Motor Vehicle Safety Technology Development

The Road Ahead

An Industry View

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Executive Director
Vehicle Structure & Safety Integration
June 6, 2005

Trends and Themes

Trends

- Market Growth
- Product Globalization with Local Variants
- Global Over Capacity and Pricing Challenges
- Market Demands

Themes

- Public Health Challenge in Human and Economic Cost
- Pace of Technological Change
- Technology Integration
- Government Industry Collaboration

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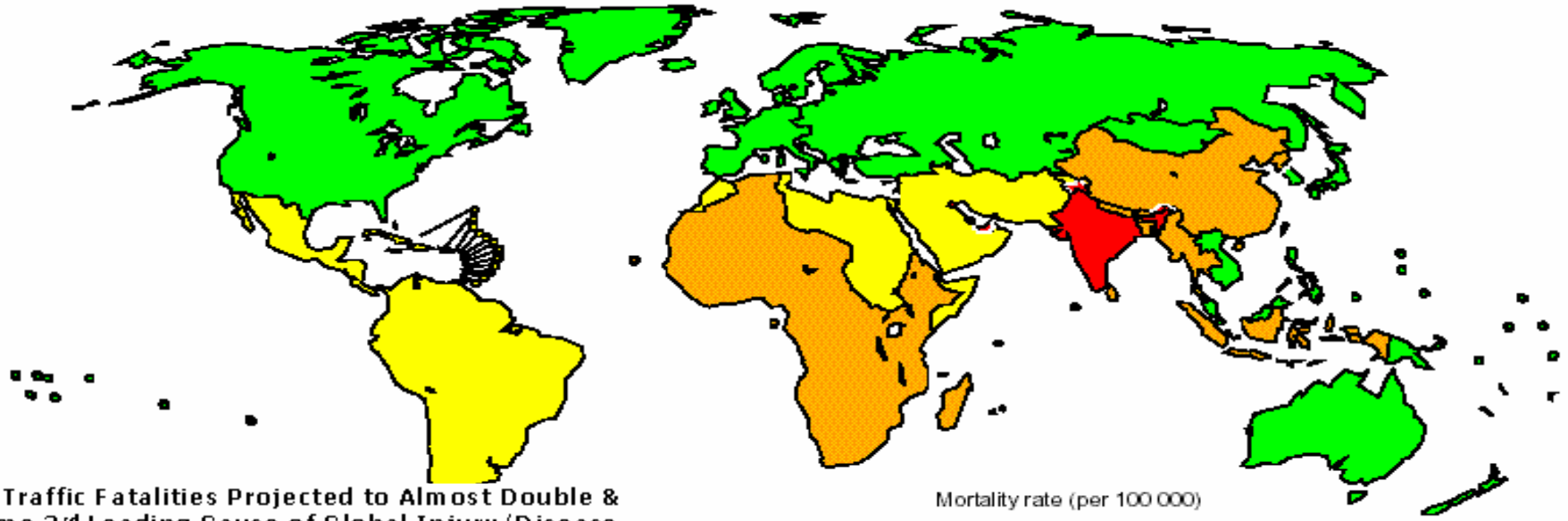
World Health Organization
Road Traffic Safety
The Next Decade



Road Traffic Fatalities Projected to Almost Double & Become 3rd Leading Cause of Global Injury/Disease

Rank	1998	2020
1	Lower respir. infections	Ischaemic heart disease
2	Perinatal Conditions	Unipolar major depression
3	Diarrhoeal Diseases	Road traffic crashes
4	HIV / AIDS	Cerebrovascular Disease
5	Unipolar depression	COPD
6	Ischaemic heart disease	Lower respir. infections
7	Cerebrovascular Disease	Tuberculosis
8	Malaria	War
9	Road traffic crashes	Diarrhoeal Diseases
10	Tuberculosis	HIV / AIDS

Source: Murray and Lopez, The Global Burden of Disease

Sources: World Health Organization (WHO), The Injury Chart Book, 2002;
WHO / World Bank / GRSP, World report on road traffic injury prevention, April, 2004;
A 5-year WHO strategy for road traffic injury prevention, 2002

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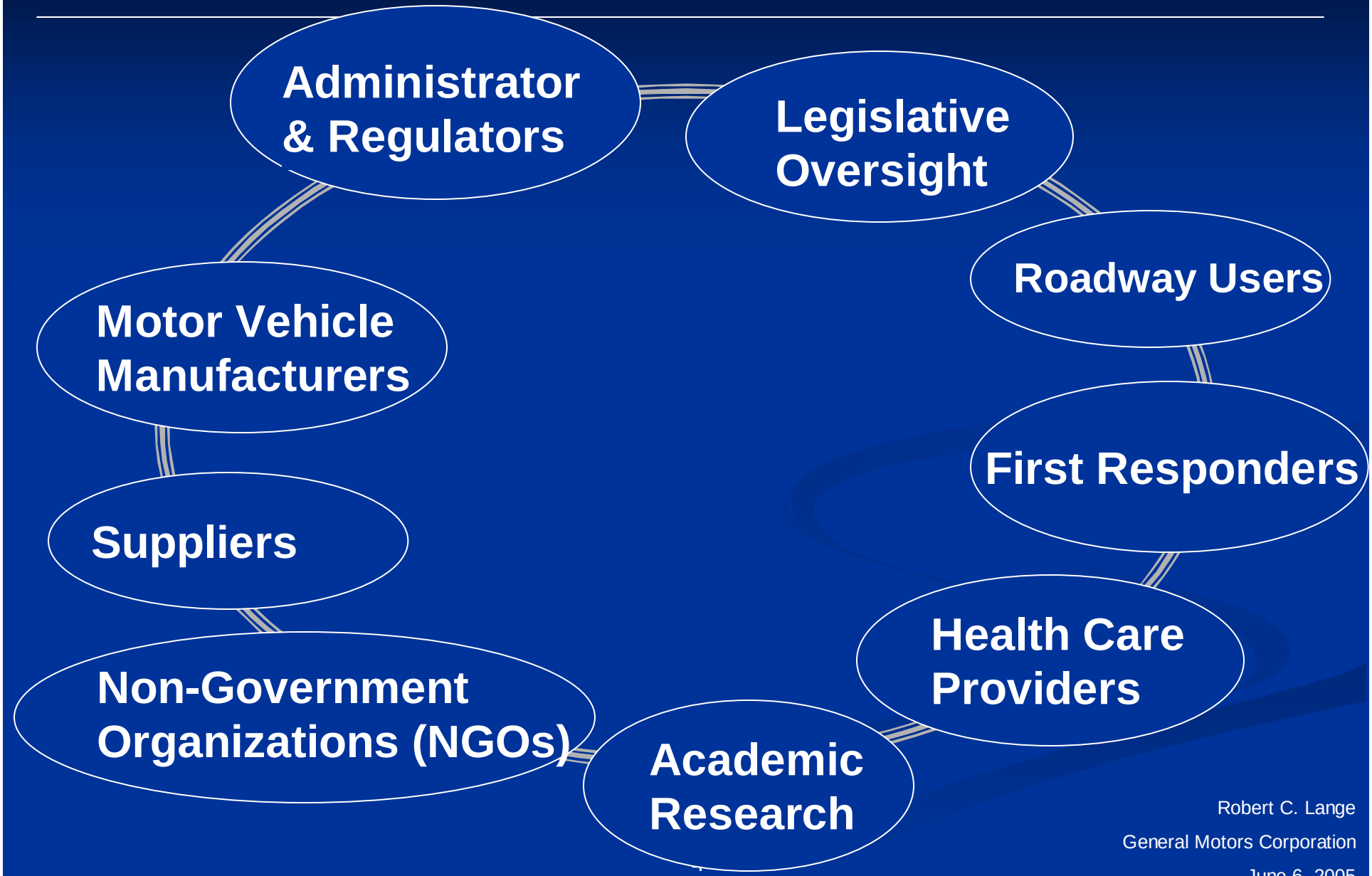
Partners in Injury Control



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Vision Statement

Zero Fatalities

Zero Crashes

Continuous Improvement

Target Reductions

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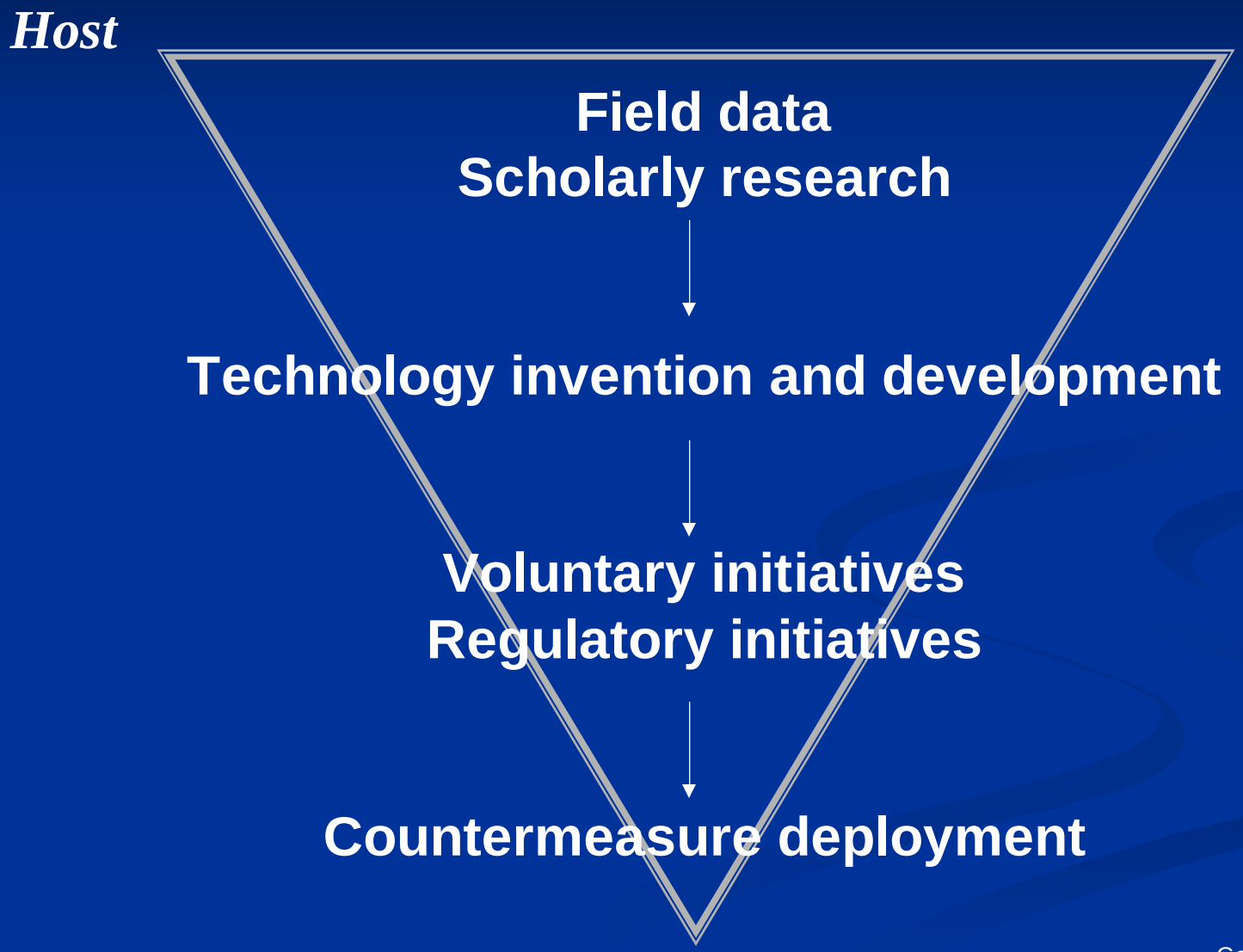
Injury Triangle and Antidote Development



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Haddon Matrix (modified)

Vehicle Dimension Only

Pre-Collision	Collision	Post-Collision
Normal Driving: Navigational Aid Traffic Information Dynamic Route Guidance Adaptive Cruise Control	Safety Belts Frontal Air Bags Side Air Bags Roof Rail Air Bags Rollover RRAB Pretensioners Knee Air Bags	ACN AACN Emergency Services
Avoidable Crashes: DRLs ABS, Traction Control, ESC Longitudinal Control Functions Belt Pretension		
Non-Avoidable Crashes: Brake Assist Vehicle Preconditioning		

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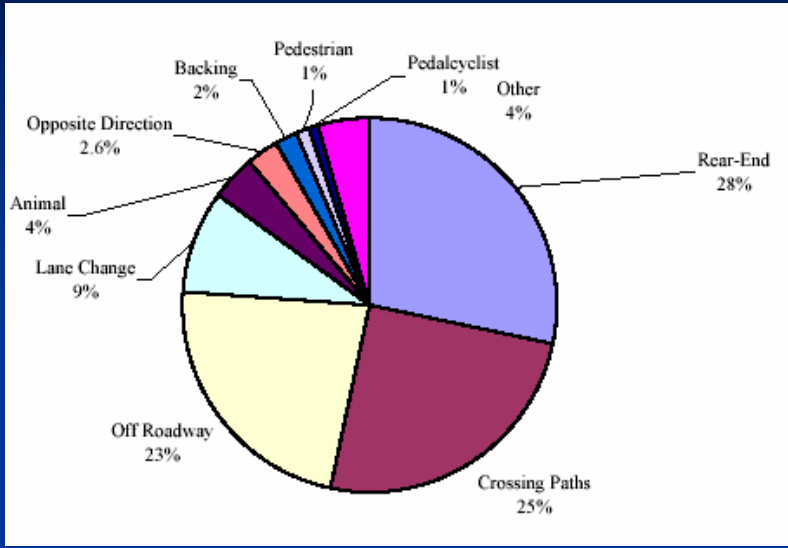
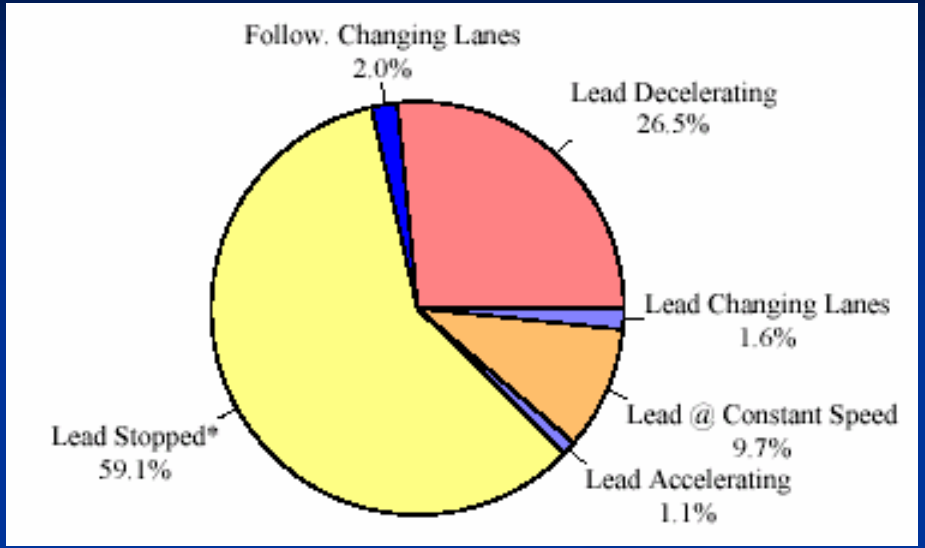
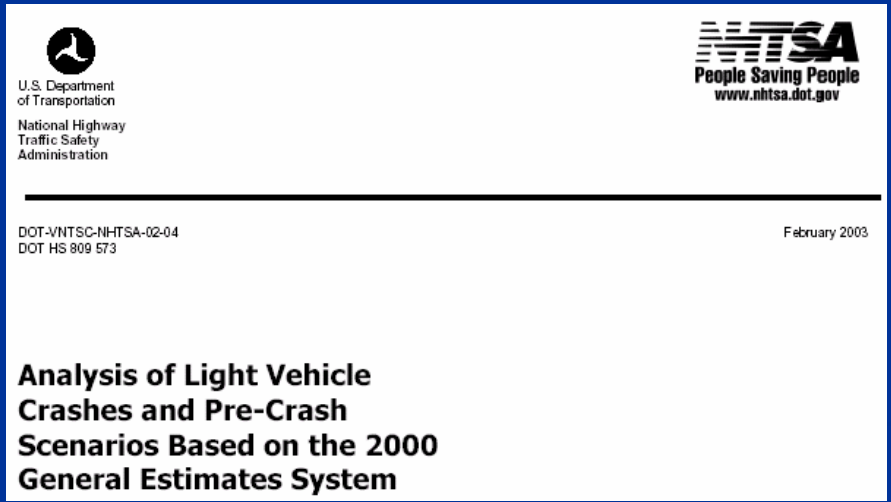
Crashes by Type



Share of Crashes by Type for All Vehicles



Distribution of Pre-Crash Scenarios for Rear-End Crashes of Light Vehicles



U.S. Department of Transportation

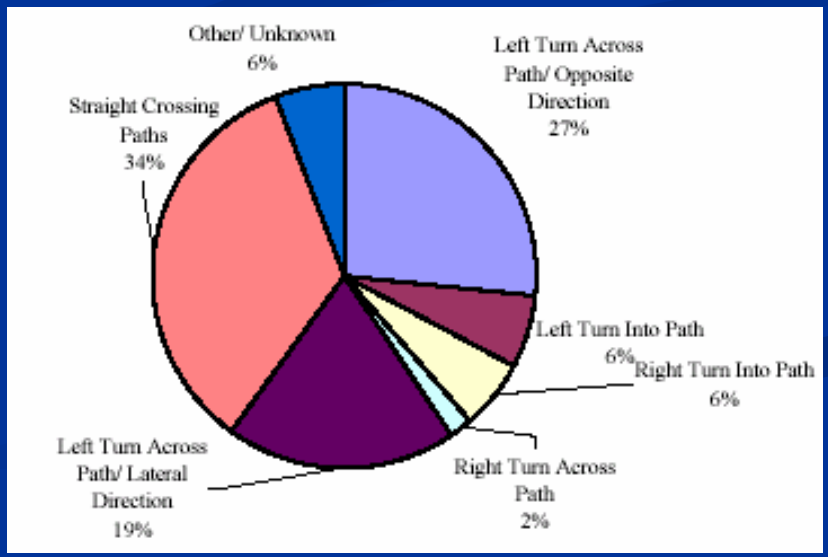
National Highway Traffic Safety Administration

NHTSA
People Saving People
www.nhtsa.dot.gov

DOT-VNTSC-NHTSA-02-04
DOT HS 809 573

February 2003

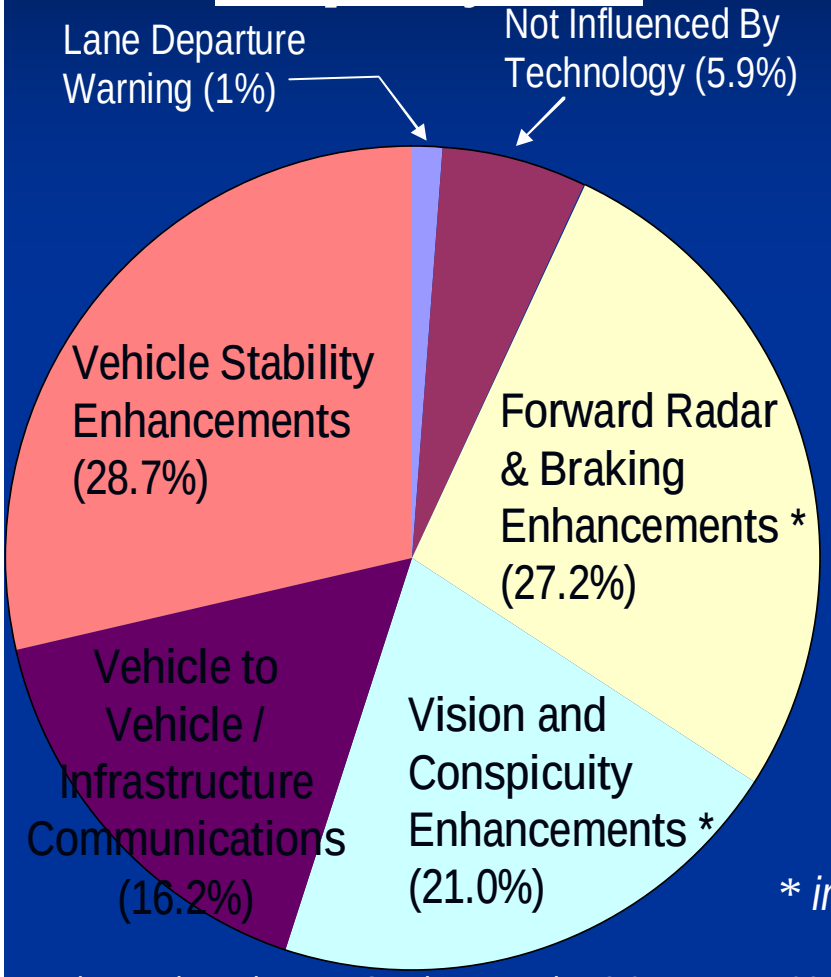
Analysis of Light Vehicle Crashes and Pre-Crash Scenarios Based on the 2000 General Estimates System



Distribution of Pre-Crash Scenarios for Cross Path Crashes of Light Vehicles

Technologies To Help Avoid A Crash

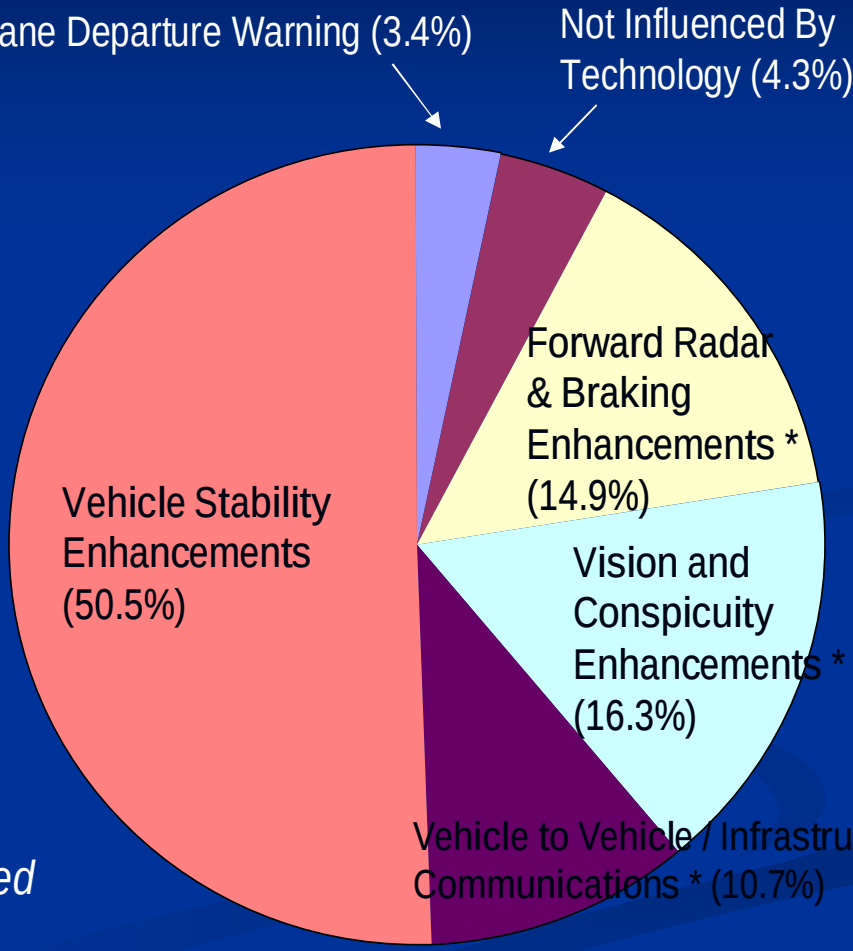
Frequency Base



* *inter-related*

Estimates based on '44 Crashes' Version 3.0 January 1997

Societal Harm



Estimates based on '44 Crashes' Version 3.0 January 1997

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The Vision

Vehicle Electronics, Controls, Software, Sensors and Actuators

+

Wireless Communications

+

Digital Maps and GPS

=

Real-Time Traffic Management

+

Improved Throughput

+

Enhanced Roadway Safety

+

Enhanced Energy Efficiency and Reduced Emissions

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Assessment of ESC Effectiveness

	Passenger Cars (NHTSA)	SUVs (NHTSA)	Passenger Cars & SUVs (IIHS)
Percent reduction in single vehicle crashes	35%	67%	41%
Percent reduction in fatal single vehicle crashes	30%	63%	56%

Source: *Preliminary Results Analyzing the Effectiveness of Electronic Stability Control (ESC) Systems.* National Highway Traffic Safety Administration, 2004

Source: *Effects of Electronic Stability Control on Automobile Crash Risks.* Insurance Institute for Highway Safety, 2004

All GM SUVs and vans will have StabiliTrak standard by the end of 2007. It will be standard on all GM cars and trucks sold to retail customers by the end of 2010.

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Forward Collision Warning

Surprise Trial Studies
(Task 2 & 3a)

TTC Judgment Study
(Task 2)

First Look Study
(Task 2)

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Warning and Assist Functions

Seamless Longitudinal Warning & Assist Functions

	Sensors				Actuators		Enabled functions				
	Short Range Object Detection	Maps	Vision	Long Range Object Detection	Upgraded Brake Actuation	Motorized Belt					
Front							ABS/ESP	Brake Assist 1	Brake Assist 2		
				x	x		ACC	ACC Stop	ACC S&Follow		
				x	x	(x)	FCW	FCA	Precrash 1, 2	VCC	
			x	x	x		ACC ve		ACC S&F ve		
			x	x	x	(x)	FCW ve	FCA ve	Precrash ve	VCC ve	+ Optimized DAB/PAB/KB
		x	(x)	x	x		IACC	ACC S me	ACC S&F me		
		x	(x)	x	x		FCW m(v)e	FCA m(v)e			
	x		(x)	x	x	(x)			ACC S&G (1,2)		
	x	x	x	x	x	(x)			ACC S&G me		
	x		(x)	x	x	(x)	FCW +	FCA +	Precrash +	VB (1,2)	+ Optimized DAB/PAB/KB
	x		x			(x)			Precrash		+ Optimized DAB/PAB/KB
Rear	x		(x)			(x)	RPA	RPA + NPA	RPA+SAPA	RPA+APA	
	x		x			(x)	RBW	RBA	R-Precrash	R-VCC / R-VB	+ Optimized DAB/PAB/KB
	x		x			(x)			R-Precrash	R-Crash	+ Optimized DAB/PAB/KB

Lateral Warning Functions

Sensors				Actuators		Enabled functions		
Rear Vision Object Detection	Side Long Range Object Detection	Side Short Range Object Detection	Front Vision	Active Front Steer	Motorized Belt			
			x			LDW		
			x	x		HC	LK	
		x			(x)	SOD	SOD+SP	+Optimized RRAB/TB
	x	x				LCW		

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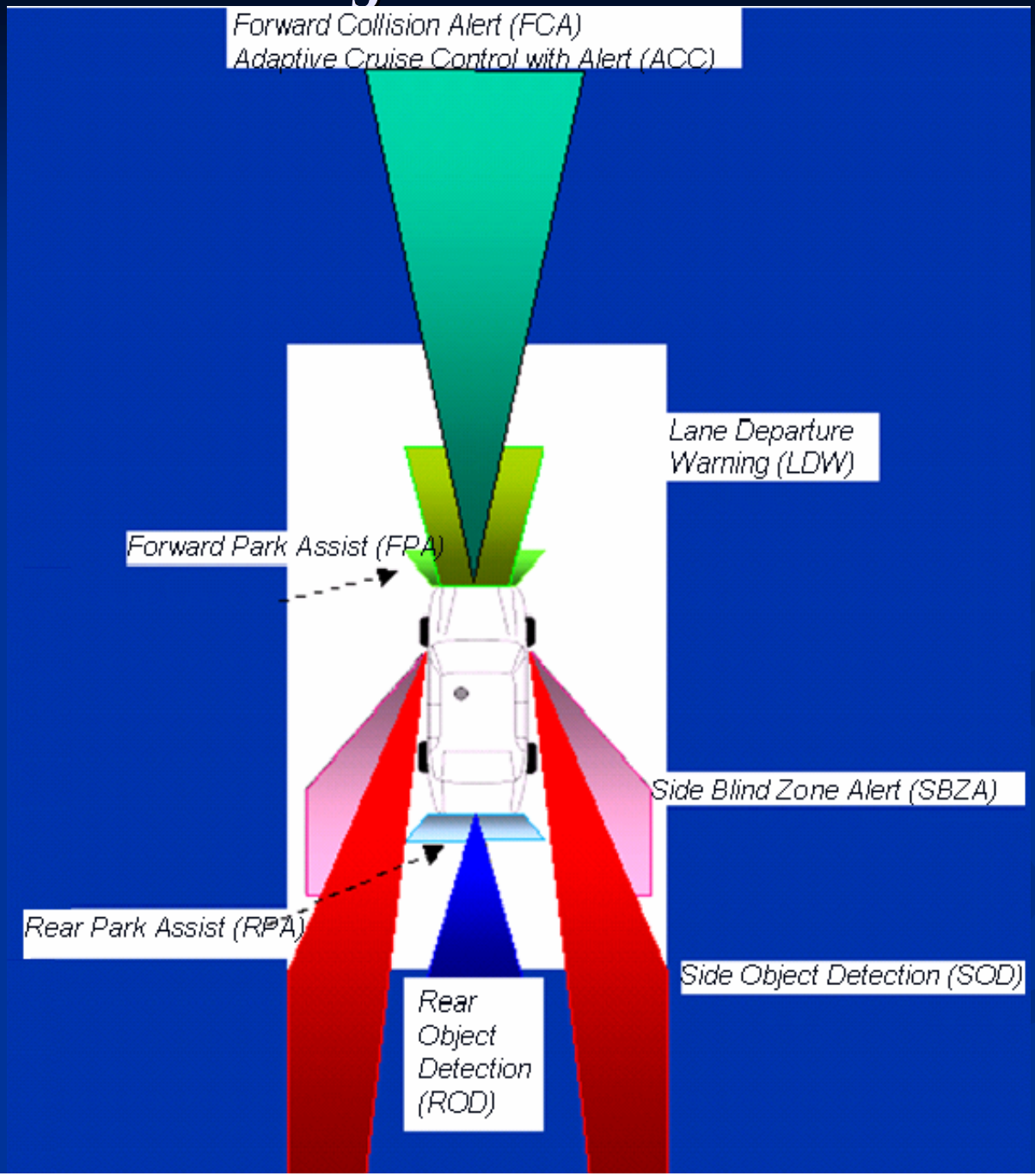
Lateral and Longitudinal Control Technologies



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Vehicle Safety Communications

Identified potential benefits of vehicle safety applications enabled or enhanced by short range communication technologies.

Assessed the communication requirements, including vehicle-vehicle and vehicle-infrastructure modes.

Contributed to DSRC standards to ensure they effectively support safety (IEEE lower layer & SAE message set).

Developed ‘Next Generation’ DSRC Testing Platform.

Conducted testing to assess proposed DSRC standards for potential to effectively support vehicle safety applications.

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Safety Use Cases

Communications Between Vehicle and Infrastructure

- Blind Merge Warning
- **Curve Speed Warning**
- Emergency Vehicle Signal Preemption
- Highway/Rail Collision Warning
- Intersection Collision Warning
- In Vehicle Amber Alert
- In-Vehicle Signage
- Just-In-Time Repair Notification
- **Left Turn Assistant**
- Low Bridge Warning
- Low Parking Structure Warning
- Pedestrian Crossing Information at Intersection
- Road Condition Warning
- Safety Recall Notice
- SOS Services
- **Stop Sign Movement Assistance**
- Stop Sign Violation Warning
- **Traffic Signal Violation Warning**
- Work Zone Warning

Communications Between Vehicles

- Approaching Emergency Vehicle Warning
- Blind Spot Warning
- Cooperative Adaptive Cruise Control
- Cooperative Collision Warning
- **Cooperative Forward Collision Warning**
- Cooperative Vehicle-Highway Automation System
- **Emergency Electronic Brake Lights**
- Highway Merge Assistant
- **Lane Change Warning**
- Post-Crash Warning
- **Pre-Crash Sensing**
- Vehicle-Based Road Condition Warning
- Vehicle-to-Vehicle Road Feature Notification
- Visibility Enhancer
- Wrong Way Driver Warning

Highest ranking applications based on safety benefit estimates using '44 Crashes'

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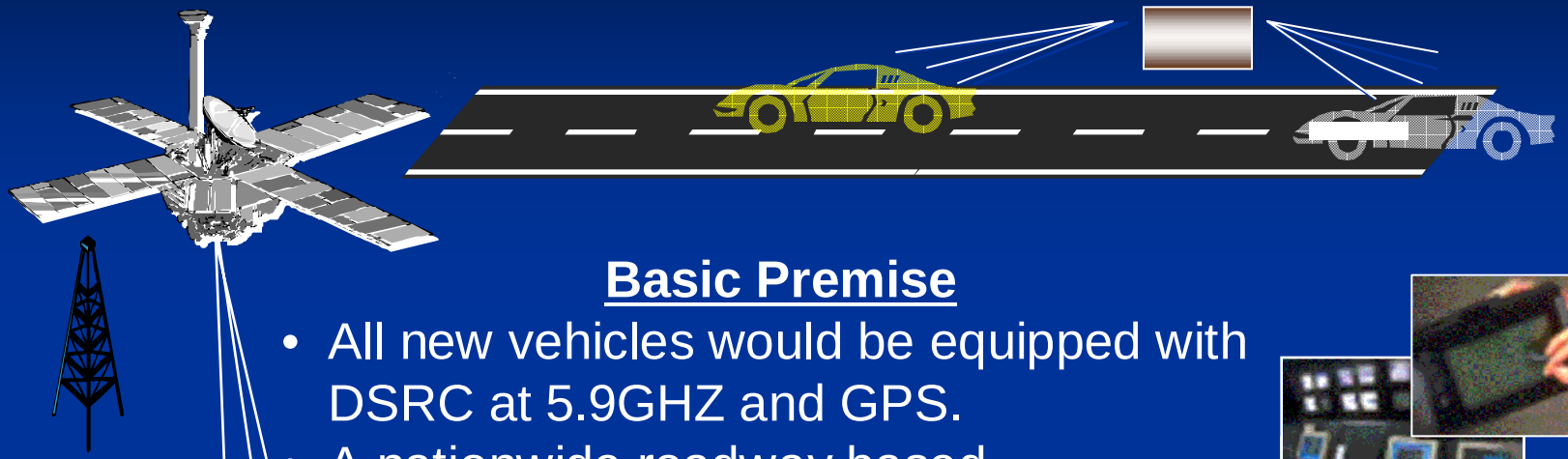
Vehicle Infrastructure Integration

Creating an "enabling communication infrastructure"



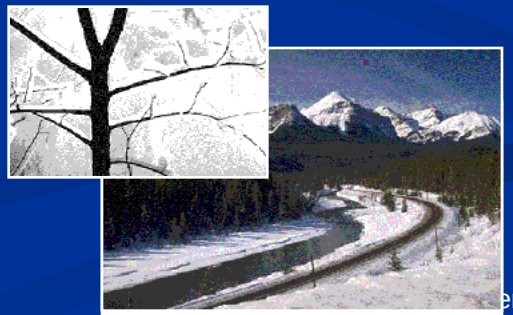
Basic Premise

- All new vehicles would be equipped with DSRC at 5.9GHZ and GPS.
- A nationwide roadway based communications network will be created.

Traveler Information

Intersection Collision Avoidance

Traffic Management



Weather Sensing

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