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TRANSFORMATIVE CONCEPTS

Transformative Concepts are integrated, operational models that use vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) data and communications to operate surface transportation networks with the aim of reducing the environmental impacts of transportation-related emissions and fuel consumption.

Transformative Concepts emphasize combining applications that result in significant environmental benefits to surface transportation networks. Transformative Concepts also consider regulatory/policy and educational tools.

These Transformative Concepts are:

- Eco-Signal Operations
- Eco-Lanes
- Low-Emissions Zones
- Support of Alternative Fuel Vehicle Operations
- Eco-Traveler Information
- Eco-Integrated Corridor Management (E-ICM)

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

INTRODUCTION

The U.S. Department of Transportation (U.S. DOT) is assessing applications designed to unleash the full potential of connected vehicle, travelers, and infrastructure, to enhance current operational practices and transform surface transportation systems management. Applications for the Environment: Real-Time Information Synthesis (AERIS) is the "green" research component of the multimodal research initiative of the Intelligent Transportation Systems Joint Program Office (ITS JPO) within the U.S. DOT Research and Innovative Technology Administration (RITA).

Environmental applications have the potential to reduce fuel consumption and emissions.

The AERIS Program will lead to the rapid and cost-effective deployment of interoperable technologies and applications that reduce the negative impacts of transportation on the environment. The program will act to promote the highest levels of collaboration and cooperation in the research and development of transformative environmental applications. The AERIS Program positions the Federal Government to take on an appropriate and influential role as a technology steward for a continually evolving integrated transportation system.

VISION

The vision for AERIS research is to create actionable information that helps system users and operators make "green" transportation choices. Through research, the AERIS Program intends to assess how the suite of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) connectivity and communications options and data may contribute to improvements in air quality, greenhouse gas (GHG) reductions, and fuel savings. The AERIS Program will then evaluate and quantify the magnitude of these improvements.

OBJECTIVES

The objectives of the AERIS program are to:

- Generate and capture environmentally relevant, real-time transportation data (from vehicles and the roadside infrastructure).
- Use this environmental data to create actionable information that can be used to facilitate "green" transportation choices for all modes.
- Assess whether AERIS applications yield good enough environmental benefits to justify further investment by the USDOT.

RESEARCH PLAN

The AERIS research program will be executed over 5 years.

Track 1—Establish Foundation

The first step is to comprehensively review the state-of-the practice (SOP). The purpose of this track is 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 environ-

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mental impacts, and (4) Review existing models of traveler behavior and existing traffic simulation models to determine how the effectiveness of improvement strategies can be gauged.

All five SOP reports are complete. These reports include assessments of: (1) applications, (2) evaluation techniques (3) behavioral and activity based modeling (4) environmental modeling and (5) technology to enable environmental data acquisition. The AERIS Program also sponsored seven Broad Agency Announcement (BAA) projects to expand its knowledge of ITS applications for the environment. BAA projects included engagement with the International Community, research on eco-driving and eco-routing algorithms, and research into collecting environmental data from vehicles.

Track 2—Identify Candidate Transformative Concepts and Applications

The next step is to identify Transformative Concepts – or groups of applications – that appear likely to improve environmental decisions by public agencies and travelers, and then profile, characterize, and screen them by making an initial assessment of their effectiveness. In this track, a Concept of Operations will be developed for each Transformative Concept. As the Concepts of Operation are developed and data needs are defined, the program will also assess standards relevant to the environment and consider if the needs are being met or more data should be considered.

Track 3—Analyze and Evaluate Candidate Transformative Concepts and Applications

Based on initial results, a select group of applications that show the most promise will then undergo a more rigorous analysis. The ITS JPO team will begin a process of identifying, and modifying as necessary, appropriate evaluation tools and building a robust evaluation and modeling process using connected vehicle data. Further research may substantiate prototyping and testing applications. Finally, the team will investigate how the data sets might help improve and validate environmental and other models (such as the EPA's MOtor Vehicle Emission Simulator "MOVES" model).

Track 4—Recommend Transformative Concepts and Applications

At the end of this research program, the ITS JPO expects to be able to recommend a number of applications for further research investment, testing, and deployment.

Track 5—Policy and Regulatory Research

There will be a parallel effort to conduct more "policy-oriented" research, designed to ensure that the technical research will provide results that can be deployed and provide value within the institutional and social environment.

Track 6—Stakeholder Interactions and Technology Transfer

There will be a concentrated, ongoing effort to engage and interact with stakeholders throughout the program's progress; the goal is to create champions for this research, both within the United States and internationally.

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/modes?
- Does this data support AERIS research objectives?
- What data are 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 GHG levels globally?
- By how much should any ITS application be able to reduce emissions and/or fuel consumption to be a viable candidate for future testing and perhaps 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

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?

The U.S. Government's Role

The U.S. DOT's Research and Innovative Technology Administration's (RITA's) Intelligent Transportation Systems (ITS) Joint Program Office fosters the development and future deployment of these connected vehicle technologies. But connected vehicle research involves all agencies within U.S. DOT including National Highway Traffic Safety Administration, the Federal Highway Administration, the Federal Motor Carrier Safety Administration, Federal Transit Administration, and the Federal Railroad Administration.

U.S. DOT and its public and private partners are working to address the technical, safety, and policy challenges and are helping to create the standards and the wireless architecture that will be the backbone of the system.

Connected vehicle research will leverage the potentially transformative capabilities of wireless technology to make surface transportation safer, smarter, and greener. If successful, connected vehicles will ultimately enhance the mobility and quality of life of all Americans while helping to reduce the environmental impact of surface transportation.

For more information about this initiative, please contact:

Marcia Pincus
Manager, Environment and ITS Evaluation Program
ITS Joint Program Office
Research and Innovative Technology Administration
marcia.pincus@dot.gov
(202) 366-9230

Robert Ferlis
Office of Operations Research and Development
Turner Fairbank Highway Research Center
Federal Highway Administration
Research and Innovative Technology Administration (RITA)
robert.ferlis@dot.gov
(202) 493-3268

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