ITS and IntelliDrive^{SM} for the Environment: AERIS Program Overview

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# What is AERIS?

AERIS = Applications for the Environment: Real-time Information Synthesis

What is IntelliDrive?

IntelliDrive is a suite of technologies and applications that use wireless communications to provide connectivity:
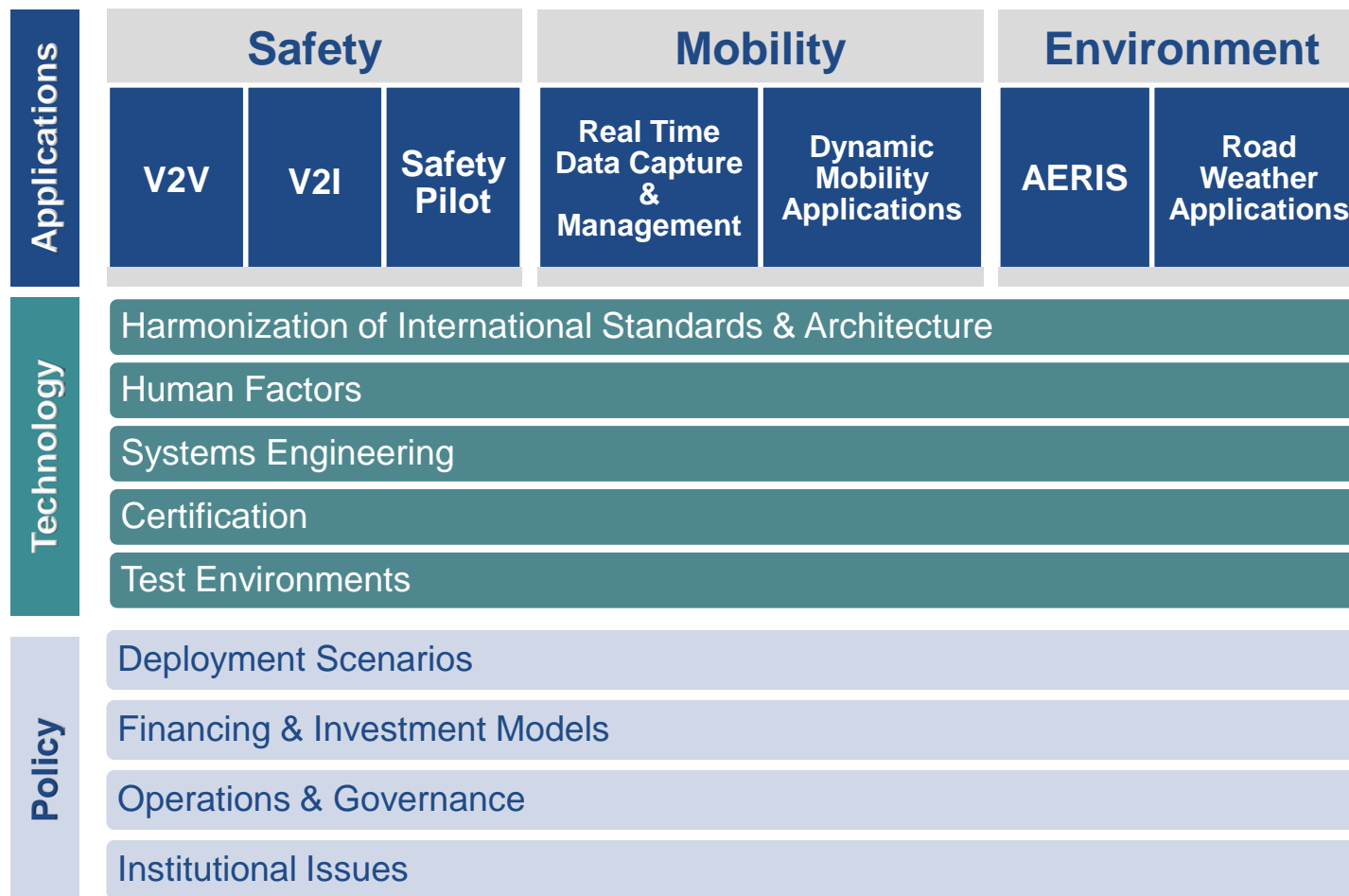
- Among and between vehicles of all types
- Between vehicles and roadway infrastructure
- Among vehicles, infrastructure and wireless consumer devices

Drivers

Vehicles

Infrastructure

Wireless Devices
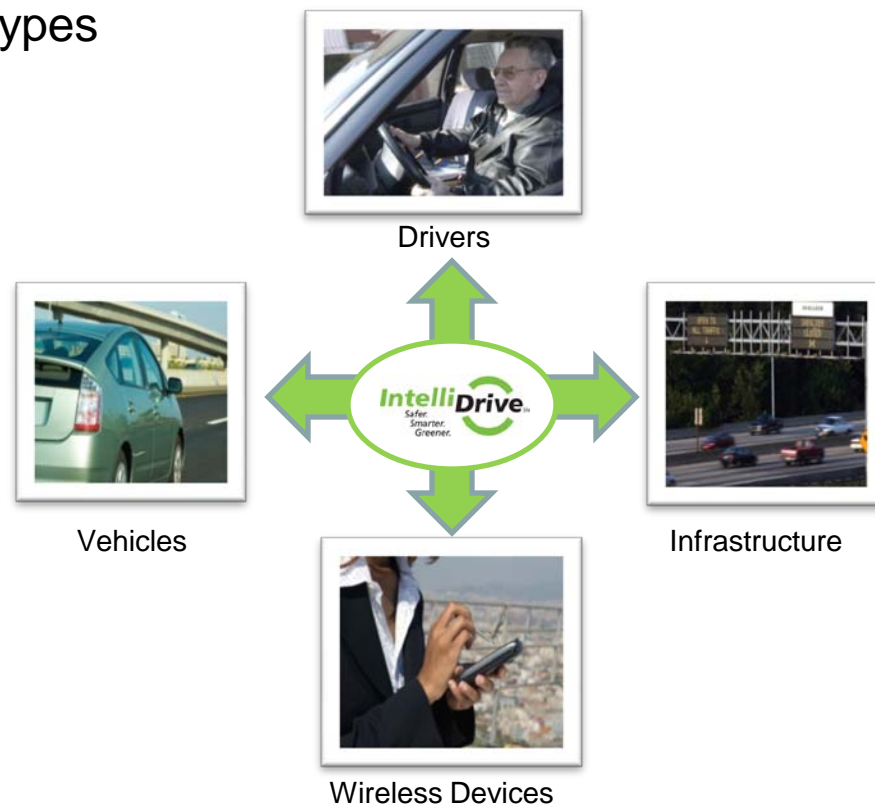
Major IntelliDrive Objectives

1. Move aggressively on vehicle-to-vehicle (V2V) communications

2. Accelerate in-vehicle technology
   - Enables safety, active traffic management, and environment applications

3. Accelerate infrastructure communications capability
   - Signal Phase and Timing (SPaT) is an initial focus
   - Enables safety, mobility, and environmental applications

4. On-road multimodal pilot deployments for high-value applications

5. Monitor and evaluation of driver distraction issues

6. Understand benefits and communications needs (DSRC/other) of transformative mobility and environmental applications

Overall Structure of IntelliDrive

Applications	Safety			Mobility		Environment	
	V2V	**V2I**	**Safety Pilot**	**Real Time Data Capture & Management**	**Dynamic Mobility Applications**	**AERIS**	**Road Weather Applications**

Technology

- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Certification
- Test Environments

Policy

- Deployment Scenarios
- Financing & Investment Models
- Operations & Governance
- Institutional Issues

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Why Do this Research?

Environmental Problem

- 2.9 billion gallons of wasted fuel each year – 3 weeks worth of gas for every traveler
- The transport sector accounts for approximately 28% of GHGs in the U.S.
- Vehicles represent almost 80% of transport sector GHGs
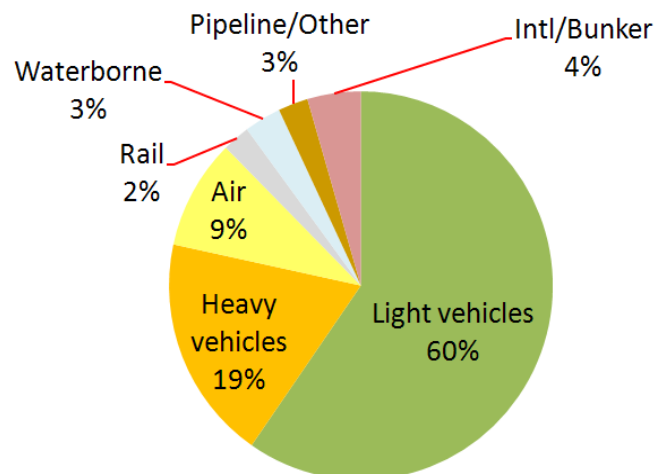
Environmental Goal

⬇Emissions   ⬇GHG   ⬇Particulates

- Enable better environmental management of the system through V2V and V2I connectivity
- Enable eco-friendly options for traveler mobility

Setting Some Context

- There are many strategies available to reduce transportation's contribution to GHG levels and improve air quality

- ITS can contribute to these reductions

- The AERIS program is focused on assessing how ITS may contribute to GHG emissions reductions and air quality improvements, and how much, <u>in an IntelliDrive-enabled future</u>

- AERIS research will investigate, analyze and model IntelliDrive applications and scenarios to determine if they provide a significant environmental benefit, either individually or in combination

    NOTE: Research is underway by many, but much more needs to be understood, modeled, tested and evaluated, especially in real-world, large scale test beds and test situations

Environmental Data Supports Transformative Applications

Data Capture and Management

- Vehicle Status Data
  - ...65 mph...
  - ....brakes on....
  - ....two passengers....
- Infrastructure Status Data
- Weather Data
- Truck Data
- Transit Data
- Location Data

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Environmental Applications

- Transit Signal Priority
- Low Emission ZONE
- Real-Time Travel Info "Green" Routes
- "Green" Fleet Management
- Eco-driving
- Signal Phase & Timing Adjusts Real-Time Conditions

AERIS Research Objectives

Investigate whether it is possible and feasible to:

- Generate/capture **environmentally-relevant real-time transportation data** (from vehicles and the system)

- Use this environmental data to create **actionable information** that can be used by **system users and operators** to support and facilitate **"green" transportation choices** for all modes

Assess whether doing these things yields a good enough environmental benefit to justify further investment by the Department

TRANSFORMATIVE and INNOVATIVE

"Imagine"

- **Vehicle Level**
  - Widespread "eco-driving" with signal phasing and timing (also at network level)
  - Emissions-based credits in real time, that take into account where the driver is, the time of day, weather, vehicle operation, etc. to incentivize drivers

- **Network Level**
  - Integrated Corridor Management (ICM)-like system able to optimize based on real-time environmental factors (e.g., on code-red air quality days)
  - Real-time tradeoffs for environmental and mobility/economy/societal goals, for all modes, based on real-time system management needs

- **Others**
  - Low–emission zones with an IntelliDrive component
  - Applications that incentivize green choices
  - Green platooning/eco-lanes or eco-corridors
  - Alternative fuel vehicles including electric vehicle recharging stations with access to the grid
  - Technologies that improve the "greener" operation of fleets – including transit and freight

> Complex multi-element scenarios using many layered and leveraged ITS technologies/applications

Basic Research Questions

Data

- What environmentally-relevant vehicle-based data is available, and what is its quality and validity? (<u>All types</u> of vehicles)

Information/Connectivity

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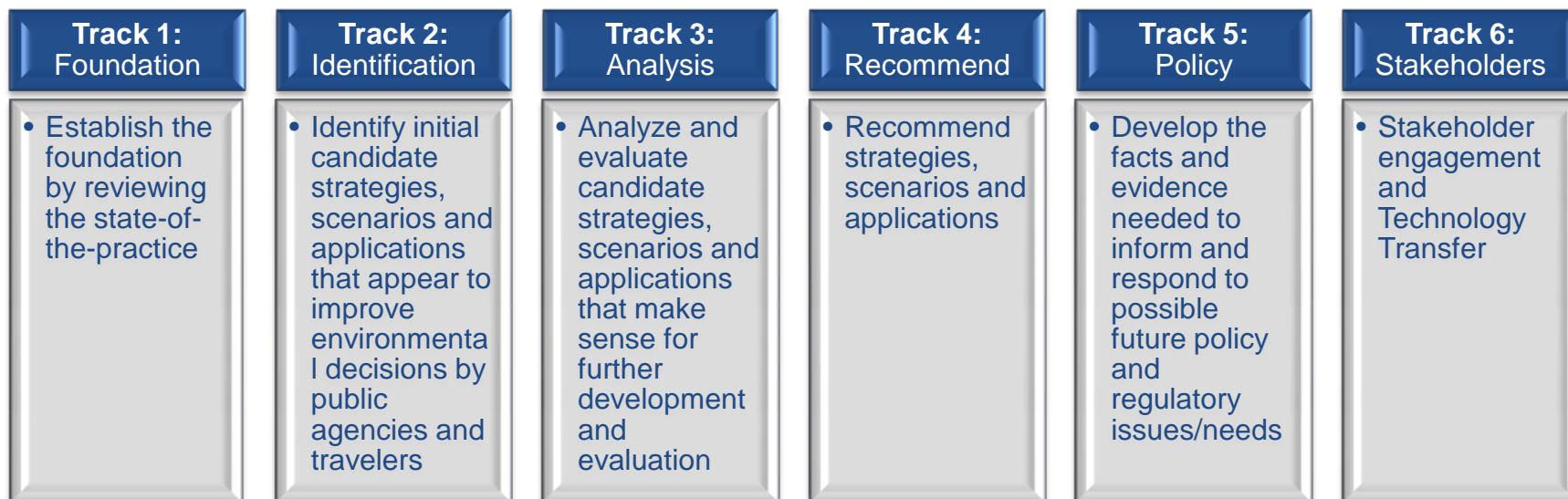
Benefit

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

AERIS Research Program

AERIS

- Five Years, Six "Tracks"
- Multimodal Approach
- Working with Data Capture and Management Program and Dynamic Mobility Applications Program

Track 1: Foundation	Track 2: Identification	Track 3: Analysis	Track 4: Recommend	Track 5: Policy	Track 6: Stakeholders
• Establish the foundation by reviewing the state-of-the-practice	• Identify initial candidate strategies, scenarios and applications that appear to improve environmental decisions by public agencies and travelers	• Analyze and evaluate candidate strategies, scenarios and applications that make sense for further development and evaluation	• Recommend strategies, scenarios and applications	• Develop the facts and evidence needed to inform and respond to possible future policy and regulatory issues/needs	• Stakeholder engagement and Technology Transfer

"Don't Knows"

Environmental Data

- What environmentally-relevant data can we get from cars, trucks, buses, and other vehicle modes?

  - Does this data support AERIS research objectives? If not, what do we need?

  - How much is there? Is it useful?

  - What types of data and how much is needed to make improvements in current models and algorithms?

  - What is the cost to capture and archive this data?

- How can in-vehicle data best be integrated with transportation system and other data?

- How can we incentivize individual "green" choices, or facilitate network wide "green" decision making with this data?

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"Don't Knows"

Evaluation

- In a data-rich IntelliDrive environment, what are the most state-of-the-art techniques for modeling and evaluating the performance of technologies that hope to show a definitive and worthwhile environmental benefit?

- Can evaluation results support validation of GHG reduction targets?

- What is the role of induced demand?

"Don't Knows"

Performance

- What does it mean to have an application that could potentially save "1 million tons of carbon every year"?

  - Is that a good result? For an individual application, or for a multi-application scenario? Nationally or locally or on a corridor?

- By how much should any ITS application or scenario be able to reduce GHG or improve air quality to be a viable candidate for future, more in-depth testing and perhaps eventual deployment?

- What technologies and data are needed to differentiate between the improvements in air quality as opposed to GHG?

  - Different ITS applications may provide more air quality benefit than GHG, and vice-versa

Recent Major AERIS Activities

- **March 2010 |** Program Charter Signed; multimodal support
- **International Cooperation is underway**
  - ITS JPO / EU Sustainability Working Group created (met June 2011 in Brussels)
  - ITS JPO / MLIT (Japan's Ministry of Land, Infrastructure, Transport and Tourism) general Memorandum of Cooperation signed (met October 2010 in Tokyo)
    - Environment just one part of joint discussions

- **October 2010 |** Seven (7) awards made in response to the AERIS Broad Agency Announcement

- **December 2010 |** Webinar to introduce larger community to the AERIS Research Program

- **December 2010 |** Expect to have two (2) "State of the Practice" scans complete
  - State of the Practice in Research on ITS and the Environment
  - State of the Practice in Evaluation Techniques for ITS and the Environment

Future Plans

- Orlando ITS Word Congress (Fall 2011)

- Meetings at TRB with European and Japanese colleagues

- Possible Spring or Summer 2011 meetings in Europe

- Begin work on additional State-of-the Practice scans (activity-based travel models, environmental models, data acquisition technologies)

- Begin to develop AERIS Expert Technical Working Group

- Plan to conduct several, more detailed webinars on aspects of AERIS research program and results/findings

- Begin work on environmental data sets, scenario development, and analysis

- Workshop planned for Spring 2011 to create and define scenarios, better define scenario requirements and associated applications/technologies

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Concluding Points

- The AERIS research program is multimodal, and multimodality is critical to the success of the program
- AERIS is IntelliDrive-focused
- Looking at GHG <u>and</u> air quality benefits (wider scope than most)
- Not looking at other environmental aspects yet
- Exploring a wide variety of communications technologies to see which ones are most effective for different approaches
- Exploring individual applications/technologies and multi-app scenarios
- International cooperation is important
- Leveraging as much pre-existing research as possible
- Seeking the input and participation of the larger community as we move forward, particularly in identification of applications and defining transformative and scenarios
- Feel free to contact any of today's presenters if you have questions/comments