The Future of Vehicle Safety

Presented at the University of Minnesota CTS Winter Luncheon 2008

Ron Medford
Senior Associate Administrator, Vehicle Safety
Top 10 Leading Causes of Death in the United States for 2004, by Age Group

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause and Number of Deaths</th>
<th>All Ages</th>
<th>Years of Life Lost[^2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Malignant Neoplasms 147,932</td>
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<td>8,741,953</td>
</tr>
<tr>
<td>2</td>
<td>Malignant Neoplasms 145,745</td>
<td>145,745</td>
<td>8,659,801</td>
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<tr>
<td>3</td>
<td>Heart Disease 120,223</td>
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<td>7,612,763</td>
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<td>4</td>
<td>Heart Disease 119,036</td>
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[^2]: Years of life lost are based on the life expectancy at age 65 for any cause of death.

Note: The cause of death classification is based on the National Center for Health Statistics (NCHS)/CDC, Mortality Data 2004.
Motor Vehicle Traffic Crashes 2006

- 42,642 fatalities
- 1.42 fatalities per 100million VMT
- 2,575,000 injuries
$230 billion total
- $32 billion medical cost
- $51 billion for impaired driving
- $17.5 billion for failure to use belts ('03)

Source: *The Economic Impact of Motor Vehicle Crashes, 2000*
Vehicle Miles Traveled
1966 – 2006 (in Billions)

Source: FHWA
Persons Killed and Rate

Source: FARS and FHWA
Motor Vehicle Crash & Injury Rates
Police Reported

Source: 2004 Annual Assessment
Crashes of all Severities
2005 GES

- Off-Roadway: 23%
- Rear-End: 28%
- Crossing Paths: 25%
- Lane Change: 9%
- Pedestrian: 1%
- Pedalcyclist: 1%
- Other: 4%
- Animal: 4%
- Opposite Direction: 2%
- Backing: 2%
Passenger Car / Light Truck Fatalities
2006 FARS

Passenger Car

- 13% Noncollision
- 13% Impact with Non-fixed Object
- 18% Impact with Fixed Object
- 1% Other/Unknown
- 5% Rear Impact with Another MV
- 18% Side Impact with Another MV
- 32% Frontal Impact with Another MV

Light Truck

- 23% Noncollision
- 13% Impact with Non-fixed Object
- 12% Impact with Fixed Object
- 1% Other/Unknown
- 9% Side Impact with Another MV
- 5% Rear Impact with Another MV
- 37% Frontal Impact with Another MV
The Crash Timeline - Prevention

Volvo forward collision warning
The Crash Timeline – Severity Reduction

PREVENTION  SEVERITY REDUCTION  INJURY MITIGATION  MEDICAL ATTENTION

-1000  -500  VEHICLE / EVENT
The Crash Timeline – Injury Mitigation

PREVENTION

SEVERITY REDUCTION

INJURY MITIGATION

MEDICAL ATTENTION

VEHICLE / EVENT

0 200 msec.
# The Crash Timeline – Medical Attention

<table>
<thead>
<tr>
<th>PREVENTION</th>
<th>SEVERITY REDUCTION</th>
<th>INJURY MITIGATION</th>
<th>MEDICAL ATTENTION</th>
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<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
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</table>

## ENVIRONMENT / POST EVENT

![Image](image5.png)
Lives Saved by Belts and Combined Safety Technologies - 1960-2002

Lives Saved
By All Other Safety Features
Lives Saved By Safety Belts Alone

Total Lives Saved 328,551

Source: NHTSA
Safety Belt Use Rates in US

1% Increase in Belt Use Saves 268 Lives in US
Effectiveness of Safety Belts

Source: “Fatality Reduction by Safety Belts For Front-Seat Occupants of Cars And Light Trucks,” Charles J. Kahane, Ph.D, December 2000, DOT HS 809 199
NCAP Revisions

- Improved crashworthiness ratings
- Introduction of crash avoidance and advanced technologies
Side Impact

- **Updated FMVSS No. 214**
  - Provide greater head and chest protection
  - We estimate that this final rule will prevent at least 266 fatalities and 352 serious injuries a year when fully implemented throughout the light vehicle fleet

- **Pole test**

- **New dummies**
Crash Types
2005 GES and FARS

- These 4 crash types = 85% of all crashes
  - Run-Off-Road (23%)
  - Rear-End (28%)
  - Lane Change (9%)
  - Crossing Path (25%)

- And ~75% of all fatalities
  - Run-Off-Road (41%)
  - Rear-End (5%)
  - Lane Change (4%)
  - Crossing Path (14%)
Crash Causal Factors

- Driver Related Factors: 90%
- Vehicle Related: 2%
- Road Surface: 8%

Evolution of Vehicle Electronics

Crash Avoidance and Injury Mitigation

The Future

Information
Augment driver performance
- Adaptive cruise control
- Brake assist
- Drowsy-driver monitoring
- Night Vision
- Warnings of specific types of impending crash; such as rear-end, lane/road departure, intersection, etc.

Take control of the vehicle
- Intervene when driver action would be insufficient to prevent a crash (ESC and Rollover prevention)
- Alcohol detection

Augment other vehicle systems
- DSRP - vehicle to vehicle communications
Rollover 2006 Data

- **R/Os account for (pass vehicles):**
  - ~3% of the crashes
  - ~35% of occupant fatalities

- **10,698 killed**
  - 8,826 in single vehicle crashes

- **Percent occupant fatalities result from R/O crashes**
  - 59% SUV occupants deaths from R/O
  - 47% pickup occupant deaths from R/O
Rollover Activities

- Safety Belts
- Electronic Stability Control
- NCAP Rollover Prevention
- Ejection Mitigation
- Roof Strength
### Effectiveness of ESC

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Percent Reduction for Single Vehicle Crashes</th>
</tr>
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<tr>
<td><strong>State Data (5 states)</strong></td>
<td></td>
</tr>
<tr>
<td>1997 – 2002 Single Vehicle Crashes</td>
<td></td>
</tr>
<tr>
<td>Passenger Cars</td>
<td>35%</td>
</tr>
<tr>
<td>SUV’s</td>
<td>67%</td>
</tr>
<tr>
<td>Passenger Cars</td>
<td>30%</td>
</tr>
<tr>
<td>SUV’s</td>
<td>63%</td>
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Longer Term
New ITS Safety Initiatives

- Integrated Vehicle-Based Safety Systems (IVBSS)
- Intersection Crash Prevention Systems (CICAS)
- Vehicle-Infrastructure Integration (VII)
- Next generation 911
Integrated Vehicle-Based Safety Systems

- Integrates into the same platform
  - Rear-end collision avoidance
  - Road departure crash prevention
  - Lane change and merge systems
Cooperative Intersection Collision Avoidance Systems (CICAS)

- Every year at intersections:
  - 9,100 Fatalities
  - 1,500,000 Injuries
  - 3,000,000 Crashes

- To develop and demonstrate cooperative intersection collision avoidance systems

- To assess the value and acceptance of collision avoidance systems that utilize cooperative communication
Vehicle Infrastructure Integration (VII)

- Facilitates implementation of FCC allocation of frequency at 5.9 GHz for safety communication
- Creating an “enabling communication infrastructure”
- Emphasis on safety applications
- Potential to reduce congestion
Crash Mitigation
What can Advanced Technologies do to Help Reduce Injuries?

- Take control of the vehicle to mitigate the severity of a crash
  - Automatic braking
  - Automatic steering
  - Belt pre-tensioners
  - Close windows

- Prepare restraint systems for a pending crash
  - Improves the performance of restraint systems in preventing or mitigating the severity of injuries
Post Crash
What can Advanced Technologies do to Help Improve Outcomes?

- **Automatic Collision Notification**
  - Calls for help

- **Advanced ACN**
  - Assesses crash severity
  - Transmits urgency information (Severity of crash which is related to possible injuries)

- Improves crash occupant triage

- Event Data Recorders (EDR)
Advanced Technology

What level of reliability is needed to:

- Convince consumers that they’ll work and be worth the money
- Convince manufacturers to put them in their vehicles

How much of the safety technical function can be taken away from consumers without causing false reliance?
NHTSA’s Role

- Continue to encourage the refinement and integration of advanced technologies through ITS
- Evaluate technology effectiveness
- Help ensure minimum performance
- Educate consumers
- Encourage the market (e.g. NCAP) where appropriate
- Regulate (e.g. ESC) where appropriate
Alcohol-Related Fatalities & Rate (per 100M VMT) 1982 – 2006
Drivers (Veh & MC) Involved In Fatal Crashes with Positive BACs, 2006

![Bar chart showing the number of drivers involved in fatal crashes with different BAC levels. The median BAC in 2003 is 0.16 and the legal limit in 50 states is indicated.]

Source: 2006 Annual Assessment
Development of Advanced Alcohol Sensing Technology

- Cooperative research and development effort
  - NHTSA and Automotive Coalition for Traffic Safety (ACTS)

- 5-Year effort
  - NHTSA contributing up to $1M per year with ACTS matching or exceeding NHTSA’s contribution

- Concept
  - In-vehicle capability to detect impairment before vehicle can be operated

- Significant technical and public acceptance challenge
Potential Technical Areas of Promise

- Volpe conducted a technology review
- Potential technologies include:
  - Breath Alcohol Ignition Interlock Device (BAIID)
  - Tissue Spectroscopy
  - Transdermal Detectors
  - Ethanol Vapor Detectors
  - Occular Measures
SAAB Alchokey & P.A.S. III Alcohol Screening System

- Is an adaptation of an anti-theft system
- Includes a mouthpiece at the end of the key fob, in which a driver blows
- If alcohol is detected, it will not allow the engine to start (i.e., interlock)
- Passive system that “sniffs” ambient air
- Applications include testing for alcohol in exhaled breath or vehicles/other enclosed spaces, or over open containers
Vehicle technologies that can detect distraction/impairment are being developed.
What is the appropriate action if the vehicle detects an impaired driver during operation?
August 2007 – Nissan announced a concept car featuring multiple preventative features.

Intermediate Steps with Advanced Technology

- Alcohol Odor Sensors
- Facial Recognition System
Heavy Truck Fatalities
2006 FARS

- **Noncollision Impact with Non-fixed Object**: 10%
- **Impact with Fixed Object**: 4%
- **Other/Unknown Impact with Another MV**: 1%
- **Rear Impact with Another MV**: 15%
- **Frontal Impact with Another MV**: 46%
- **Side Impact with Another MV**: 12%
- **Fatalities**:
  - Truck Occupants: 805
  - Other Vehicle Occupants: 3,766
  - Non-occupants: 424
Rulemaking expected in late ’08
NHTSA is currently researching benefits of
  • Yaw stability systems
  • Roll stability systems
  • Yaw + roll stability systems
Heavy Truck Tires

- Upgrade to FMVSS 119 in ’08
  - Upgrade endurance test
  - Add new high speed test

- Agency initiated truck tire testing in 2003 in support of this upgrade
Heavy Truck Tractor Stopping Distance

- **Upgrade to FMVSS 121 in ’08**
  - Substantial reductions in stopping distance are achievable with current technology

- **Estimate 20 to 30 percent reduction in stopping distance**
Motorcycle Riders Killed and Rate

In 2006, per registered vehicle, the fatality rate for motorcycle riders was 5.5 times higher than the fatality rate for passenger vehicle occupants.

Source: NCSA
Motorcycle Rider Fatalities
by Age Group and Year

Source: 2004 Annual Assessment
DOT Motorcycle Action Plan

- New national standards for entry-level rider training
- Curb counterfeit helmet labeling
- Motorcycle-specific road improvements
- Provide training to law enforcement officers on their role in reducing motorcycle crashes
- PSA featuring Secretary Peters discussing safe riding techniques
Thank you!