EXPLORATORY ADVANCED RESEARCH PROGRAM

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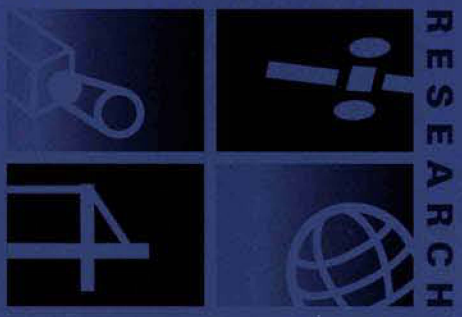


THE SAFE, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users authorized the Exploratory Advanced Research Program. An Exploratory Advanced Research program has been established to conduct longer term, higher risk research that will result in potentially dramatic breakthroughs for improving the durability, efficiency, environmental impact, productivity, and safety of highway and intermodal transportation systems.

The following 15 projects were awarded through two Broad Agency Announcements seeking research and development projects that could lead to transformational advances in highway engineering and intermodal surface transportation in the United States. The awards represent an estimated FHWA investment of over $13 million, spanning multiple years. With cost-share agreements in place for most projects, the total estimated budget for these projects is over $24 million.

PEDESTRIAN AND DRIVER SAFETY

Mathematical Analysis of the Empirical Mode Decomposition Algorithm

FHWA has signed a contract with Princeton University to further refine this advanced mathematical concept for analyzing multicomponent digital signals and to explore its potential applications in highway safety, infrastructure, and environment. For more information, contact Kunik Lee (Kunik.Lee@dot.gov; 202-493-3491).

Development of Methodologies to Evaluate the Nighttime Safety Implications of the Roadway Visual Scene Under Varying Cognitive Task Loads

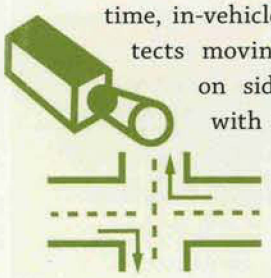
Under a cooperative agreement with the Virginia Tech Transportation Institute, this project aims to help improve nighttime driving safety. Researchers are developing a model framework of human visual perception in the driving environment that is comprehensive yet simple enough to derive probabilistic forecasts of driver performance under given visual conditions. Also under development is a unified driver/roadway monitoring system. Linked to in-vehicle instrumentation, the system combines an infrared eye tracker and a dynamic photometer. For more information, contact Carl Andersen (Carl.Andersen@dot.gov; 202-493-3366).

Human Factors for Limited-Ability Autonomous Driving Systems

FHWA has contracted with General Motors Corporation to study the human factors aspects of limited automated driving systems. Concerns the research will address include drivers becoming over-reliant upon the systems, evoking such systems outside of design parameters, and not being aware when the systems are not operating as intended. Expected outcomes are the impact of human factors on performance of automated systems and better definition of roles of drivers using such systems in a variety of scenarios. For more information, contact Kunik Lee (Kunik.Lee@dot.gov; 202-493-3491).

Layered Object Recognition System for Pedestrian Collision Sensing

This research with the Sarnoff Corporation and AutoLiv Electronics America will develop a real-time, in-vehicle, vision-only system that detects moving or stationary pedestrians on sidewalks and along roadways with high accuracy and a very low false alarm rate. The goal is to reduce the frequency of automobile–pedestrian incidents through a low-cost technology that can be widely implemented. Project completion is anticipated in 2009. For more information, contact Wei Zhang (Wei.Zhang@dot.gov; 202-493-3317).



Increased Understanding of Driver Visibility Requirements

In this study, the Science Applications International Corporation, National Institute of Standards and Technology, and Texas Transportation Institute are developing a rational theoretical framework for determining the quantity and quality of visual information needed by drivers to navigate the roadway safely and effectively. Project completion is anticipated in 2009. For more information, contact Carl Andersen (Carl.Andersen@dot.gov; 202-493-3366).

PREDICTING SOCIETAL AND COMPLEX NATURAL SYSTEMS

Modeling the Urban Continuum in an Integrated Framework

Arizona State University, University of Arizona, and University of Washington are partnering to develop and demonstrate an integrated simulation approach to urban systems modeling. Key elements of the effort are land-use microsimulation models to simulate market dynamics (location choices), activity–travel behavior models to simulate the patterns of individuals and vehicles along the continuous time axis, and dynamic traffic assignment models to simulate network dynamics and performance in real time. Project completion is anticipated in 2011. For more information, contact Brian Gardner (Brian.Gardner@dot.gov; 202-366-4061).

BUILDING, MAINTAINING, AND MANAGING FUTURE HIGHWAYS

Nondestructive Evaluation for Corrosion Detection in Reinforced Concrete Structures

Corrosion of steel reinforcements is the main cause of damage and early failure of reinforced concrete structures in civil engineering. An objective, spatially resolved, and rapid corrosion inspection method could lead to cost savings of billions of dollars worldwide through early-stage detection of corroded reinforcement in concrete. To overcome difficulties with conventional inspection techniques, this benchmark project focuses on the promising technique of time-resolved thermography with induction heating combined with three-dimensional microwave imaging. This project is performed in collaboration with a National Research Council Research Associate, and completion is anticipated in 2011. For more information, contact Frank Jalinoos (Frank.Jalinoos@dot.gov; 202-493-3082).

Development of Stiffness Measuring Device for Foot Pad Roller Sensor for Pavements

The aim of this project with the Colorado School of Mines Division of Engineering, Caterpillar Inc., and other roller manufacturers is to develop a measurement approach to determine mechanistic soil properties (e.g. stiffness, modulus) continuously in real time during static compaction of fine and mixed-grain soils with a pad-foot roller compactor. Project completion is anticipated in 2010. For more information, contact Mike Adams (Mike.Adams@dot.gov; 202-493-3025).

High Performance Stress-Relaxing Cementitious Composites for Crack-Free Pavements and Transportation Structures

Cracking in portland cement concrete pavements and structures is a major problem. In this research, the Texas A&M University's Texas Transportation Institute is attempting a bold, crosscutting approach to preventing cracking. If successful, the project can point the way to a new use of nano- to microscale inclusions in the concrete to enable it to relax a little under stress, thus reducing harmful cracking. Project completion is anticipated in 2009. For more information, contact Richard Meininger (Richard.Meininger@dot.gov; 202-493-3191).

Development and Demonstration of Systems-Based Monitoring Approaches for Improved Infrastructure Management Under Uncertainty

Researchers at the University of Central Florida, Lehigh University, and the Florida Department of Transportation will develop a novel integrated framework for improved infrastructure management, using novel sensing technologies, deterioration models, and decisionmaking tools. The project will include numerical simulations as well as laboratory testing to demonstrate the performance of individual components of the research. Project completion is anticipated in 2010. For more information, contact Hamid Ghasemi (Hamid.Ghasemi@dot.gov; 202-493-3042).

OPERATING SYSTEMS AND REDUCING CONGESTION

Next Generation of Smart Traffic Signals

The University of Arizona ATLAS Center is teaming with City of Tucson and Maricopa County to develop a self-adaptive traffic signal system that observes (through cameras and other sensors) the traffic in the network, predicts traffic demands and conditions, and sets phase durations to optimize an objective specified by the jurisdiction. A second phase of the project will include vehicle–infrastructure integration (VII). Project completion is anticipated in 2009. For more information, contact Raj Ghaman (Raj.Ghaman@dot.gov; 202-493-3270).

Development and Evaluation of Selected Mobility Applications for VII

The California PATH Program and Caltrans are designing, testing, and evaluating three innovative ways of using wireless communication capabilities from VII to improve mobility. A key goal of the project is to quantify the impacts that each of the three mobility applications would have on key transportation measures of effectiveness (highway congestion, throughput, and energy consumption). Project completion is anticipated in 2010. For more information, contact Robert Ferlis (Robert.Ferlis@dot.gov; 202-493-3268).

Intelligent Multi-Sensor Measurements to Enhance Vehicle Navigation and Safety Systems

This research, conducted by Auburn University GPS and Vehicle Dynamics Lab along with IBEO Automobile Sensors, aims to develop an accurate, robust, and reliable vehicle positioning system capable of providing high-update-rate lane-level measurements for future navigation and control (safety) systems. Project completion is anticipated in 2009. For more information, contact David Gibson (David.Gibson@dot.gov; 202-493-3271).

Intersection Control for Autonomous Vehicles

A University of Texas at Austin team is considering the impact of autonomous vehicles on urban traffic infrastructure, specifically at intersections. The aim is to dramatically decrease time wasted at intersections and increase vehicle throughput on roads. Project completion is anticipated in 2010. For more information, contact Gene McHale (Gene.McHale@dot.gov; 202-493-3275).

Making Driving Simulators More Useful for Behavioral Research

The University of Iowa, under this contract, will evaluate issues related to the use of interactive driving simulators in highway safety and operations research. Driving behavior in simulators will

be correlated to driving behavior in the real world. The influences of visual, auditory, and haptic fidelity will be investigated. The research will develop a theoretical model of the relationship between driver performance in interactive driving simulators and driving performance in real vehicles on real roads. For more information, contact Thomas Granda (Thomas.Granda@dot.gov; 202-493-3365).

WHAT IS THE EXPLORATORY ADVANCED RESEARCH PROGRAM?

FHWA's Exploratory Advanced Research (EAR) Program focuses on long-term, high-risk research with a high payoff potential. The program addresses underlying gaps faced by applied highway research programs, anticipates emerging issues with national implications, and reflects broad transportation industry goals and objectives.

To learn more about the EAR Program, visit the Exploratory Advanced Research Web site at www.fhwa.dot.gov/advancedresearch. The site features information on research solicitations, results of completed research, links to published materials, summaries of past EAR events, and details on upcoming events.

For additional information, contact David Kuehn, 202-493-3414 (email: David.Kuehn@dot.gov), or Terry Halkyard, 202-493-3467 (email: Terry.Halkyard@dot.gov), at FHWA.

EXPLORATORY ADVANCED **RESEARCH**

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