Break-out Sessions

Review the Read-Ahead Materials and come prepared to discuss of the AERIS Transformative Concepts

<http://www.its.dot.gov/aeris/index.htm>





AERIS

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UNITED STATES
DEPARTMENT OF TRANSPORTATION

Applications for the Environment: Real-Time Information Synthesis (AERIS) Transformative Concepts Workshop: Day 2

Washington, D.C.

March 15, 2012



AERIS

"Cleaner Air Through Smarter Transportation"

WELCOME AND DAY 2 OVERVIEW

(MARCIA PINCUS)

The Charge for Today

- The purpose of today's workshop is to focus on "*Engineering the Future*"
 - Leverage what was discussed yesterday and apply it to the AERIS Transformative Concepts
 - The AERIS Team will be eliciting input for the following AERIS Transformative Concepts:
 - Eco-Signal Operations
 - Eco-Lanes
 - Dynamic Low Emissions Zones
 - Input will be elicited through two rounds of Break-out Sessions
 - The AERIS Team will document this input for incorporation into Draft Concept of Operations documents



How Are We Going to Do It?

- The objectives of today's breakout sessions are to begin thinking about the Transformative Concepts in more detail and to identify:
 - The actors as they pertain to the AERIS Transformative Concepts
 - The applications for which that actor is responsible
 - The interactions between actors at each step of the Transformative Concept
 - The type of information exchanged between actors

- The AERIS Team plans to take a systematic approach for developing details of the AERIS Transformative Concepts, beginning with the development of Concepts of Operations.



AERIS CONCEPTS OF OPERATIONS

(J.D. SCHNEEBERGER)



What is a System?

“A combination of interacting elements organized to achieve one or more stated purposes.”

-- International Council of Systems Engineering

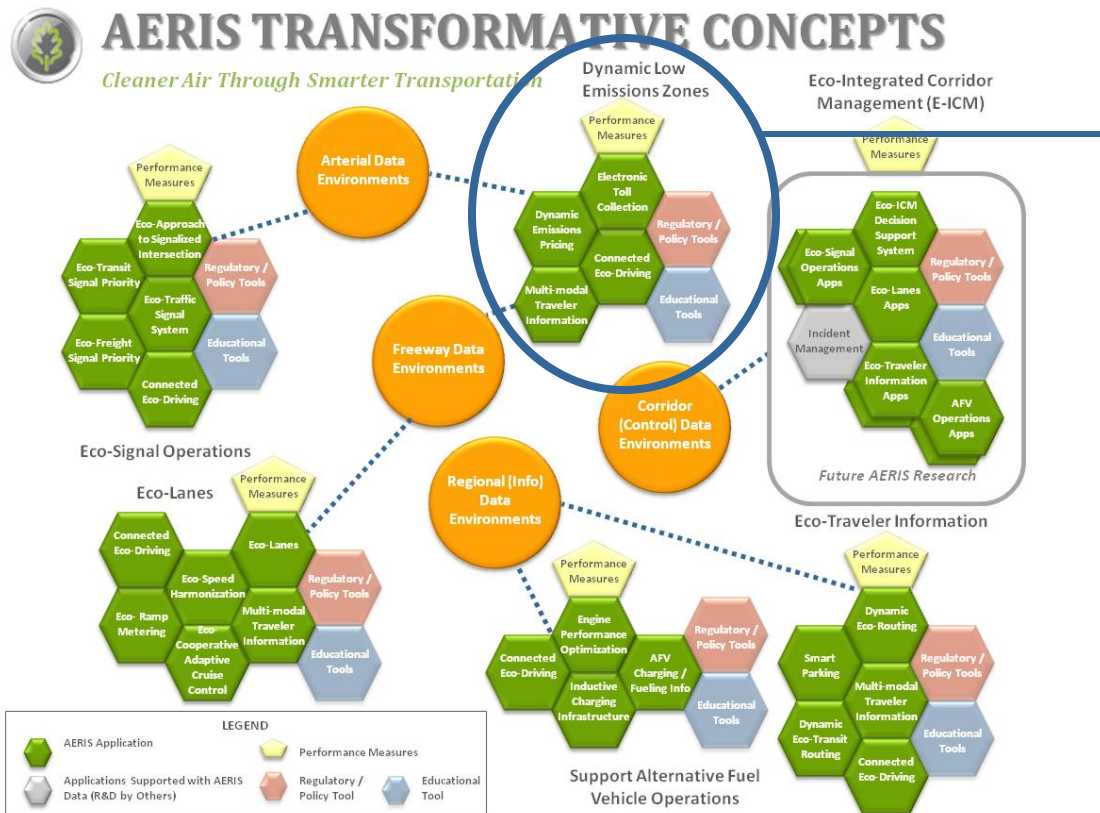
“An aggregation of end products and enabling products to achieve a given purpose.”

-- Electronics Industry Association EIA-632



A System for AERIS

- For the AERIS Program, think of a 'system' as a group of applications, or Transformative Concept.



The group of applications identified in the Dynamic Low Emissions Zones Transformative Concept are a 'system'



Concepts of Operations

- The AERIS Team will be developing Concepts of Operations for the following AERIS Transformative Concepts:

- *Eco-Signal Operations*
- *Eco-Lanes*
- *Dynamic Low Emissions Zones*

**We will be discussing these three
AERIS Transformative Concepts at
today's workshop**

- Eco-Traveler Information
 - Support for Alternative Fuel Vehicle (AFV) Operations
-
- The Concepts of Operations are intended to be a blueprint describing the Transformative Concepts so we can understand how they may work.

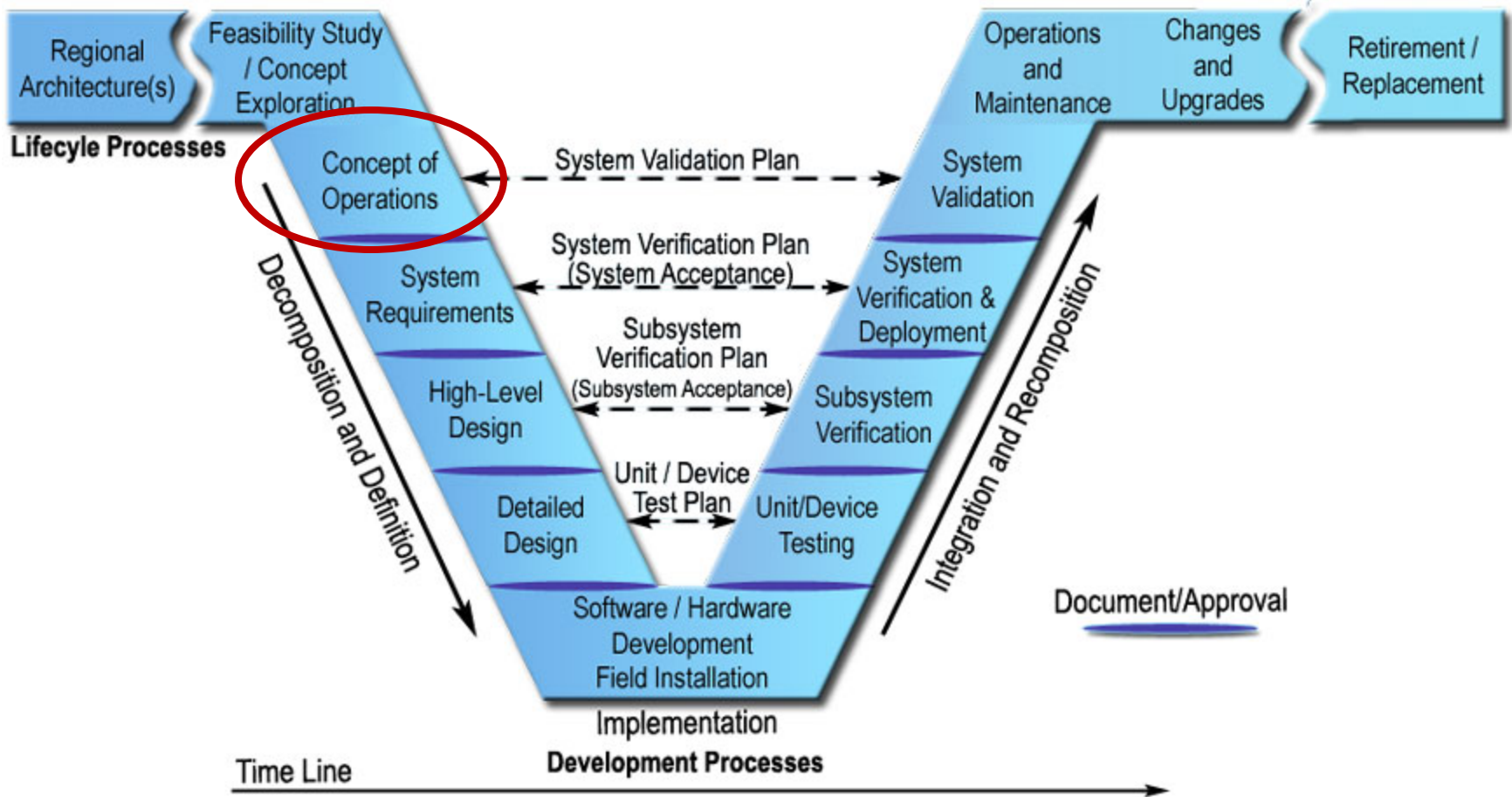


Concept of Operations

- The Concept of Operations provides a means for describing operational needs without becoming bogged down in detailed technical issues that will be defined later in the process.
- Its purpose is to clearly convey a high-level view of the system to be developed that each stakeholder can understand.
 - **Who** – Who are the stakeholders/actors involved with the system?
 - **What** – What are the elements and the high-level capabilities of the system?
 - **Where** – What is the geographic and physical extent of the system?
 - **When** – What is the sequence of activities that will be performed?
 - **Why** – What is the problem or opportunity addressed by the system?
 - **How** – How will the system be developed, operated, and maintained?

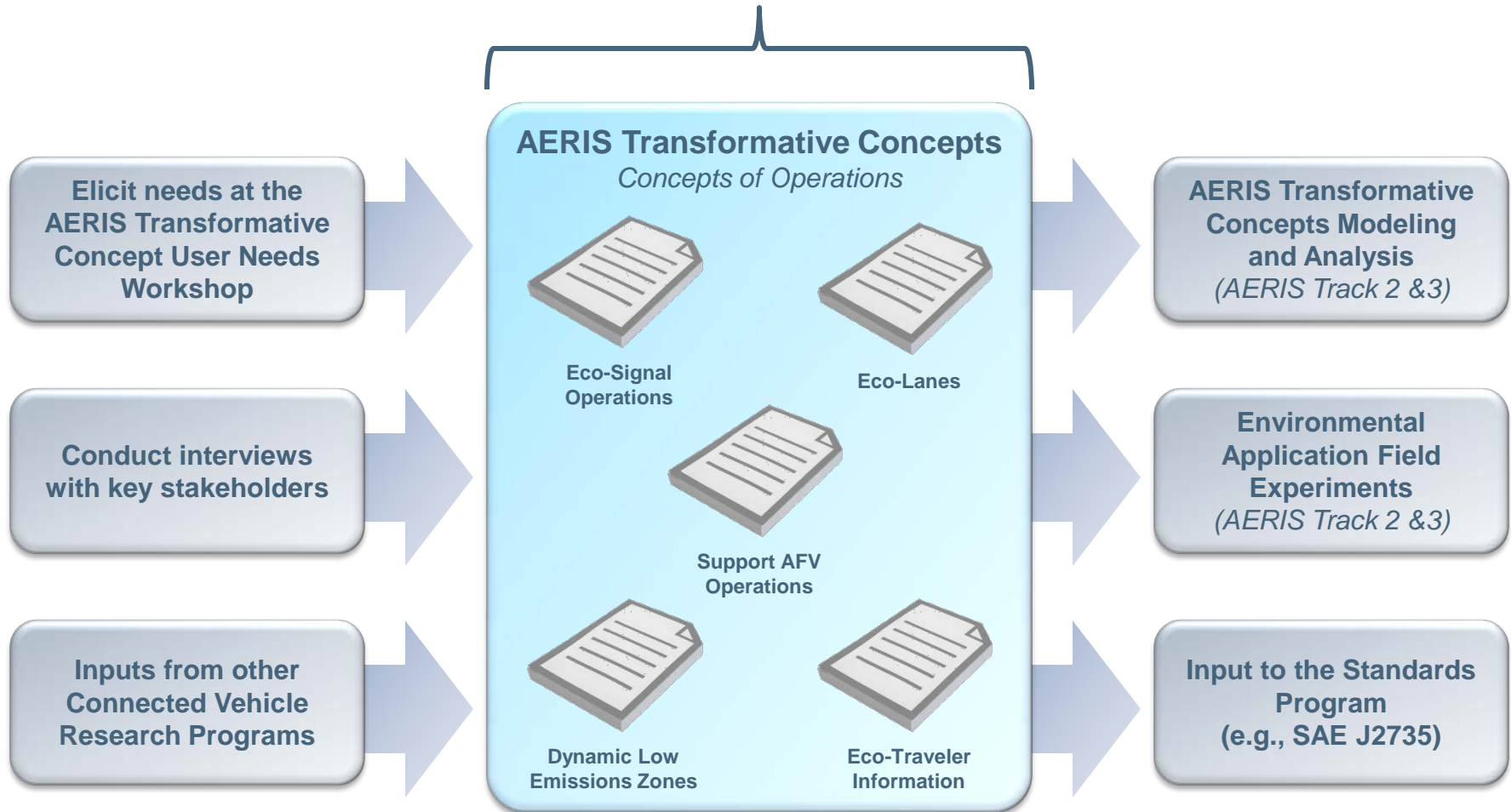


The Systems Engineering Life-Cycle Process



ConOps Role in the AERIS Program

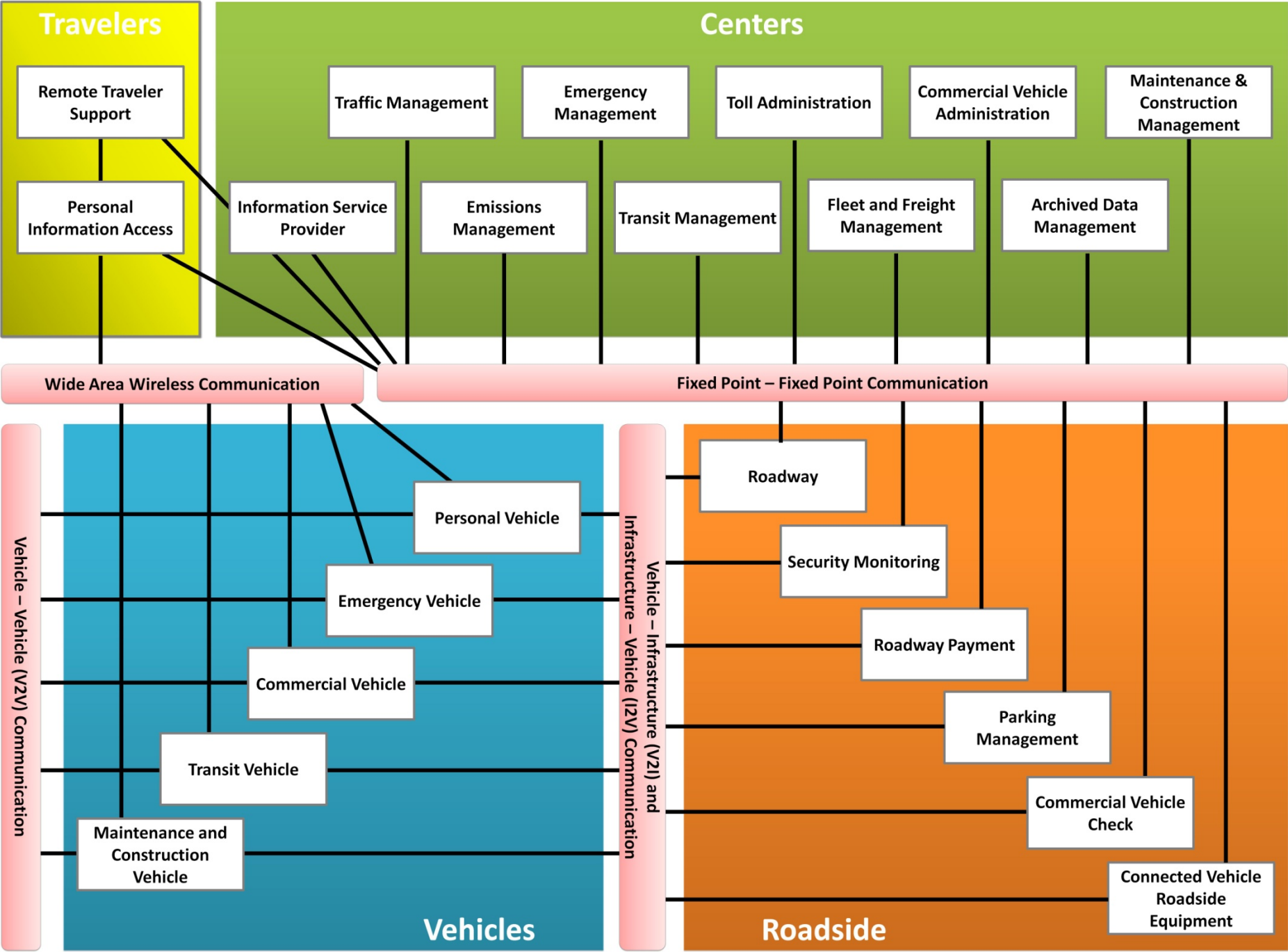
AERIS Baseline Assumptions



Who Are the Actors?

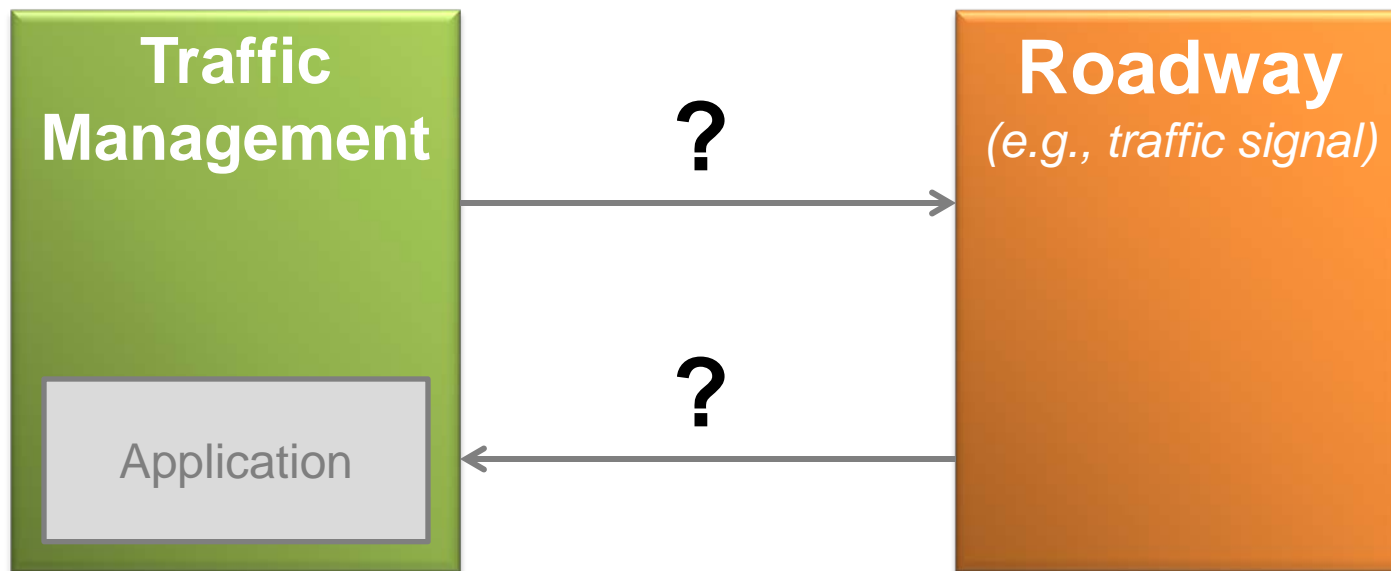
- An actor is a person, organization, or external system that plays a role in one or more interactions with your system.
 - Traffic Management Center (TMC)
 - Transit Operations Center
 - Vehicle
 - Connected Vehicle Roadside Equipment
- Actors may not necessarily represent a specific physical entity, but merely a particular facet (i.e., “role”) of some entity that is relevant to the specification of its associated use cases.
- A single physical entity may play the role of several different actors and, conversely, a given actor may be played by multiple different instances.





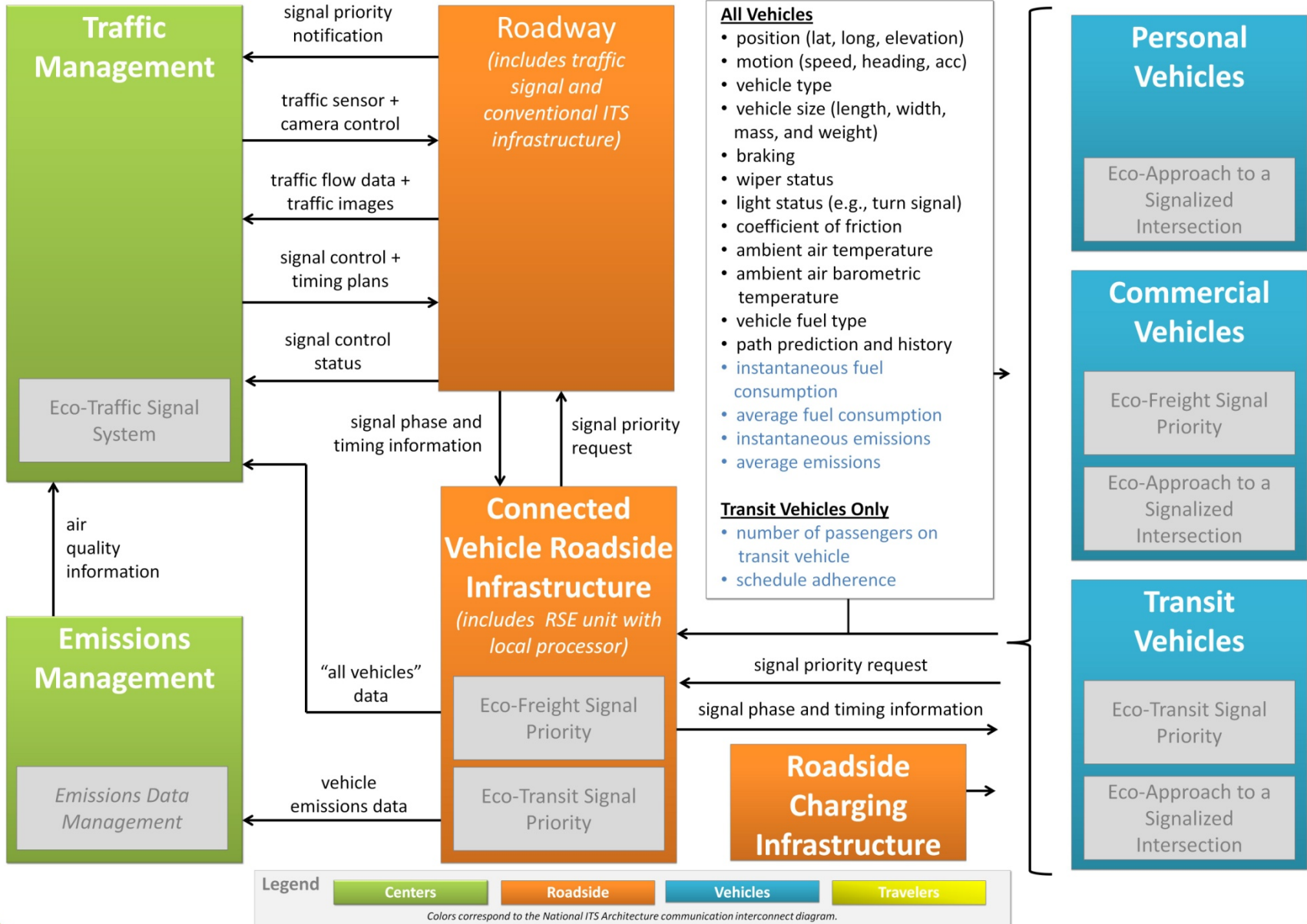
Interactions Between Actors

- We want to define the interactions between actors for each step of the AERIS Transformative Concept.
- What information needs to be exchanged between actors to enable environmental applications and AERIS Transformative Concepts?





AERIS TRANSFORMATIVE CONCEPTS | ECO-SIGNALS

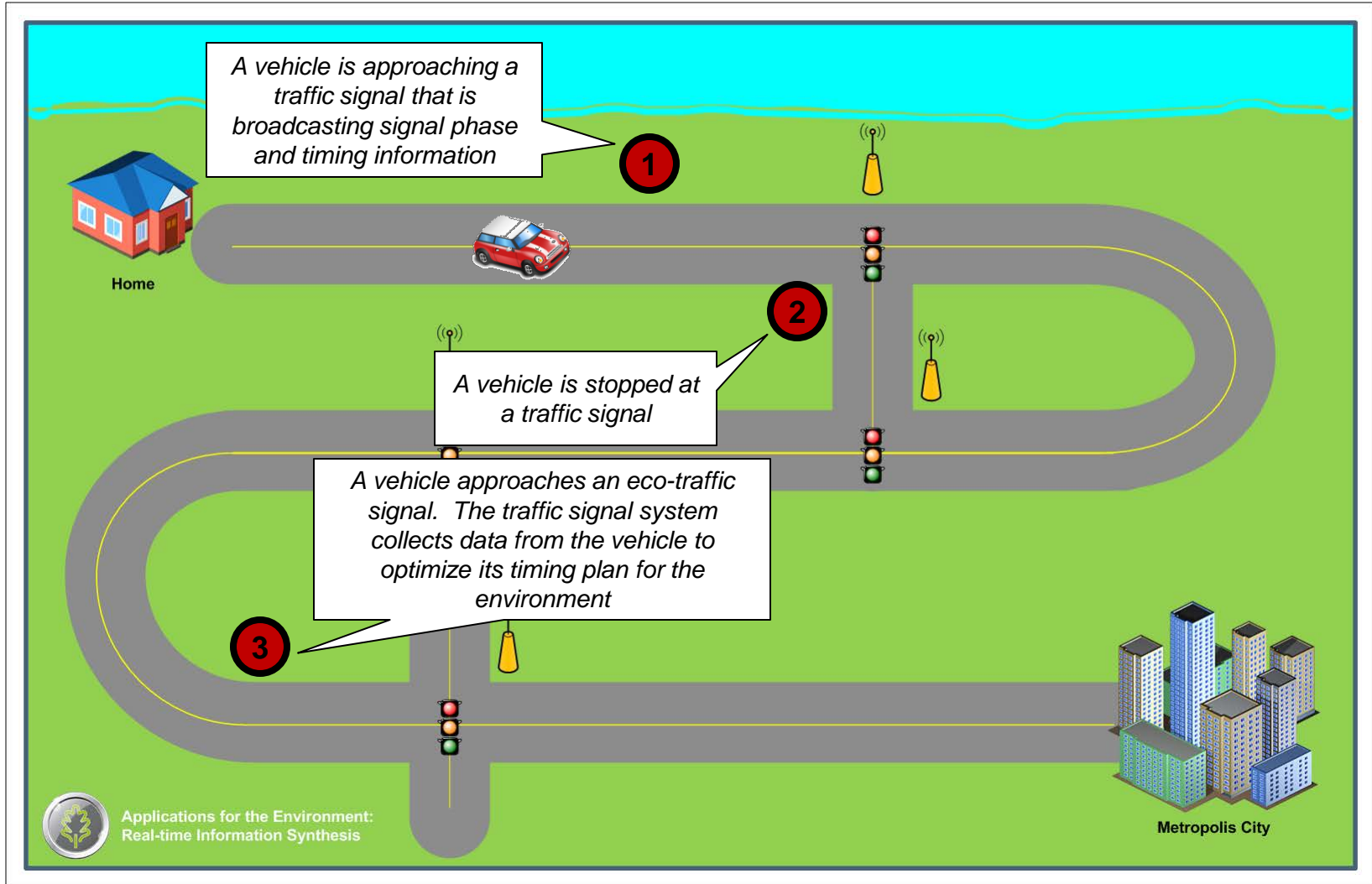


Today You Are Theatrical Agents

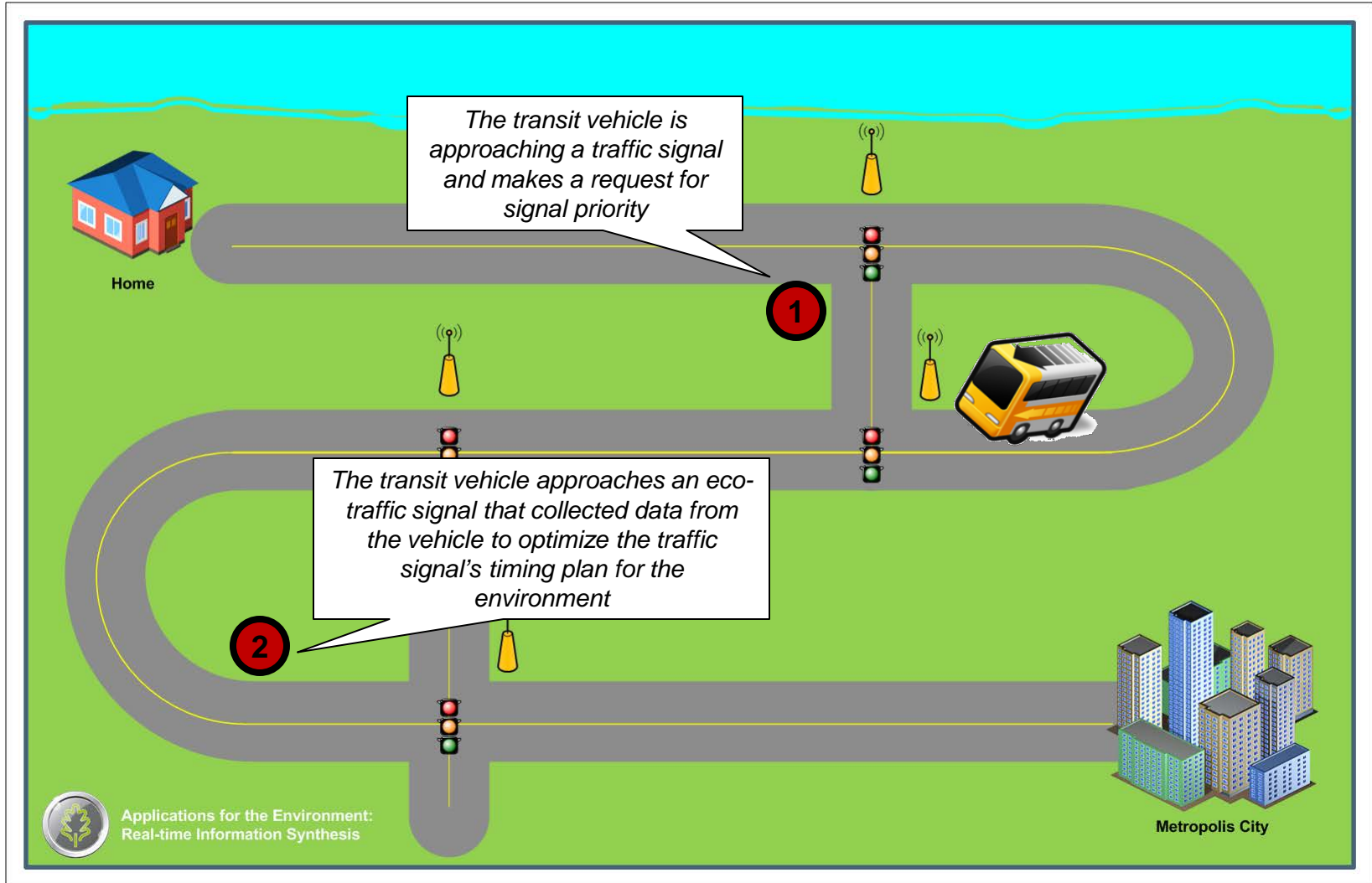
- Today we are asking you, the workshop participants, to provide input on behalf of the actors.
- Your inputs will be used to develop user needs for the Transformative Concepts.
- Feel free to wear many hats.



Eliciting User Needs Through Storyboards



Would Things Be Different for a Transit Vehicle?



Break-out Sessions

- Work in groups (led by group facilitators)
 - Transformative Concept Background Information – 25 minutes
 - Provide an overview of the AERIS Transformative Concept
 - Review the list of applications
 - Review the list of actors
 - Facilitated discussion to elicit stakeholder input – 50 minutes
 - Walk-through storyboards step-by-step and review information flow diagrams to discuss interactions between actors
 - Combine comments for debrief – 15 minutes
 - Debrief feedback to whole group – 15 minutes per group



Break-out Session Ground Rules

- The AERIS Team wants to promote an open, honest exchange of ideas among workshop participants.

- Break-out Session Ground Rules:
 - Speak openly and honestly
 - Listen carefully to what others have to say
 - Treat everyone, and their ideas, with respect
 - All input provided by stakeholders will be treated as anonymous
 - Input will be aggregated and synthesized
 - Where appropriate, input will be selectively excerpted *without attribution*
 - ‘Imagine’



Break-out Session #1

- Workshop participants will be divided among three (3) rooms to ensure that everyone has the opportunity to think creatively and constructively.

- The first round of Break-out Groups will facilitate discussion around the Eco-Signal Operations Transformative Concept.

- Break-out Session Rooms
 - Left side of the room: **Room 337A**
 - Right side of the room: **Room 338**



REPORTS FROM BREAK-OUT SESSION #1



BREAK-OUT SESSION #2 OVERVIEW



Break-out Session #2

- There will follow a similar process for Break-out Session #2.
- Report to the same room that you reported to for the first Break-out Session.
- The Eco-Lanes and Dynamic Low Emissions Zones Transformative Concepts will be discussed during these Break-out Sessions.
 - Left side of the room will be discussing Eco-Lanes: **Room 337A**
 - Right side of the room will be discussing Dynamic Low Emissions Zones: **Room 338**



REPORTS FROM BREAK-OUT SESSION #2



CLOSING REMARKS

(MARCIA PINCUS)





AERIS

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