U.S. Department of Transportation
Federal Highway Administration

FOREVER OPEN ROAD
Redefining Road Transport for the 21st Century
FEHRL's Flagship Programme

Associated with the Forever Open Road programme

About the Exploratory Advanced Research (EAR) programme

Exploratory advanced research focuses on long-term, high-risk research with a high payoff potential. It matches opportunities from discoveries in science and technology with the needs of specific industries. The uncertainties in the research approach and outcomes challenge organizations and researchers to be innovative problem-solvers, which can lead to new research techniques, instruments, and processes that can be applied to future high-risk and applied research projects.

In 2005, legislation established the Exploratory Advanced Research (EAR) Program at the Federal Highway Administration (FHWA) in the United States Department of Transportation with up to $14 million in annual funding for breakthrough research with the potential for dramatic long-term improvements to transportation systems—improvements in planning, building, renewing, and operating safe, congestion-free, and environmentally sound transportation facilities.

The EAR Program secures broad scientific participation and extensive coverage of advanced ideas and new technologies through three key processes:

- FHWA engages stakeholders in the EAR Program from evaluating potential research topics through communicating research results.
- FHWA identifies and scopes topics through extensive initial-stage investigation. The EAR Program has supported scanning trips and meetings involving more than 200 national and international experts to assure use of the most recent advances in science and engineering.
- FHWA uses expert panels to ensure the technical quality of sponsored research. The panels are composed of Federal, State, academic, and international scientific and engineering experts who are vetted to avoid conflicts of interest. The panels frequently include members from multiple disciplines to assure that cross applications and novel approaches to research are fully assessed.

Access to international expertise is critical for the EAR Program. In some research areas, governments, industries, and universities in other parts of the world have developed important advances that could be applied to U.S. highway transportation.

The FHWA EAR Program has engaged international experts by sponsoring scanning tours, convening forums, inviting expert reviewers, and offering postdoctoral research fellowships. FHWA expects to continue these ad hoc collaborations and to formalize longer term relationships as part of Forever Open Road that could lead to joint research funding or paired projects.

EAR Program Focus Areas

The EAR Program funds research across a range of issues that are critical to the transportation industry:

- **Connected Highway and Vehicle System Concepts** – This focus area emphasizes the longer-term needs to reach critical departmental safety and mobility goals by developing the theory and assessing feasibility for systems that leapfrog current technological approaches for linking infrastructure with future vehicle and personal mobile technology
- **Breakthrough Concepts in Material Science** –This focus area leverages new approaches in materials science to produce innovative new highway materials with characteristics that enable enhanced functionality (including multi-functionality), constructability, sustainability, cost effectiveness or operating characteristics of highway infrastructure and system monitoring sensors to enhance highway safety, reliability, and resilience.
- **Human Behavior and Travel Choices** – This focus area leverages research concepts from the social sciences including psychology and economics along with more traditional research for improving safety, reducing congestion, and improving the livability of the nation's communities
- **New Technology and Advanced Policies for Energy and Resource Conservation**– This focus area cuts across infrastructure, operations and societal and complex natural systems to support innovative methods for reducing highway industry costs and moving towards sustainability
- **Technology for Assessing Performance** – This focus area seeks novel approaches and breakthrough technology that will revolutionize the use of performance management in the highway sector.

Cross-Cutting Areas

- **Nano-Scale Research** – This focus area cuts across all primary focus areas and takes advantages of higher magnitudes of investment from other agencies to support of greater highway system resilience, improved safety and operations, and reduced environmental impacts. It encompasses modeling and measuring phenomena to increase an understanding of properties as well as the application of scientific advances from other fields critical to improving the safety, reliability and resilience of the highway system.
- **Information Sciences** – This focus area takes advantage of paradigm shifting breakthroughs found across academia, government and the private sector in the computer and information technology fields including automation, data processing and management, computing, cyber (or virtual) systems, communication, and visualization

EAR Program Results

The EAR Program strives to develop partnerships with the public and private sectors because the very nature of EAR is to apply ideas across traditional fields of research and stimulate new approaches to problem solving. Through five solicitations, the EAR Program has awarded 45 projects involving both government and academic researchers. These projects represent the investment of $32 million in federal funds and leverage $16 million in matching funds.

The EAR Program bridges basic and applied research. Research may include improved understanding of phenomena that can accelerate or allow for new lines of applied research. An example is a project called “Increased Understanding of Driver Visibility Requirements,” in which investigators 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. This work will assist in future safety research.

In addition to sponsoring EAR projects that advance the development of highway infrastructure and operations, the EAR Program is committed to promoting cross-fertilization with other technical fields, furthering promising lines of research, and deepening vital research capacity.

- **Cross-fertilization** – Research may include the application of scientific and technological discoveries in other fields to transportation. An example is a project entitled “Intelligent Multisensor Measurements to Enhance Vehicle Navigation and Safety Systems,” in which researchers are developing a robust and reliable vehicle-positioning system capable of providing accurate, high-update-rate, lane level measurements for future vehicle navigation and control. In this project, investigators are applying technology developed and tested in other industries, including aerospace, to improve highway safety.
- **Disseminating new findings** – Each EAR project includes a transition plan for finding appropriate research follow up activities through disseminating new findings and pursuing the potential for continued research. Where the findings suggest the value of further investigation, the EAR Program identifies appropriate activities to engage interested stakeholders who may want to continue the research. For example, when new technologies developed in a project are meeting anticipated objectives, there may be interest in applied research at FHWA, among State departments of transportation, in transport agencies outside the U.S., or private industry. Other research projects may lead to unexpected findings or clarification about questions and approaches, which could suggest continued investigation under the EAR Program.
- **Building capacity** – The EAR Program also furnishes value by increasing the capacity of organizations and individuals to conduct research. For example, the EAR Program supports the National Research Council Research Associateship Program, which provides postdoctoral and senior scientists and engineers with opportunities to conduct research on projects that complement other EAR Program research.

Getting Involved with the EAR Program

To take advantage of a broad variety of scientific and engineering discoveries, the EAR Program involves both traditional stakeholders (State department of transportation researchers, University Transportation Center researchers, and Transportation Research Board committee and panel members) and non-traditional stakeholders (investigators from private industry, related disciplines in academia, and research programs in other countries) throughout the research process. From 2006 through 2011, the EAR Program involved stakeholders throughout the following program activities:

- **Identifying and scoping topics** as part of over 30 meetings and scanning trips.
- **Reviewing proposals and projects**. More than 200 experts provided assessments of proposals, ongoing projects, or possible new projects. Most reviewers are from academic institutions and, in descending order, State and local departments of transportation, other Federal agencies, private companies, and the international community.
- **Conducting research.** The program has awarded 45 research projects on 34 different topics between 2007 and 2011. The research awards include work by multidisciplinary teams at 33 academic institutions, 16 private companies, 10 State and local agencies, and 7 U.S. Federal laboratories, and four institutions outside the U.S.

Learn More

For more information, see the EAR Program Web site at www.fhwa.dot.gov/advancedresearch. The site features information on research solicitations, updates on ongoing research, links to published materials, summaries of past EAR Program events, and details on upcoming events.