

# EXPLORATORY ADVANCED **RESEARCH**



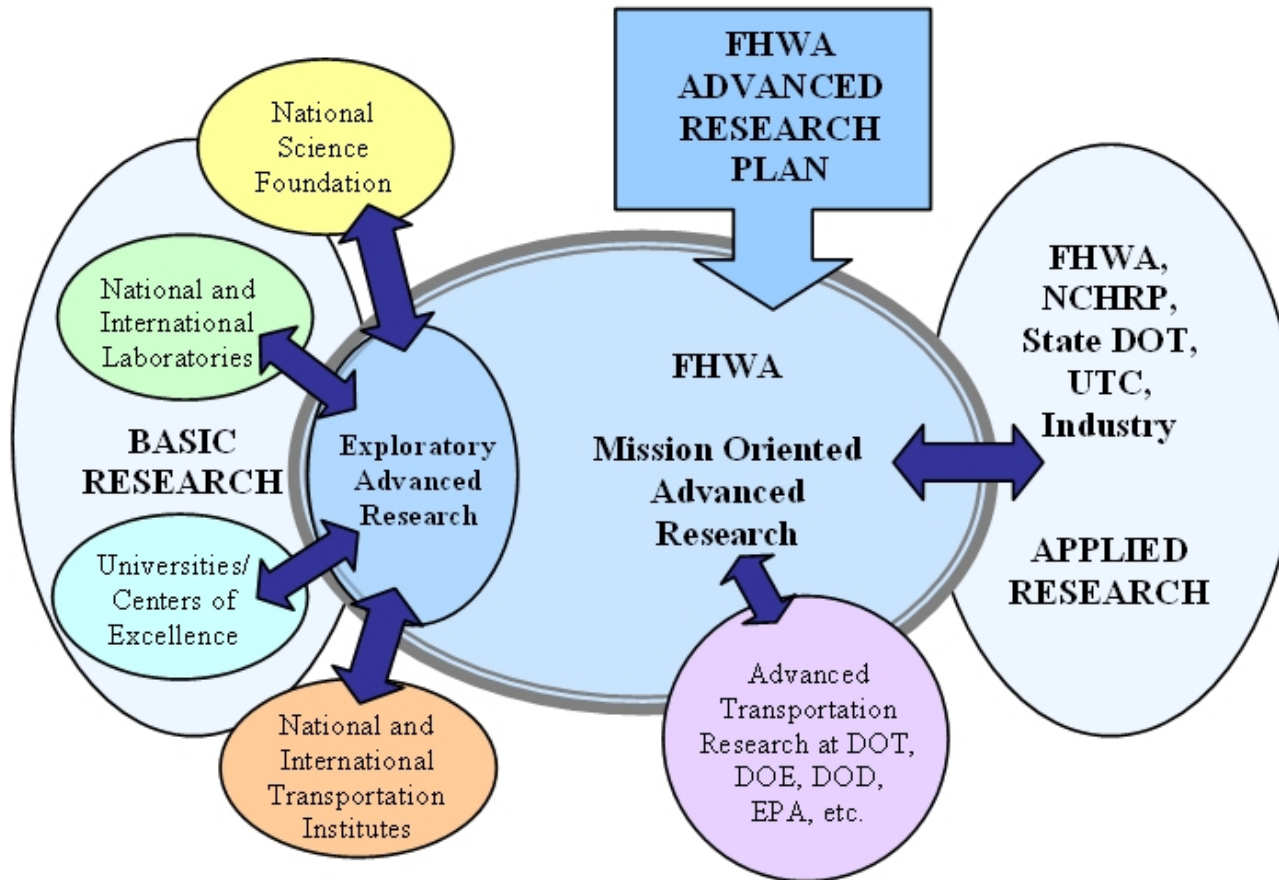
## **Federal Highway Administration Exploratory Advanced Research**

Presentation for the  
**Iowa Mid-Continent Research Symposium**  
August 19, 2011



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# What is EAR?



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# 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)



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# 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



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# 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



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## Development and Evaluation of Selected Mobility Applications for VII

### PATH Research in FHWA Exploratory Advanced Research Program

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CA PATH Program

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# Background

- Topic area in first EAR solicitation based on FHWA interest in *mobility applications enabled by vehicle-infrastructure cooperation*
- Three related PATH pre-proposals integrated in one project



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# 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)



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# 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



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# 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?



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# 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



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# Cooperative ACC (CACC)

- V2V cooperation enables higher ACC performance capabilities
- I2V cooperation enables dynamic adjustment to traffic conditions



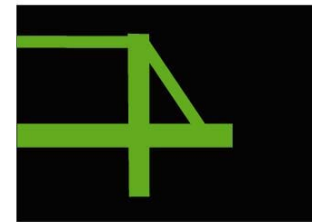
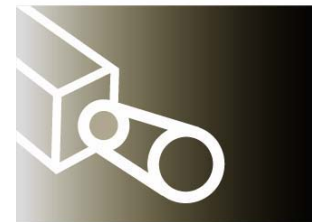
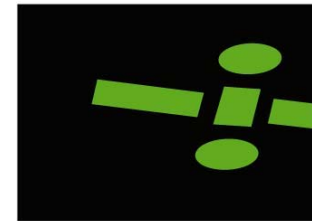
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# Lead Vehicle Braking, 1.1 s Gap

ACC



CACC



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# 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



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# 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



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# 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



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# 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



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# 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:

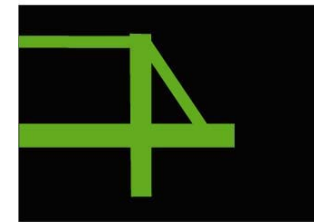
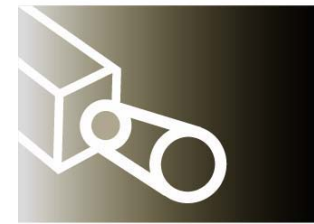
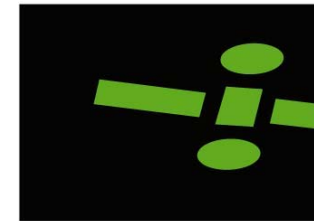
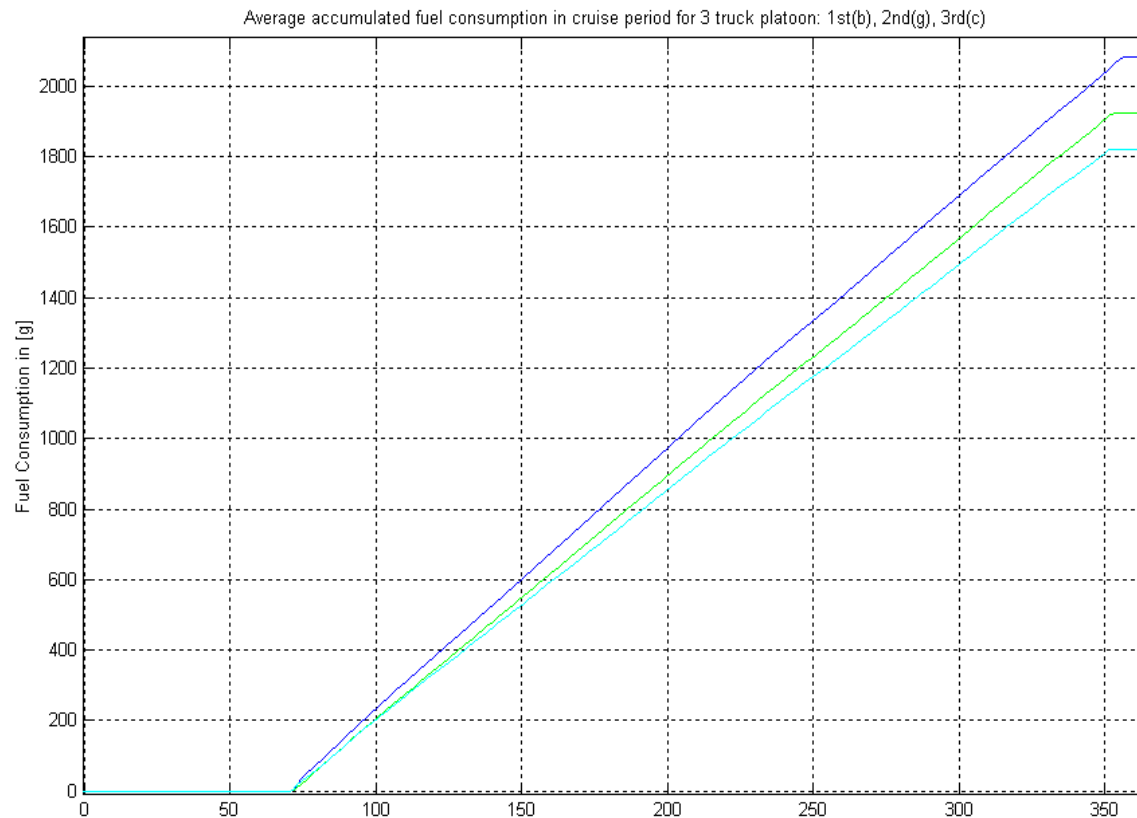


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# Fuel Saved by 3 Trucks Driving in Close-Formation Platoons

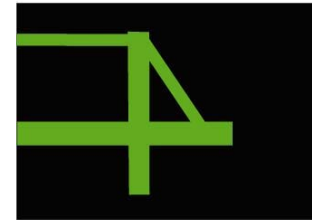
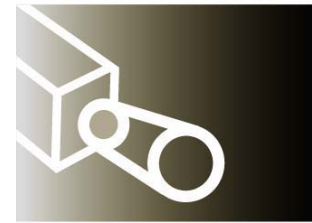
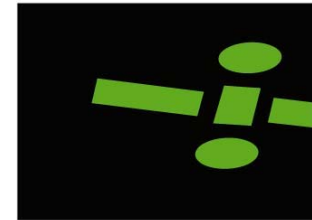


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# 3 Truck Platoon (2010)



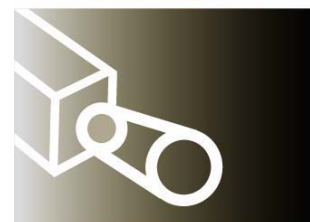
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# Post-EAR Action Needs

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



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# Project Handoff

- Continued Commitment to projects transitioning out of Program
  - Focused outreach of project results
  - Meetings, demonstrations with potential new funders



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# Thank You

EAR Program website

[www.fhwa.dot.gov/advancedresearch](http://www.fhwa.dot.gov/advancedresearch)

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