What is EAR?

- Basic Research
- Exploratory Advanced Research
- Mission Oriented Advanced Research
- Applied Research

- National Science Foundation
- National and International Laboratories
- Universities/Centers of Excellence
- National and International Transportation Institutes
- FHWA
- NCHRP, State DOT, UTC, Industry
- Advanced Transportation Research at DOT, DOE, DOD, EPA, etc.
Authorization

• SAFETEA-LU 2005 to present
  – Focus on high-risk, high payoff research
  – Strive for partnerships with public, private entities
  – Funding up to $14 million annually*

* Appropriated funding may vary ($10-11 million annually)
Key Processes

• Focus on high-risk, high payoff research
• Merit review is used to enhance the quality of research processes and results
• Research stakeholders are involved throughout
• Commitment to successful project handoff
Breadth with Depth

• All projects begin with initial stage investigations
  – Reference searches, scanning trips, convening workshops, etc.
• Assure leverage of the most recent, relevant and advanced research from all fields
• Not all initial stage investigations lead to (or are expected to lead to) follow-on or actionable results
Development and Evaluation of Selected Mobility Applications for VII

PATH Research in
FHWA Exploratory Advanced Research Program

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Background

- Topic area in first EAR solicitation based on FHWA interest in \textit{mobility applications enabled by vehicle-infrastructure cooperation}

- Three related PATH pre-proposals integrated in one project
Project Overview

• Goal: Show potential mobility benefits from large-scale deployment of systems using DSRC communications for V2V and V2I data exchange

• Three target systems:
  – Active traffic management
  – Cooperative and traffic-responsive ACC
  – Automated truck platoons

• $3 M total (50% cost share)
Active Traffic Management

• Goal: Avert traffic flow breakdown by controlling highway speed and density

• Approach: Combine dynamic ramp metering with variable speed limits (VSL) to control highway speed and density, averting traffic flow breakdowns
Active Traffic Management
Research Questions Being Addressed

• Range of conditions for which this can save travel time, energy and emissions?
• Willingness of drivers to follow variable speed limits?
• Ability of drivers to follow variable speed limits accurately enough, even if willing?
Post-EAR Action Needs

• Active traffic management
  – Apply models and simulations to diverse freeway applications to test generality
  – Field test with roadside variable speed limit displays
  – Integrate with other active traffic management actions
Cooperative ACC (CACC)

- V2V cooperation enables higher ACC performance capabilities
- I2V cooperation enables dynamic adjustment to traffic conditions
Lead Vehicle Braking, 1.1 s Gap

ACC

CACC
Traffic-Responsive CACC (Using I2V Cooperation)

- Adjust CACC set speed and desired gap based on downstream traffic conditions
- Decelerate earlier and more gently for impediments beyond ACC sensor range
Traffic-Responsive CACC – Expected Benefits

• Drivers selecting shorter gaps, providing lane capacity increase of at least 80%

• Safer than ACC driving, with earlier ability to respond to traffic jams by slowing down, avoiding secondary crashes

• Reductions of traffic flow breakdowns by adhering to recommended speeds
Testing Traffic-Responsive CACC

- Equipping CACC test vehicles to receive speed and gap adjustment advisories
- Generating speed and gap advisories from active traffic management task
- Driving test vehicles through instrumented Berkeley Highway Laboratory section of I-80
Post-EAR Action Needs

- Cooperative ACC
  - Develop capability for multiple CACC pairs to operate nearby (distinguishing the correct lead vehicle)
  - Full-scale field operational test
Automated Truck Platoons

- Automatic vehicle following, combining sensors and V2V communication, enables trucks to drive at short gaps (3 m)
- Prior PATH research (2003) showed benefits for two tractor-trailer trucks:
Fuel Saved by 3 Trucks Driving in Close-Formation Platoons

Average accumulated fuel consumption in cruise period for 3 truck platoons: 1st(b), 2nd(g), 3rd(c)

August 19, 2011  Iowa Mid-Continent Research Symposium
3 Truck Platoon (2010)
Post-EAR Action Needs

- Truck Platoons
  - Systematic fault detection and management
  - Testing on a continuous test course
  - Long-term testing to verify robustness
  - Site-specific deployment case studies
Project Handoff

• Continued Commitment to projects transitioning out of Program
  – Focused outreach of project results
  – Meetings, demonstrations with potential new funders
Thank You

EAR Program website
www.fhwa.dot.gov/advancedresearch

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