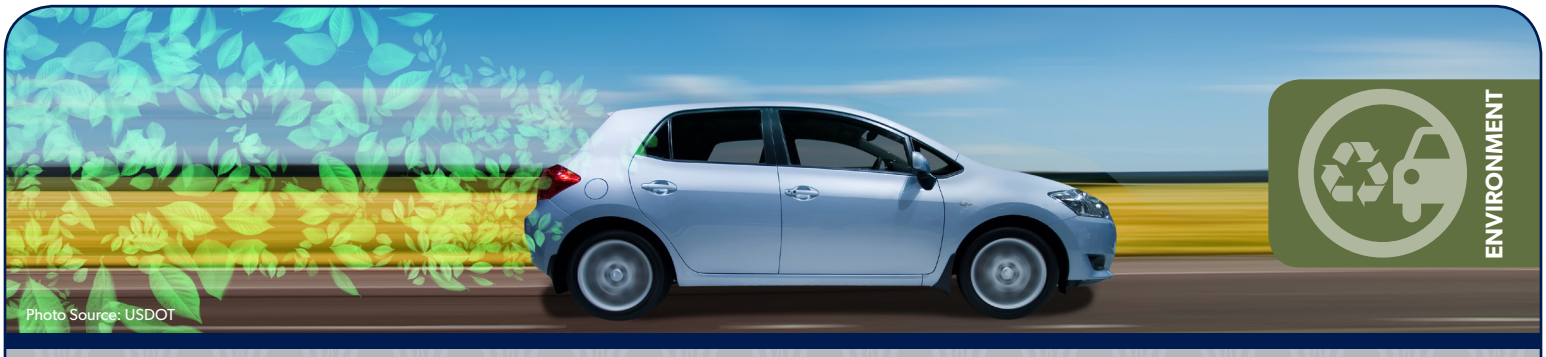

APPLICATIONS FOR THE ENVIRONMENT: REAL-TIME INFORMATION SYNTHESIS (AERIS)

INTRODUCTION

The U.S. Department of Transportation's connected vehicle research aims to tackle some of the biggest challenges in the surface transportation industry—in the areas of safety, mobility, and environment. The Applications for the Environment: Real-Time Information Synthesis (AERIS) research program is the environmental component of the Intelligent Transportation Systems (ITS) Joint Program Office's connected vehicle research program. Employing a multimodal approach, AERIS aims to encourage the development of technologies and applications that support a more sustainable relationship between transportation and the environment, chiefly through fuel-use and resulting emissions reductions. From the start, the AERIS program envisioned a transportation system in which all transportation users, regardless of mode, would have the information needed to make better and greener transportation choices, at any time and in any place.

VISION

The vision for AERIS research is "Cleaner Air through Smarter Transportation." The program seeks to create actionable information that helps system users and operators make green transportation choices. Through research, AERIS will encourage the development and deployment of technologies and applications that support a more sustainable relationship between surface transportation and the environment through fuel-use reductions and more efficient use of transportation services.

OBJECTIVES

The objectives of the AERIS program are to investigate whether it is possible and feasible to:

- Identify connected vehicle applications that could provide environmental impact reduction benefits via reduced fuel use, improved vehicle efficiency, and reduced emissions.
- Facilitate and incentivize green choices by transportation service consumers (system users, system operators, policy decision makers, etc.).
- Identify vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-grid data (and other) exchanges via wireless technologies of various types.
- Model and analyze connected vehicle applications to estimate the potential environmental impact reduction benefits.
- Develop a prototype for one of the applications to test its efficacy and usefulness.

QUESTIONS

The AERIS program is considering the following questions and eliciting feedback from the stakeholder community:

Data

- What environmentally relevant data can we get from cars, trucks, buses, and other vehicles and modes?
- Does this data support AERIS research objectives?
- What data is needed to support environmental applications?
- What are the requirements for the data (granularity, frequency, type, mode, etc.)?
- Are the data requirements achievable?

Effectiveness

- Are applications that support improved air quality locally also good at reducing greenhouse gas levels globally?
- By how much should any ITS application be able to reduce emissions and/or fuel consumption to be a viable candidate for testing and potential deployment?

Evaluation

- How might evaluation of ITS and the environment in a connected vehicle-enabled future change the way we conduct evaluations and interpret results?

Tradeoffs

- Are there network-level tradeoffs between safety, mobility, and environmental improvements to transportation system operations?
- What are the acceptable levels of tradeoffs to strike a balance among the benefits?

U.S. Department of Transportation

OPERATIONAL SCENARIOS

AERIS operational scenarios are strategic bundles of connected vehicle applications that together seek to achieve environmental benefits above those of the individual applications. The operational scenarios include:

- Eco-Signal Operations
- Eco-Lanes
- Low Emissions Zones
- Eco-Traveler Information
- Eco-Integrated Corridor Management.

RESEARCH PLAN

The AERIS research program includes seven tracks.

Track 1—Establish a Foundation: This track conducted a comprehensive review of the state-of-the practice (SOP) to:

1. Determine the strengths and limits of current technology and available environmental data sets
2. Identify the capabilities, limits, and challenges of monitoring and analysis, including a review of existing models and algorithms
3. Examine and evaluate where ITS technologies and data can be more effective and contribute maximum value to reduce environmental impacts
4. Review existing models of traveler behavior and existing traffic simulation models to gauge the effectiveness of improvement strategies.

The SOP reports include assessments of applications, evaluation techniques, behavioral and activity-based modeling, environmental modeling, and technology to enable environmental data acquisition.

Foundational research also included seven broad agency announcement projects. Together, these efforts helped identify opportunities for further research within the program to analyze and evaluate specific applications and strategies for improving environmental decisions by public agencies and consumers and to improve environmental outcomes using ITS and connected vehicle technologies.

Track 2—Identification of Candidate Strategies and Applications: This track identified several strategies to improve environmental decisions by public agencies and consumers or improve environmental outcomes through connected vehicle strategies. The track identified a preliminary set of candidate applications and strategies (operational scenarios), developed a detailed concept of operations (ConOps), and conducted an initial benefit-cost analysis to support modeling and analysis in Track 3.

Track 3—Analysis and Evaluation of Candidate Strategies and Applications: This track further developed, analyzed, and evaluated the selected applications and strategies to confirm that the initial assumptions are still valid and to develop firm expectations of their potential contributions. The track included:

- **Modeling and Evaluating Selected Applications and Strategies:** Analysis plans were developed for the down-selected applications and strategies. The plans defined how the AERIS program intends to evaluate these applications. Next, an extensive modeling effort was conducted to evaluate the potential benefits of the down-selected applications and strategies.

- **Field Testing and Prototyping:** The program investigated the potential of advancing the Eco-Approach and Departure at Signalized Intersection application to prototype. A field test was conducted using a driver-vehicle interface to provide speed recommendations. In 2014, a second prototype, GlidePath, was developed that incorporated automated longitudinal control into the application.

- **Conducting a Detailed and Extensive Benefit-Cost Analysis:** Using the results from modeling and field demonstrations, the benefit-cost analysis was updated.

Track 4—Recommend Strategies and Applications for In-Depth Testing: This track aims to develop recommendations for applications and strategies for more in-depth testing and evaluation. The track will develop the AERIS Capstone Report, which will summarize the results from the five-year research program and provide recommendations for stakeholders on whether to move forward with more in-depth research and potential deployment of the AERIS applications.

Track 5—Policy, Regulatory, and Knowledge Transfer Issues and Needs: The track will explore and, if possible, resolve policy, regulatory, and knowledge transfer issues and needs throughout the life of the program.

Track 6—Stakeholder Interactions: This is a crosscutting track to identify, meet with, learn from, cooperate with, and obtain the support of a wide range of stakeholders. Included was an active outreach program with various workshops, conferences, and meetings to gain knowledge, cultivate support and buy-in for AERIS research, and leverage existing stakeholder activities.

Track 7—International Research and Coordination: This track focuses on conducting joint research with the European Union (EU). The track includes the establishment of the US-EU Sustainability Working Group, development of six white papers, and demonstration of an application at the 2015 ITS World Congress. The white papers explored topics such as connected vehicle research and development projects; testbeds, field operations tests, and deployments for the environment; evaluation methods and results for the environment; opportunities for standards harmonization; human behavior research; and the US-EU demonstration ConOps.

For more information about this initiative, please contact:
Marcia Pincus, Manager, Environment and ITS Evaluation Program
ITS Joint Program Office | (202) 366-9230 | marcia.pincus@dot.gov | www.its.dot.gov

FHWA-JPO-11-021