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Advanced Safety Technologies:
Their Role in Enhancing Vehicle Safety

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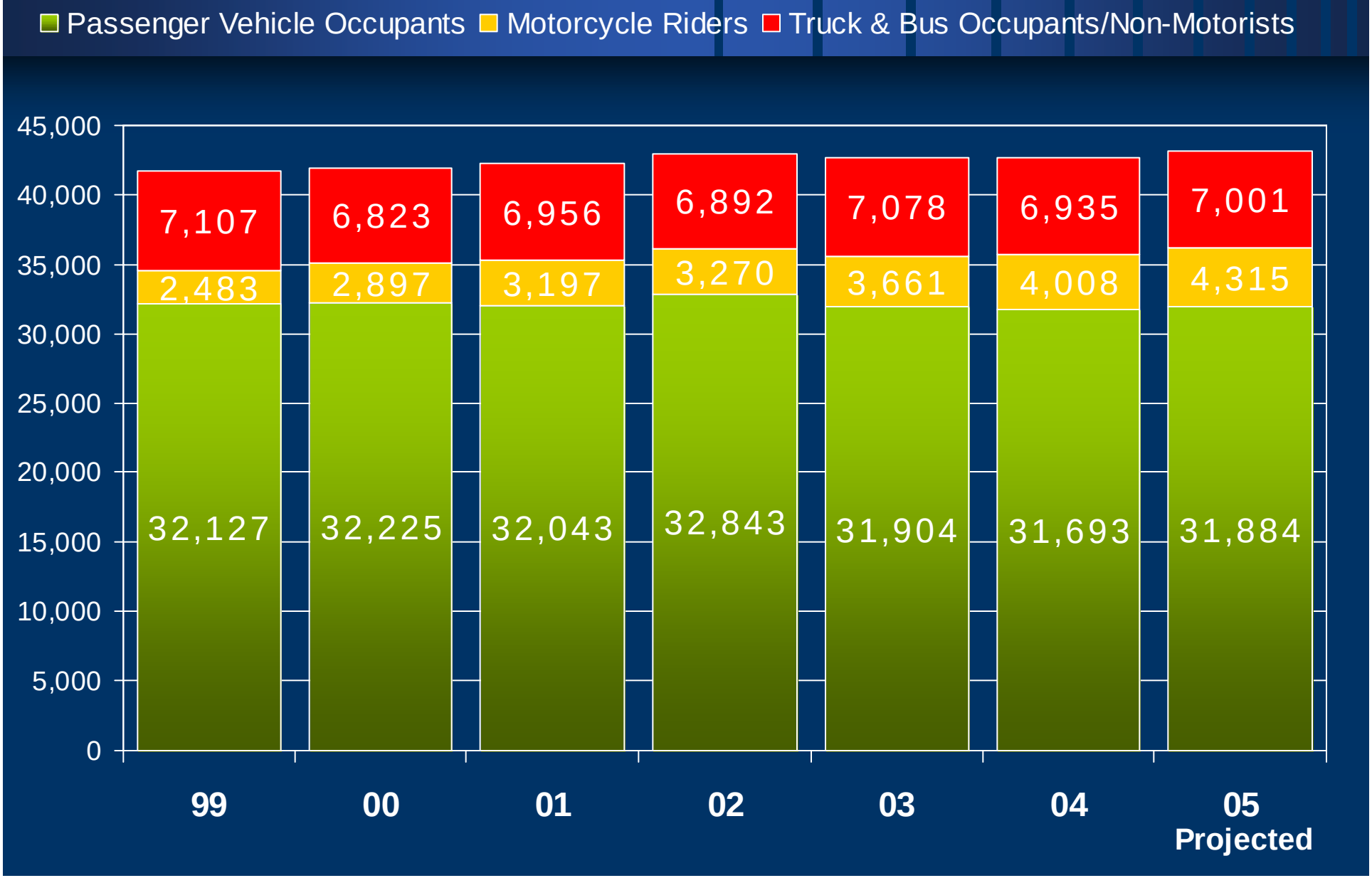
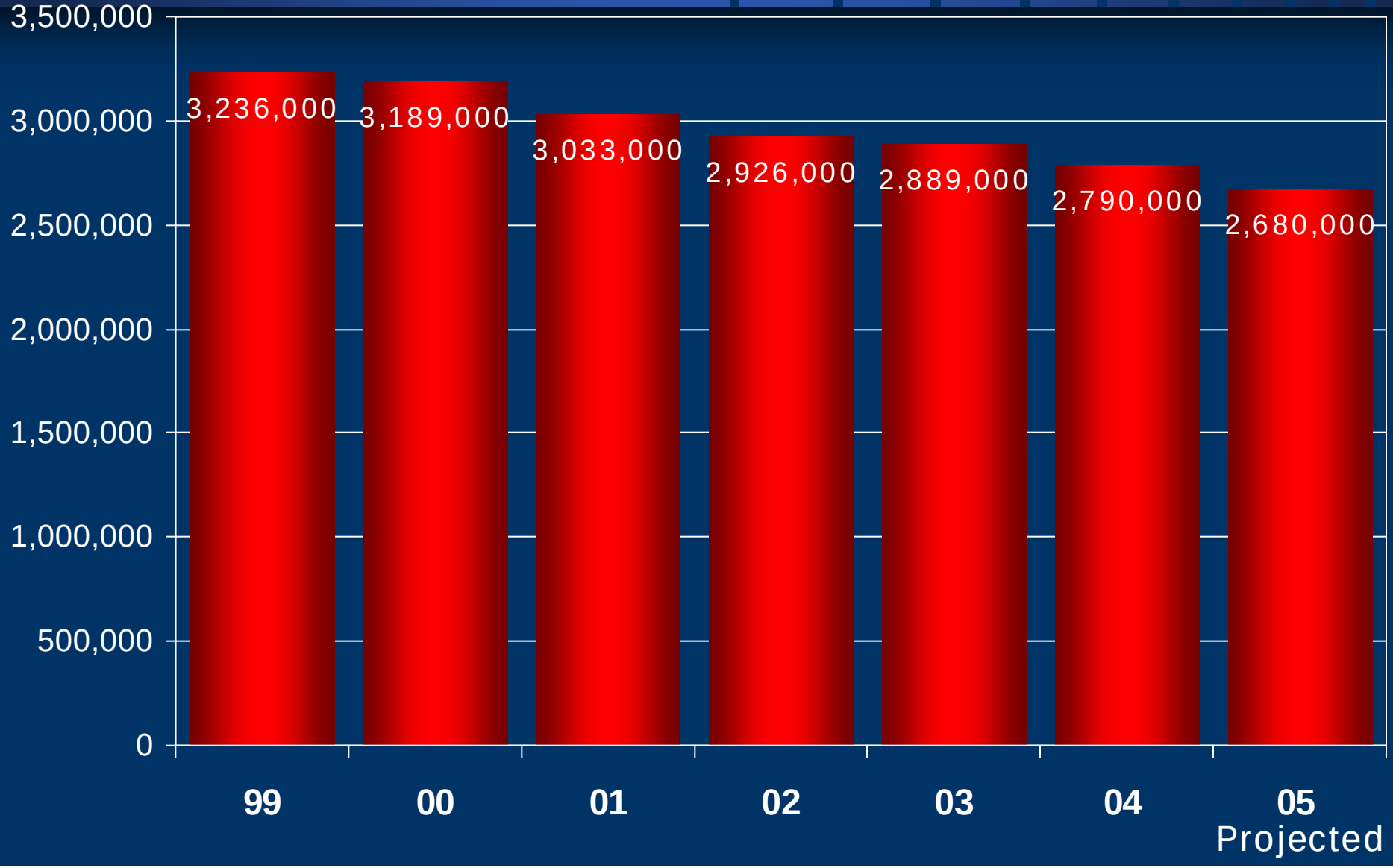
Outline

1. Safety Problems
2. Role of Technologies in Safety
3. Current and Future Technologies
4. Technologies Research
5. Accelerating Innovative Technologies
6. Conclusions

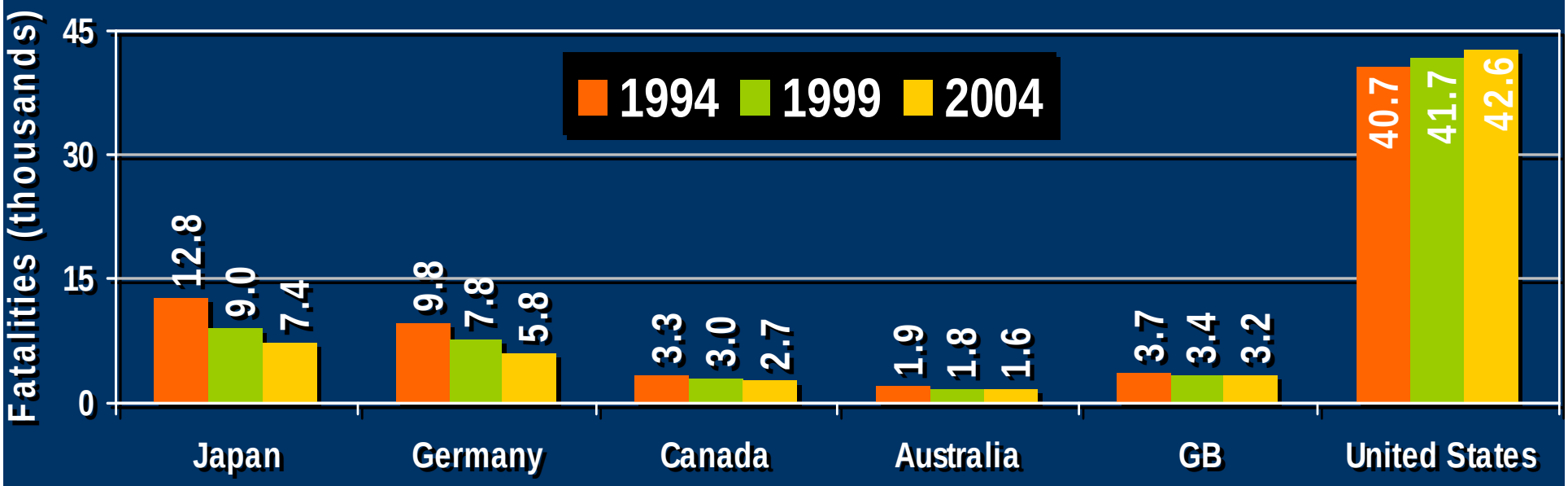
Motor Vehicle Fatalities



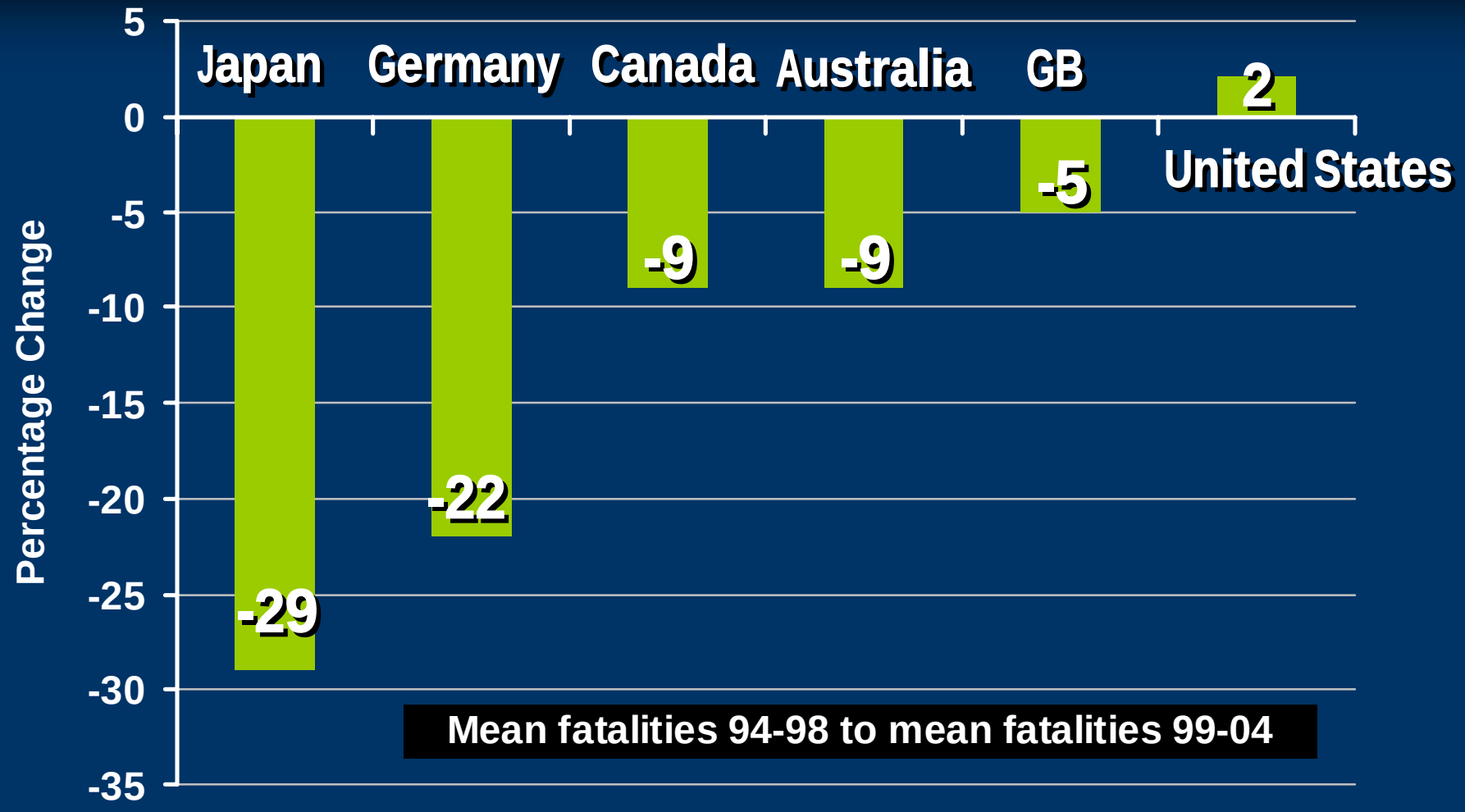
Motor Vehicle Injuries



Global Safety Problem
Number of fatalities



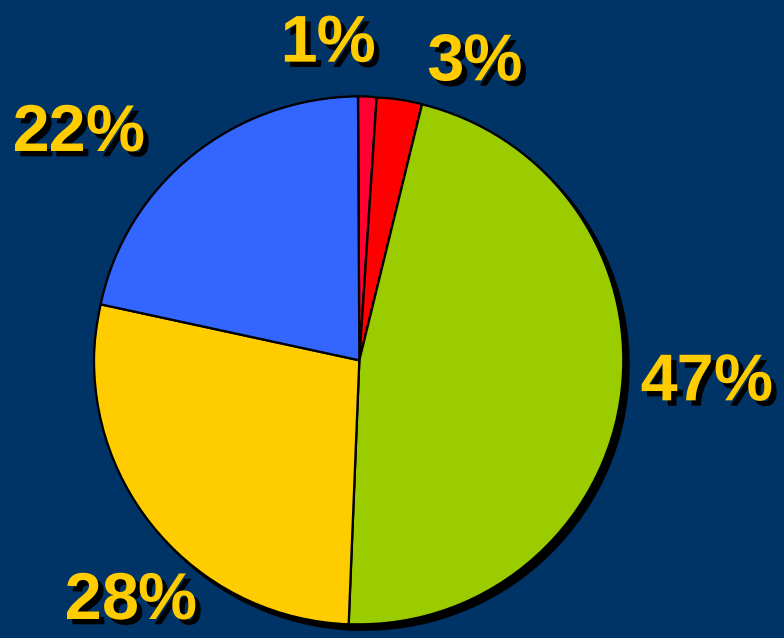
Global Safety Problem
Change in fatalities



Vehicles and Fatalities by Collision Type 2003

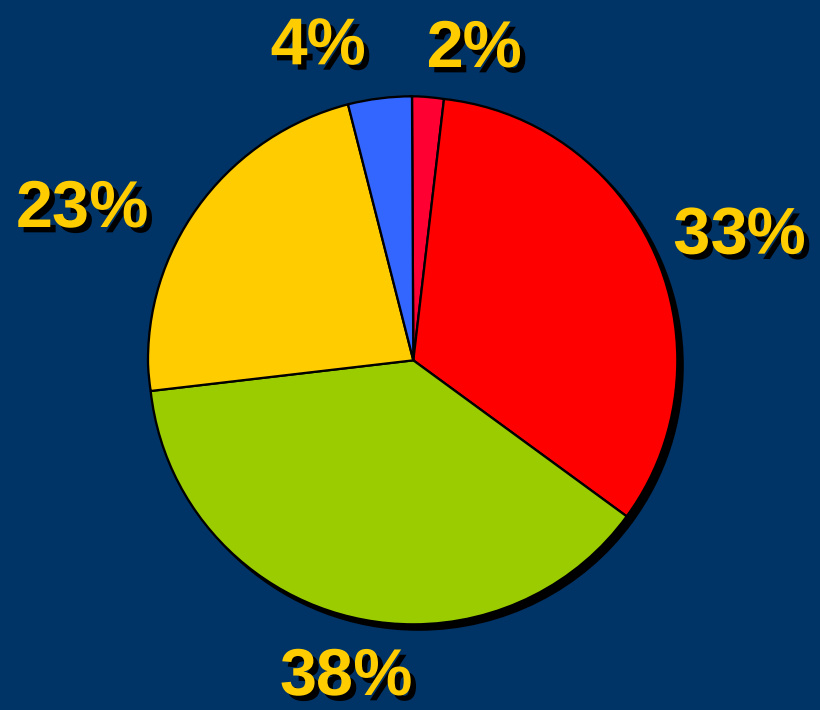
Passenger Vehicles in Crashes

Approx. 10.6 million vehicles involved



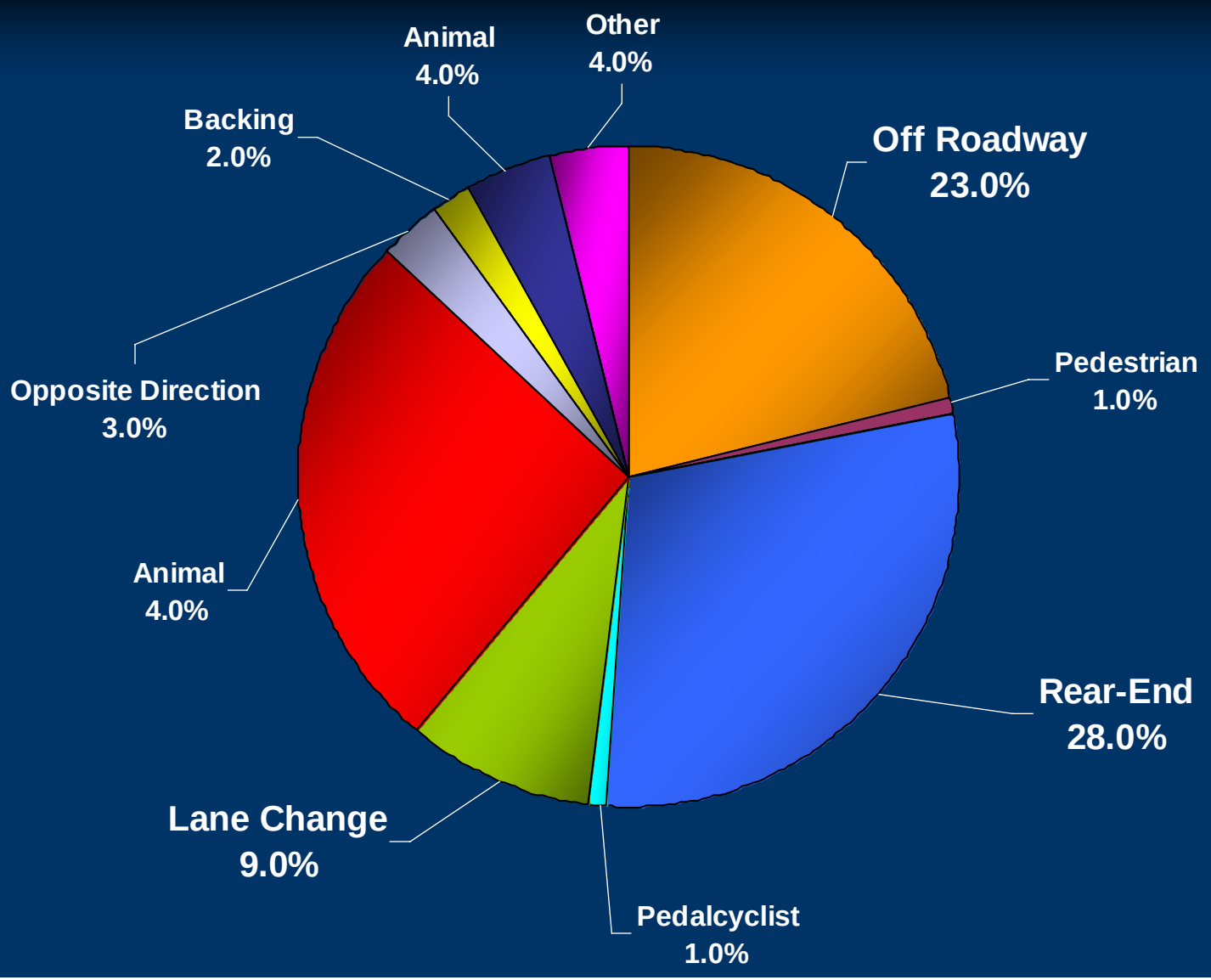
Passenger Vehicle Occupant Fatalities

31,904 total occupants killed

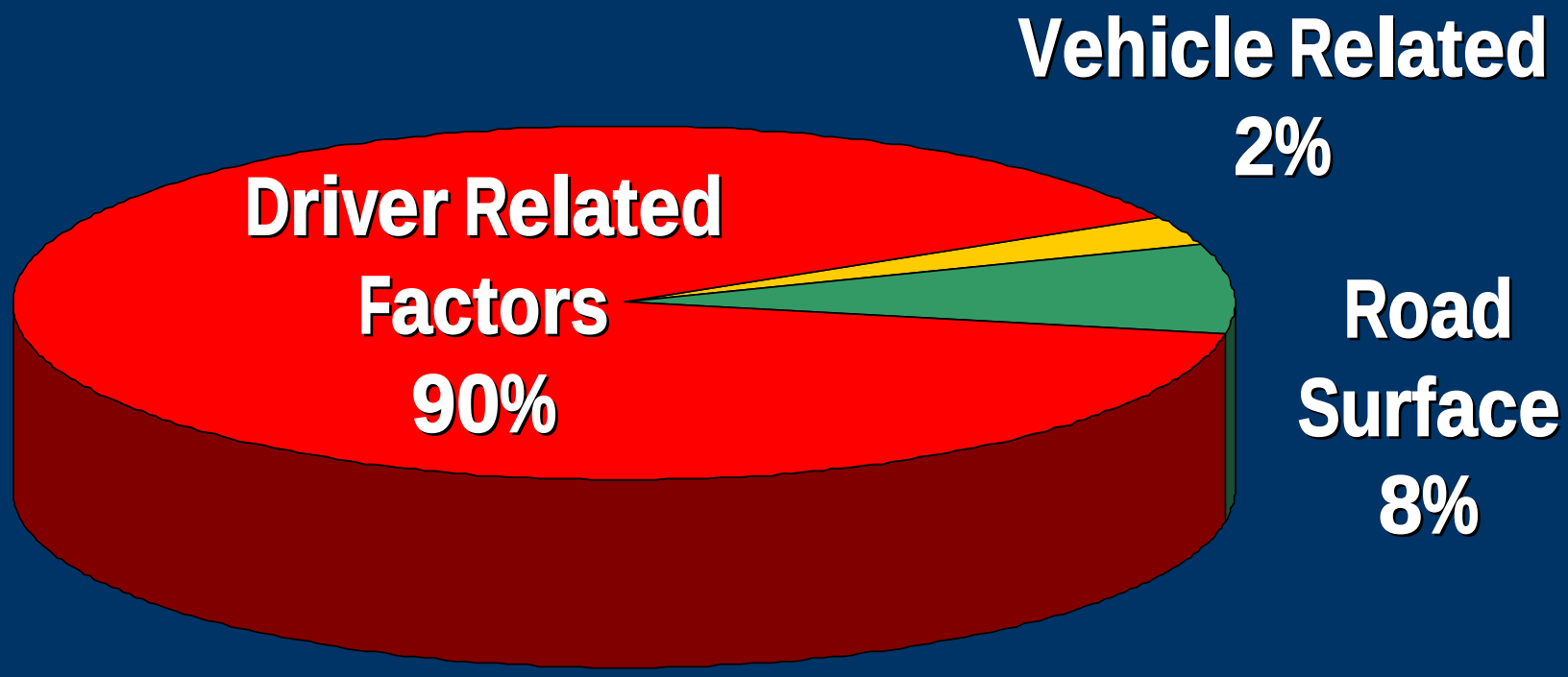


Rollover Front Side Rear Other

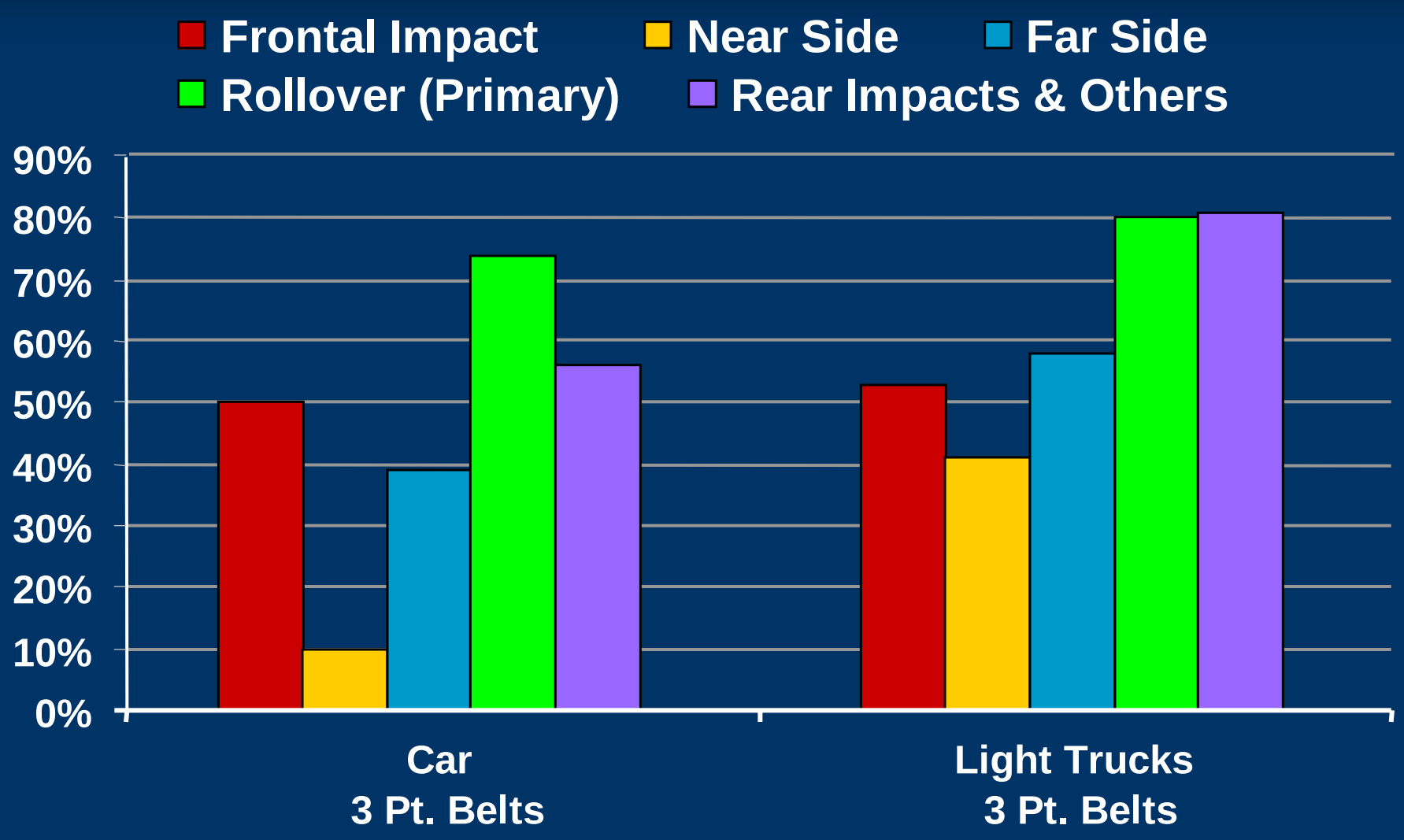
Crashes of all Severities



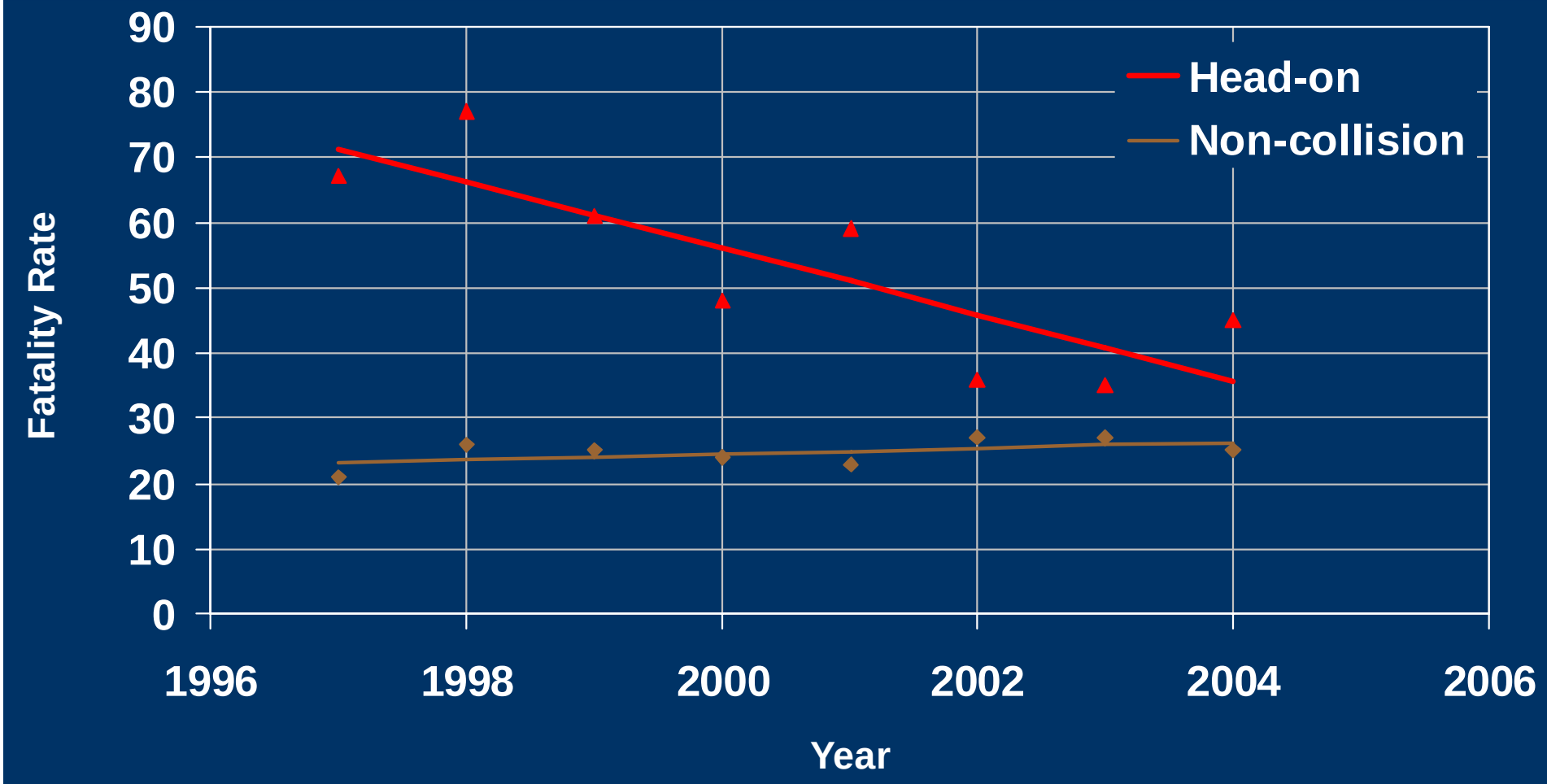
UPDATE
Crash Causal Factors



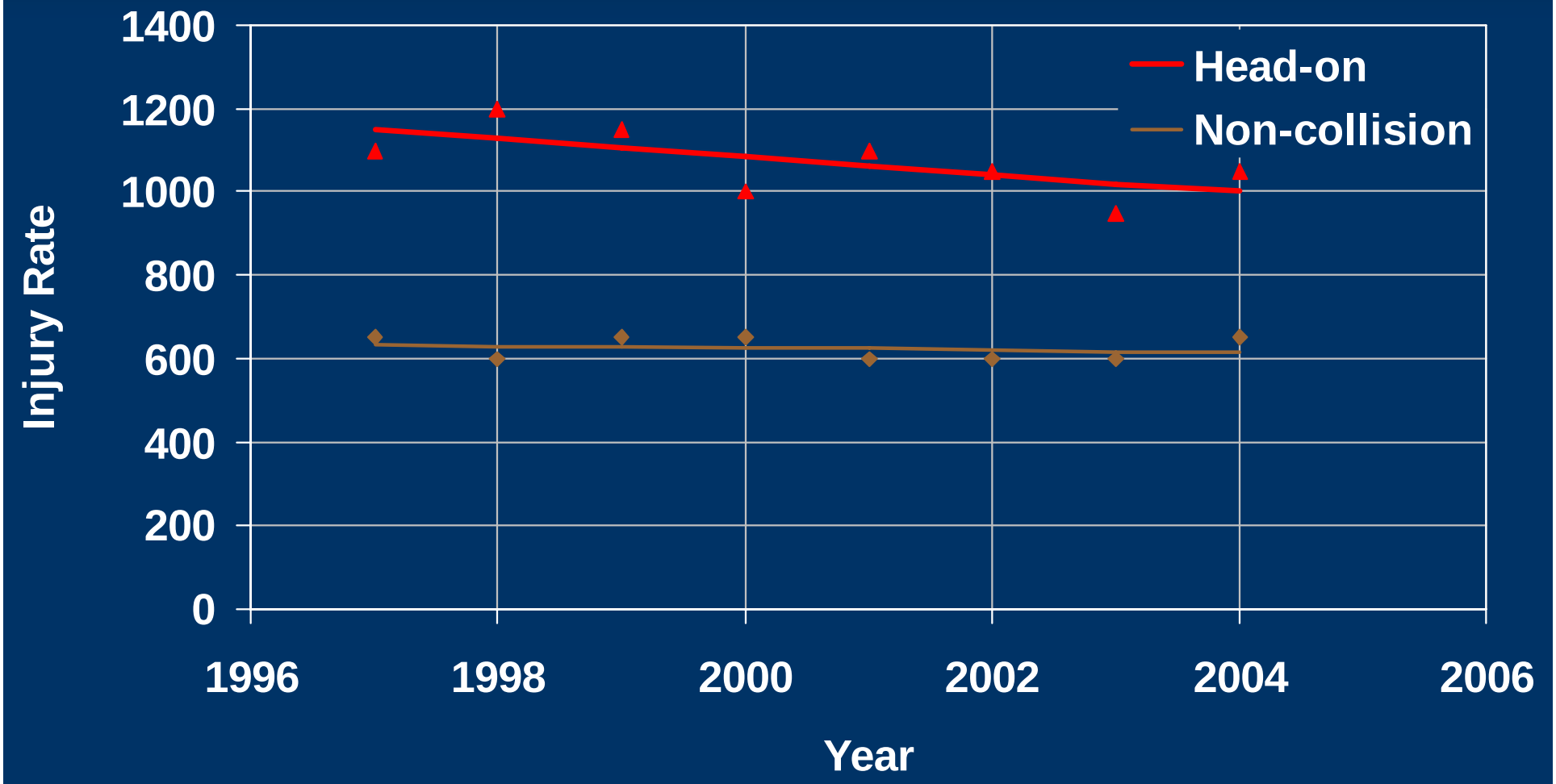
Effectiveness of Safety Belts



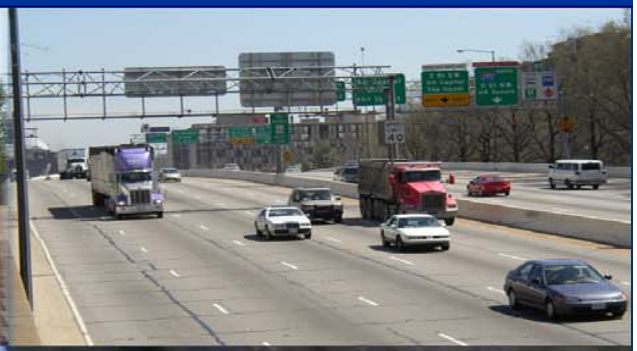
Fatalities per 1000 crashes (First Harmful Event)



Injuries per 1000 crashes (First Harmful Event)



Haddon Matrix

	Human	Vehicle	Environment
Pre-Event			
Event			
Post-Event			

Advanced Car Seating Restraint Systems

Data Collection

Why do we need EDRs ?

- **New technologies**
  - Stability control systems
  - Advanced air bags
  - Other devices that do not leave evidence
- **Better pre-crash data**
- **Better crash severity parameter estimates**
- **Better crash reconstruction**
- **Automated collision notification**

GM SDM Units
SDM-Sensing and Diagnostic Module

~5 inches

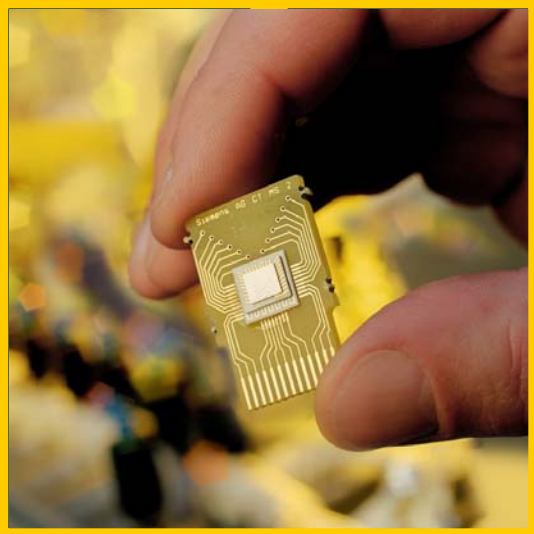
Cover removed

Alcohol Screening Systems

- System needs to be totally unobtrusive
- Nearly 100 percent accuracy essential
- Multiple sensing assures reliability

Tru touch skin biometric sensor

- Passive system that “sniffs” ambient air
- Applications include testing for alcohol in exhaled breath, vehicles, and other enclosed spaces



Siemens sensor technology to detect gases and smells

Integrated Safety Concept

Crash Time Line

Prevention | **Severity Reduction** | **Injury Mitigation** | **Medical Attention**

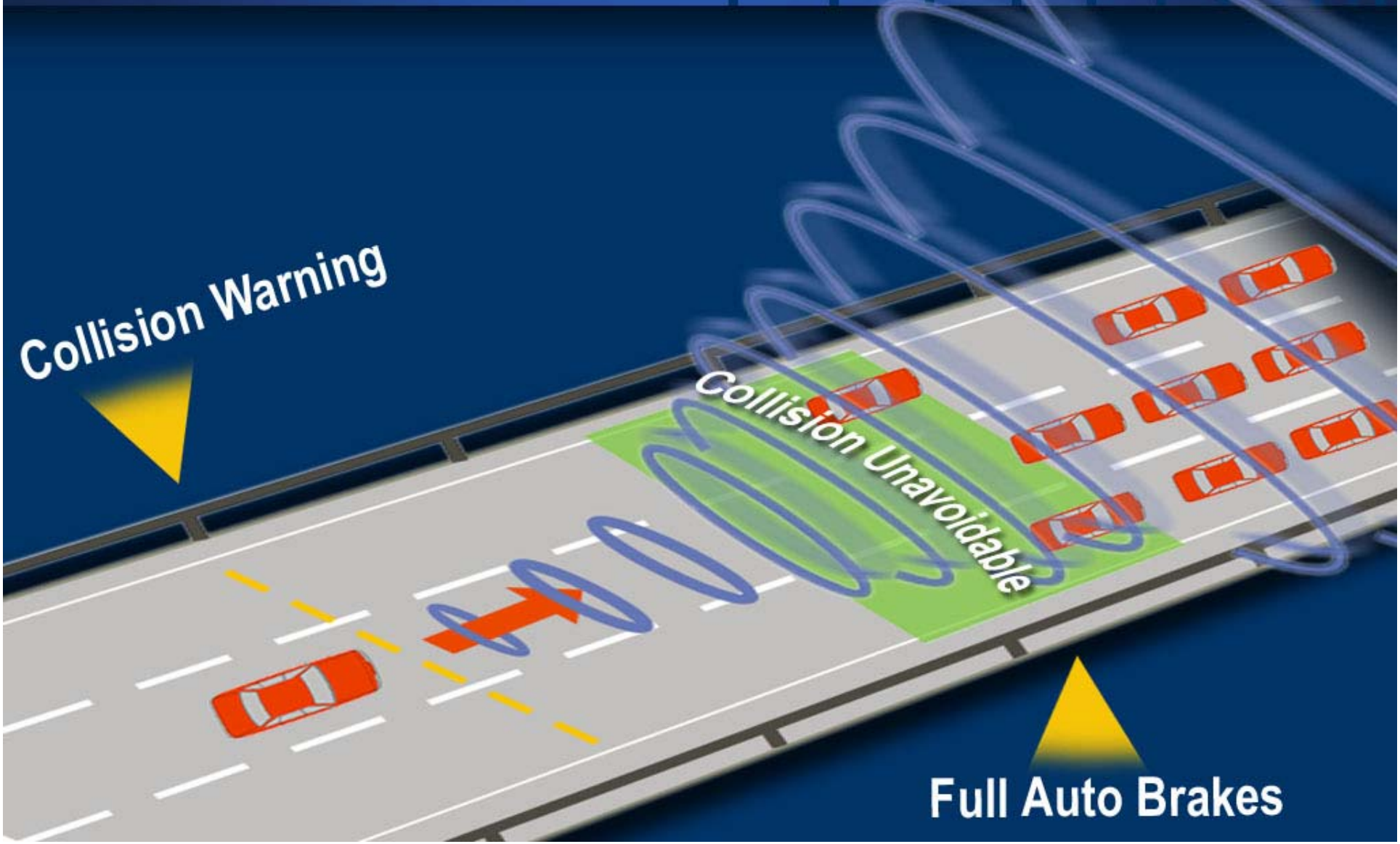
Warn → **Intervene** → **Protect** → **Notify**

- Pre-activated Restraints
- Pedestrian Protection
- Adaptive Structures
- Adaptive Restraints

- Enhanced Crash Notification
- Tailored Medical Attention

Developed by: Joseph N. Kanianthra

Collision Avoidance Concept



Automotive Technologies Timeline

Occupant Protection Systems

Adaptive Restraint System

Whip-Lash Protection

Reversible Belt Tensioners & Load Limiters

Occupant Readiness Monitoring

Belt Minders

Child Seat Mounting Systems

Comprehensive Restraint Systems **(belts & airbags)**

Energy Absorbing Structures

2006

2010

Automotive Technologies Timeline

Driver Warning & Driving Assistance Systems

Intersection Collision Avoidance Systems
Emergency Lane Assist
Road Departure Warning Systems
Co-Driver Systems
Lane Keeping Systems
Driver Alert Systems
Automotive Braking
Rear-End Collision Avoidance System
Braking Support
Pedestrian Collision Warning
Bluer Spot Warning
Lane Departure Warning Adaptive Cruise Control
Roll Stability Control
Intelligent Driver Information System
Electronic Stability Control
Antilock Brakes

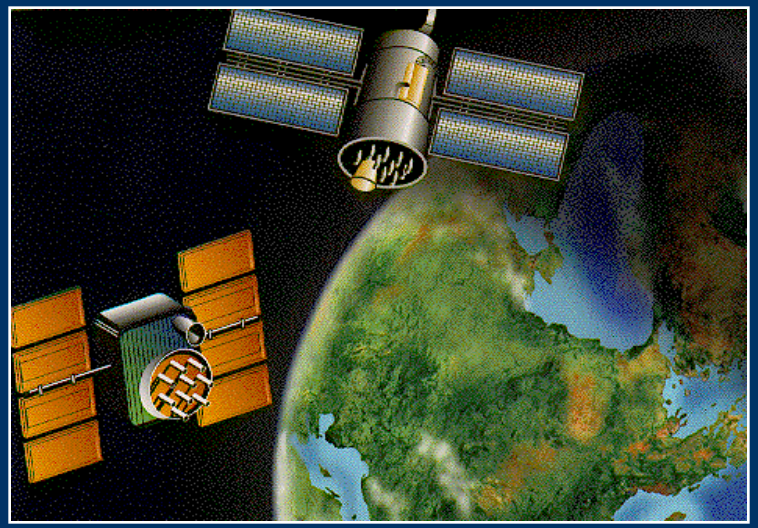
2006 2010 2014

The Challenge

How do we know if these systems, and others, improve or degrade safety?

Intelligent Transportation Systems (ITS)

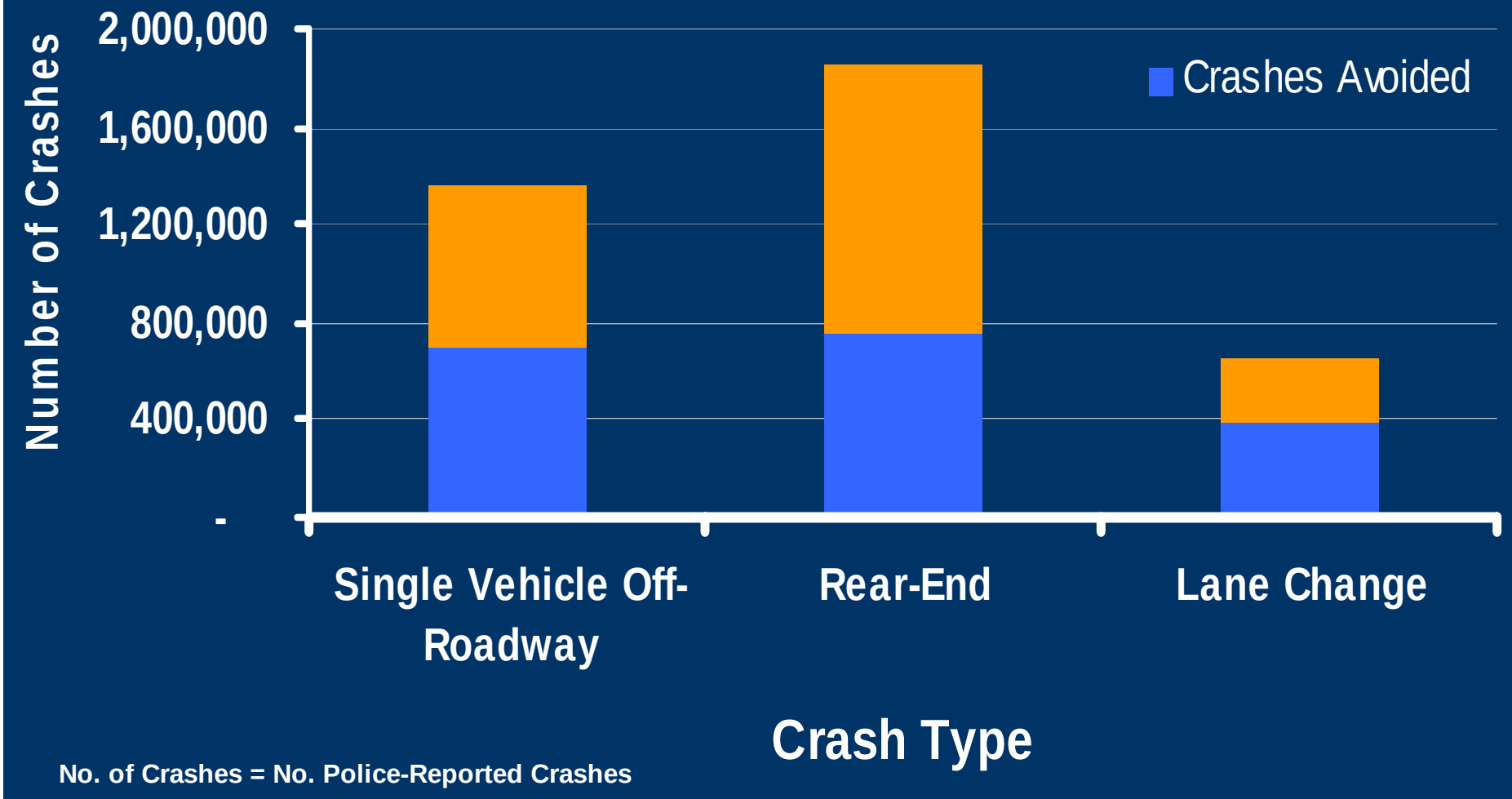
- Application of Advanced Technologies to Improve Transportation Safety and Mobility



Intelligent Vehicle Initiative (IVI)

- **The IVI Mission: Prevent Crashes, Fatalities and Injuries**
- **The Predecessor Program to VII**
- **Two Primary Goals**
  - Facilitate Accelerated Deployment of Crash Avoidance Systems
  - Prevent unintended Consequences
- **Four Vehicle Types Included: Light, Commercial, Transit and Specialty Vehicles**
- **Cooperative Program with the industry**

Safety Benefits Estimation of Crash Avoidance Systems Based on Experimental Data



No. of Crashes = No. Police-Reported Crashes

Recent Major Initiatives

Safety

Integrated Vehicle-Based Safety Systems

Cooperative Intersection Collision Avoidance Systems

Next Generation 911

Mobility

Integrated Corridor Management Systems

Mobility Services for All Americans

Clarus

Emergency Transportation Operations

Global Connectivity

Universal Electronic Freight Manifest

Crosscutting:

Vehicle Infrastructure Integration

Integrated Vehicle Based Safety Systems

- **Vision**
  - Develop Integrated collision avoidance systems to yield significantly improved effectiveness.
  - To accelerate introduction of integrated vehicle-based safety systems into the vehicle fleet
- **Approach**
  - Partner With Consortium of UMTRI, Honda, Kenworth, Visteon and Eaton.
  - Develop and Demonstrate Prototype Systems, Conduct a Field Operational Test to Assess Their Effectiveness and User Acceptance, Develop and Provide Tools to Support Deployment.

Cooperative Intersection Collision Avoidance Systems

- **Vision**
  - Develop Cooperative Intersection Collision Avoidance Systems
- **Approach**
  - Partner With Consortium of Vehicle Manufacturers and Infrastructure.
  - Develop and Demonstrate Prototype Systems, Assess Their Value and User Acceptance, Develop and Provide Tools to Support Industry Deployment.

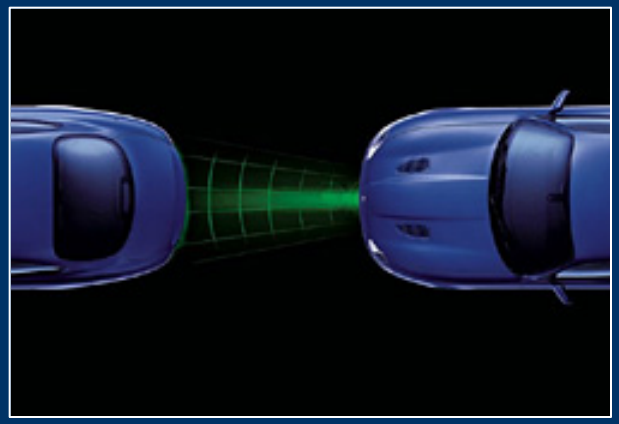
Vehicle Infrastructure Integration

- **Vision**
  - Nationwide Deployment of an Integrated Communications Infrastructure on the Roadways and Production Vehicles
- **Approach**
  - Convene a “VII Coalition”--Auto Manufacturers, AASHTO, USDOT--to Work Through Issues in the Technical, Policy, Business Models, and Outreach Areas.
  - Initiate a Program to Develop and Test Prototype Systems
  - Develop and Test Public Sector Applications
  - Develop Plan for Coordinated Deployment

Advanced Collision Avoidance Technologies (ACAT)

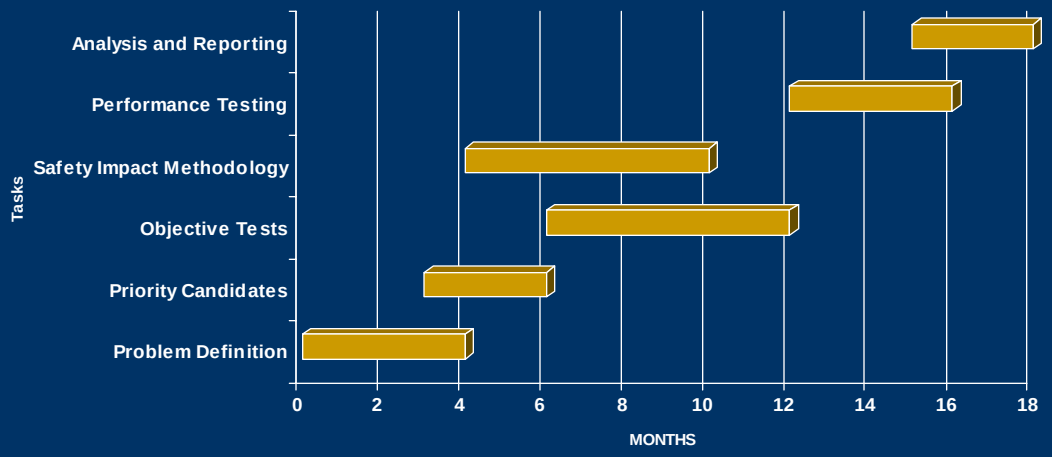
- **Determine the safety impact of new and emerging technologies**
- **This information may be used to help consumers understand:**
  - What advanced safety features are available?
  - Any unintended consequences?
  - How effective are they?

- **Emerging Technologies**
  - Electronic Stability Control
  - Adaptive Cruise Control
  - Night Vision Systems
  - Curve Speed Warning
  - Lane Departure Warning
  - Alcohol Monitoring
  - Brake Assist Systems
  - Pre-crash sensing



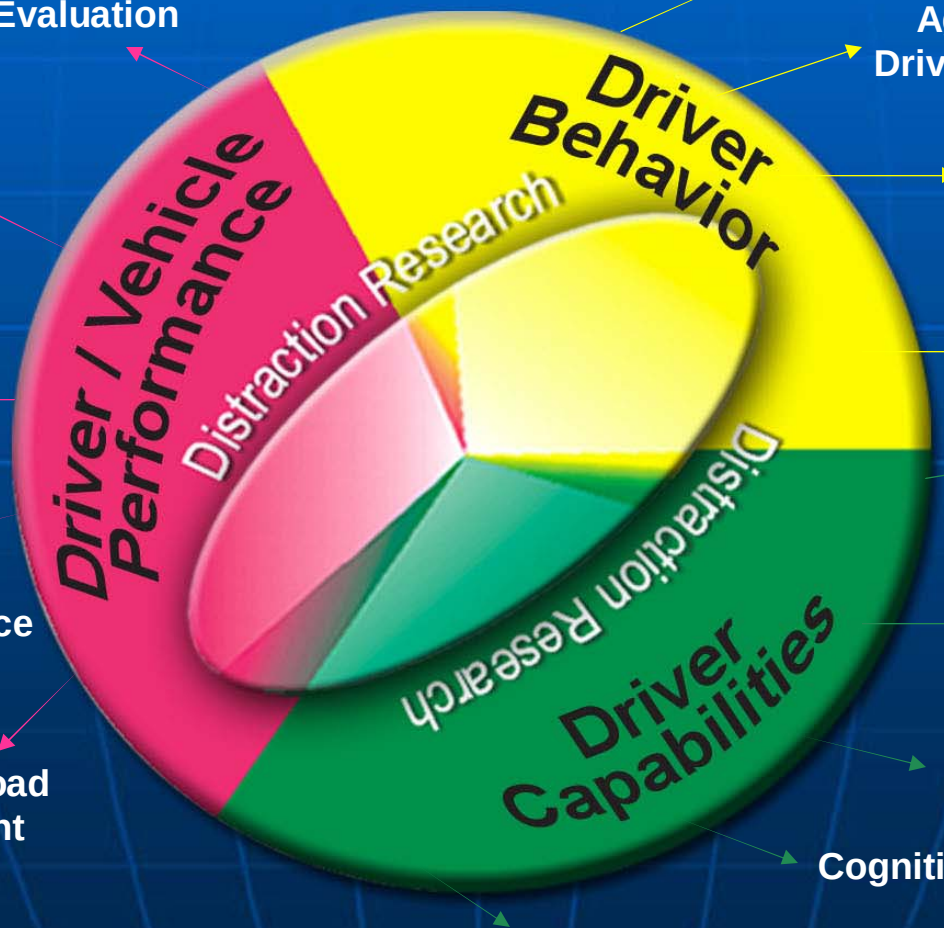
ACAT Funding and Procurement Status

- **Scope:**
  - 18 to 36 months
  - One or Two Initial Awards
  - Total Program Cost: $3m to $5m
- **Procurement Status**
  - RFA issued – next 30 days
  - Applications due 45 days
  - Awards by September 30



Technology Opportunities

Driver Vehicle Safety Research



Safety Impacting & Safety Critical In-Vehicle Technology Evaluation

Countermeasure Development

User Acceptance

System Integration for Optimum Performance

Driver Workload Management

Driver Training

Aggressive Driver Research

Behavior Modification Research

Demographic & Social Factors Research

Information Processing Research

Physical & Mental Capacity Assessment

Driving Task Demands

Cognitive & Attention Demand

Situation Awareness Capacity

Developed by: Joseph N. Kanianthra

Acceleration of Safety Technologies

- **Safety Needs Novel Approaches**
  - Crash Scenario Based Test Procedures
  - Use of Market Forces
  - Innovative regulatory approaches
  - Consumer information and education
  - Closer cooperation between Government and Industry