UNITED STATES GOVERNMENT STATUS REPORT

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United States

State of Motor Vehicle Crashes

In 2007, 41,059 fatalities occurred in the U.S. as a result of motor vehicle crashes. This is contrasted with the 54,589 people who were killed in traffic crashes in 1972 and 39,250 in 1992, the highest and lowest in the past 35 years.

The fatality rate per 100 million VMT in 2007 was 1.36, the lowest recorded in the U.S. This is contrasted to 5.5 fatalities per 100 million VMT in 1966, the highest in the past 41 years. Similarly, the fatality rate on a person basis was 13.6 fatalities per 100,000 population in 2007 the lowest in the past 35 years. This is compared to 26.4 in 1969. Based on a statistical projection, in 2008 fatalities in motor vehicle traffic crashes are estimated to have dropped to 37,313 – a 9.1-percent decline from the 41,059 fatalities reported in 2007.

The total number of police-reported crashes in the U.S. in 2007 was estimated by the National Automotive Sampling System (NASS) General Estimates System (GES) to be 6.0 million. These police reported crashes resulted in 2.5 million persons being injured. In recent years, the estimated number of injuries has decreased, as has the injury rate, based on VMT. In 2007, the injury rate reached 82 injuries per 100 million VMT. In 2007, safety belt use reached a usage rate of about 82 percent for outboard seated occupants during daytime hours.

State of Motor Vehicle Safety

Over the past several decades, the fatality rate per VMT has been steadily decreasing. The safety improvements made are due in part to the collective efforts of the operating agencies of the Department of Transportation,[1] the States, automobile manufacturers, and other organizations. NHTSA's engineering efforts combined with its educational and enforcement programs that ensure proper compliance with the U.S. regulations have been major contributors to this significant achievement in safety. Figure 1 shows the number of fatalities and the fatality rate for the period 1966 to 2005.

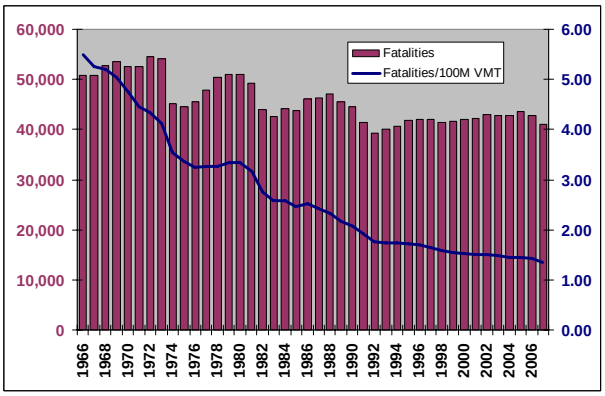

Figure 1. 2007 U.S. Fatalities and Fatality Rate by Year

As can be seen from Figure 1, the number of fatalities in the U.S., after being rather constant for the last decade, has decreased in 2007. The fatality rate has slowly decreased over this period.

Another factor affecting the fatality rate is the increase in motorcycle fatalities. Motorcycle rider fatalities, after a major decrease in the 1980s and early 1990s, have increased steadily since a historic low in 1997. In 2007, motorcycle rider fatalities numbered 5,154, an increase of over 2,700 fatalities from the 1997 level.

Table 1 provides a breakdown of all motor vehicle fatalities by person type.

Table 1. 2007 U.S. Fatalities by Person Type

	Fatalities
Total Fatalities	**41,059**
Passenger Vehicle Occupants	28,933
Motorcycle	5,154
Large Truck, Bus, Other Vehicle Occupants**	1,468
Nonoccupants*	5,504
Pedestrian	*4,654*
Pedalcyclists	*698*

**Includes Other and Unknown nonoccupants*
***Includes occupants of unknown body types.*
Many of the unknown body types in 2007 will be resolved in the final file.

Rollover crashes continue to be a major component in the US fatalities. The distribution of fatalities by vehicle type is shown in Table 2.

[1] The National Highway Traffic Safety Administration (NHTSA), the Federal Motor Carrier Safety Administration (FMCSA), the Federal Highway Administration (FHWA), Federal Transit Administration (FTA) and the Federal Railroad Administration (FRA)

Table 2. Passenger Vehicle Occupants Killed in Rollover Crashes, by Type of Vehicle

Type of Vehicle	2007
All rollover fatalities*	**10,194**
Passenger Cars	4,041
Vans	571
SUVs	2,842
Pickup Trucks	2,736
* Includes occupants of "Other Light Trucks"	

Status of Current NHTSA Research Programs

Crashworthiness Research

Frontal Crash Safety

Frontal crashes are the most significant cause of motor vehicle fatalities. This research program addresses these fatalities through development of crash test procedures using impact conditions not currently addressed by Federal Motor Vehicle Safety Standard (FMVSS) No. 208. Recent crash investigations have evaluated the safety considerations for belted, air bag equipped occupants in small overlap and oblique frontal crashes. NHTSA is also evaluating the safety potential for advanced restraint systems for front and rear seat occupants.

Crashworthiness Rollover

The crashworthiness rollover research program can be separated into two main topics, ejection mitigation and protection for non-ejected occupants. Ejection is a major cause of death and injury in light-vehicle rollover crashes. Almost two-thirds of all ejection related fatalities occur during rollover crashes. NHTSA is pursuing a phased approach to reducing occupant ejection in rollover crashes. First, a side impact pole test requirement was recently added to FMVSS No. 214 which will provide improved head protection for occupants, will likely result in greater use of side curtain air bags, and will reduce the number of partial ejections, primarily in side impacts. The other phase is to establish occupant retention performance requirements for side windows, and Congress has mandated NHTSA to issue a final rule on this by October 1, 2009. This program is aimed at providing occupant containment, primarily in rollovers, through the use of countermeasures such as side curtain air bags and/or advanced glazings. The research includes developing test procedures and performance requirements for evaluating these countermeasures. Side curtain air bags designed for occupant containment differ from those designed only for side impact head protection in that they will deploy in a rollover, they maintain pressure in the curtain for an extended time, and they cover a larger portion of the side window area.

The protection of non-ejected occupants in rollover includes increased roof crush strength and improved restraints for rollovers. The agency has conducted considerable research on roof crush strength and expects to issue a final rule upgrading FMVSS No. 216 in 2009. The agency also has a research program to evaluate the effectiveness of standard and advanced restraints systems in reducing occupant excursion from the seat in rollover crashes.

Side Impact Research

NHTSA's recent upgrade of FMVSS No. 214 requires auto manufacturers to provide head protection in side crashes and to enhance thorax and pelvis protection for a wider range of vehicle occupants. The new rule augments the previous side-impact standard by requiring an additional performance test involving a 20-mph (32 kph) vehicle side crash into a rigid pole at an approach angle of 75 degrees. The agency has incorporated the more precise biomechanical knowledge provided by second generation side impact dummies. The upgrade establishes the use of two dummies, representing a 5th percentile adult female (SID-IIs) and a 50th percentile male (ES-2re), for both the proposed oblique pole test and the barrier-to-vehicle test. NHTSA's current research in this area includes evaluating a new side impact dummy, WorldSID, which was designed by a global consortium. The new dummy has been evaluated for its biofidelity, durability, and performance in crash testing in the current U.S. vehicle fleet and crash environment and found to show promise as an acceptable test device. NHTSA is also interested in conducting a similar program for the small female WorldSID.

Integrated Safety

Integrated safety systems are intended to utilize data from pre crash warning systems to reduce occupant injuries through automatic braking and pre-deployment of advanced restraint systems. NHTSA has implemented cooperative agreements with automotive manufacturers and suppliers to develop performance criteria, objective tests, and benefits estimates for both crash imminent braking and advanced front seat restraints.

Hydrogen, Fuel Cell and Alternative Fuel Vehicle Safety Research

NHTSA's program for hydrogen, fuel cell, and alternative fuel vehicles is focused on establishing safe performance requirements for hydrogen fuel storage and delivery and electrical system safety in fuel cell and internal combustion engine (ICE)

vehicles. NHTSA's safety initiative will complement the efforts by the U.S. Department of Energy and the U.S. Council for Automotive Research (U.S.CAR). NHTSA's approach is to develop foundational research information that will be necessary to determine future requirements, such as research on performance of high pressure cylinders in fires, localized flame impingement on cylinders, electrical integrity of high voltage fuel cell propulsion systems, and developing criteria for post-crash hydrogen leakage. NHTSA will also investigate the potential safety risks posed by lithium ion battery storage devices.

Child Passenger Safety

NHTSA is evaluating test parameters and potential methodologies to replicate a representative side impact scenario that could potentially be developed into a future child restraint dynamic side impact test procedure under FMVSS No. 213. A side impact sled buck designed by Takata is currently being evaluated and side impact moving deformable barrier (MDB) into vehicle crash tests have been conducted in an effort to refine sled buck test parameters. The agency is also reviewing the current FMVSS No. 213 test procedure to determine the viability or advisability of increasing the simulated frontal impact speed from 30 mph to 35 mph and updating the existing test seat fixture.

Motor Coach Occupant Safety

NHTSA conducted a comprehensive review of motor coach safety issues and developed approaches directed to the areas that have the greatest potential for achieving improved motor coach safety most quickly. In August 2007, NHTSA published its Motor coach Safety Plan where it identified four strategies that the agency is currently pursuing on a priority basis: seat belts on buses to reduce occupant ejection; improve roof strength; upgrade fire safety; upgrade emergency evacuation. In December 2007, the agency conducted its first full frontal rigid barrier crash at 30 mph with a motor coach. This crash test along with additional sled tests provided valuable information on the forces transmitted through the seat and seat anchorages in a frontal motor coach crash for different crash pulses, impact angles, and restraint conditions. In the area of roof strength, the agency has conducted tests on 4 motor coaches using the U.S. school bus and European roof strength procedures to determine their relative stringency and practicability of application to motor coaches sold in the U.S. Research on emergency evacuation and fire safety is underway and is expected to be completed in FY 2010.

Biomechanics

NHTSA's Human Injury Research Division and Applied Biomechanics Divisions continue to implement and update their Biomechanics Research Plan to build upon the rich history of impact biomechanics research supported and carried out by NHTSA over the past 30 years. The plan prioritizes the research activities based on trends and results from updated statistical analysis of crash field investigations as well as in-depth analysis of crashes from databases such as CIREN (Crash Injury Research Engineering Network). These results establish safety needs on the basis of frequency, cost, and fatal outcome of crash injuries. Based on the analyses, the plan has developed a set of projects that can produce deliverables and results that can be used to support rulemaking initiatives or put into a "tool box" for further research use by the Agency or other research groups. Recent data analysis has indicated continued need to address the following areas: Child, Adult and Elderly Occupant Injury Mechanisms. This work can lead to injury assessment methods including advanced Anthropometric Test Device (ATD) research and associated injury criteria.

Injury Mechanisms Research

An expanded research effort in head and thoracic injury research is in progress. New projects to understand functional response of the brain and axonal tissue after an insult will shed new light on levels of strain that are tolerable with respect to function. Ongoing efforts include an analysis of mild traumatic brain injury and the criteria that may be used to assess it. Continued analysis of data using the SIMon (**S**imulated **I**njury **Mon**itor) model for the brain injury has allowed further insight into the effects of head rotation as well as translation on the potential for brain injury (Figure 2). This work may lead to enhanced brain injury criteria.

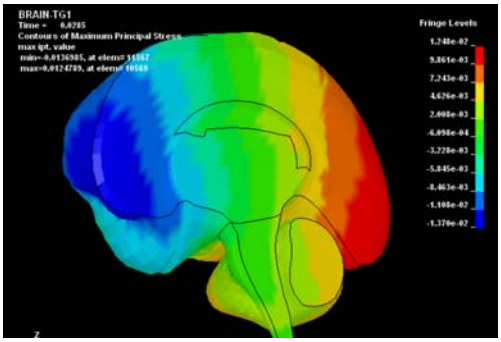

Figure 2. SIMon Finite Element brain model output indicating stress patterns in the brain.

Chest and thoracic organ injury research continues as these injuries are a major source of occupant harm in frontal, side and rollover crashes. Recent work includes assessment of a new device to measure two-dimensional deformation of individual ribs of a crash dummy rather than just one dimensional deformation

at the sternum. This device (Figure 3) has the potential to enhance prediction of thoracic injury from multiple loading modes and can be applied to crash dummies for both frontal and side impact. Work also continues on a repeatable test to evaluate human surrogate and crash dummy chest and shoulder response in three dimensions. University supported research is looking at impact response of underlying tissue that may be incorporated into future injury criteria.

Anthropomorphic Test Device Research

Activity continues to update the THOR, an advanced 50th percentile male frontal impact dummy. A set of short-term enhancements has been suggested by an international group of researchers to improve THOR response and usability. These enhancements are being applied to a few existing dummies which will be tested relative to current THOR biofidelity targets. These results may pave the way for more THOR use internationally. Already projects for an updated abdomen and new chest instrumentation are underway. A 5th percentile female version of THOR has been completed and is undergoing assessment in a variety of test conditions.

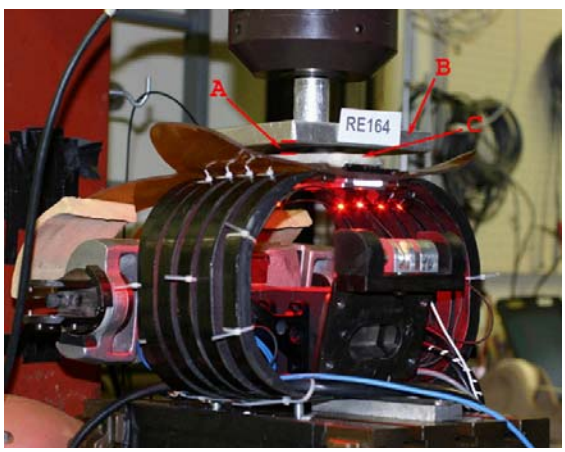

Figure 3. New crash dummy 2-D rib deformation assessment device.

NHTSA has completed an assessment of WorldSID (50th percentile male) relative to biofidelity and crash test capability. WorldSID shows better biofidelity compared to ESII-re and performs well in current side impact regulatory tests. Future work to assess repeatability and reproducibility of the male WorldSID is planned as well as efforts for the small female WorldSID. Child dummy development includes a new neck design for the Q3s, side impact child dummy. This neck design will improve the head kinematic response of the dummy as head injuries to children are most common in side impact crashes. Work continues to assess other child dummies such as the Hybrid III 6 year and 10 year old dummies to include in future regulation as well as research to enhance the response of these dummies (see below). Finally, a test series to determine biofidelity of rear impact dummies including the BioRID dummy are in progress. The Human Injury and Applied Biomechanics Divisions have developed injury criteria and calibration and certification procedures for these dummies and continue to work with industry and dummy manufacturers to complete these projects.

Vulnerable Occupant Injury Research

Vulnerable occupants include children, elderly occupants, and pregnant occupants. Dedicated field data analysis continues to help understand the issues and determine research efforts required. Recent CIREN and NASS-CDS results confirm thoracic injury as a major issue for elderly occupants. Research efforts are geared to understand the effects of changing thoracic geometry and material properties on the tolerance to thoracic loading as a person ages. Understanding the fragility (tolerance) and frailty (final outcome) for older occupants may help lead to design of tests and injury criteria that are more consistent with prediction of injury. This can lead to improved restraint design that may help to mitigate injuries in this rapidly expanding cohort of vehicle occupants

NHTSA is coordinating an ad hoc research group called the Child Passenger Protection group that consists of a multi-center research effort to better understand child injury mechanisms and associated, non-scaled injury criteria including head, neck, shoulder and thoracic injury responses and abdominal injury tolerance and criteria. This effort will result in specific child dummy response requirements that may lead to child dummy improvements and the creation of a human child computer model for further injury assessment in crash reconstructions and other tests.

Crash Injury Research Engineering Network (CIREN) Developments

CIREN continues to explore new ways to enhance NHTSA's and the public's understanding of injury causation in crashes and refining the capability to define injury criteria. The Biomechanics Tab (Bio Tab) for analyzing and deducing injury mechanisms objectively is now in routine use and has been applied to specific injury producing events such as belted rollover occupants. This application has been aided by 3-Dimensional imaging techniques for injury identification as well as initial efforts to truly integrate the CIREN network through streaming Internet video of case reviews to all centers. This allows sharing of expertise and opinions on crash, vehicle and medical results to further enhance the data quality and richness. Also, efforts to link CIREN data with NASS-CDS may provide a powerful tool for future analysis of crash and injury

data to create injury risk functions and ultimately, injury criteria. Finally, initial analysis of CIREN cases with information from Event Data Recorders (EDR) is being used to understand how crash information may be used to alert emergency response teams regarding injury severity so that better decisions can be made regarding transport of crash victims to appropriate centers of care.

Heavy Vehicle Research

NHTSA's heavy vehicle research program is directed toward improving the collision avoidance capabilities of these vehicles. A wide range of issues are currently being researched including: brake system performance improvements, enhanced heavy vehicle stability, eliminating blind spots around large combination vehicles through video/camera imaging technology, and Intelligent Transportation System (ITS) research evaluating an integrated suite of systems comprised of rear collision warning, lane departure warning, and side object detection.

The agency research has shown that major improvements in braking performance for truck tractors can be achieved by using disc brakes, larger drum brakes, or hybrid combinations of disc and drum. Stopping distance improvements of up to 30 percent or more have been demonstrated. Additional research has been initiated on autonomous braking systems (e.g. collision mitigation braking) that utilize radar sensors to sense when a safety critical rear-end crash scenario is developing and automatically apply braking to assist the driver in preventing or mitigating the scenario.

Electronic Stability Control (ESC) systems can reduce loss of control crashes involving heavy vehicles, which often result in rollover or jackknifing. Specific studies underway include testing at NHTSA's Vehicle Research and Test Center in Ohio, and safety benefit studies using hardware-in-the loop simulation and clinical analysis of large truck crash reconstruction data to determine the effectiveness of stability control systems over a wide range of conditions.

Blind spots around large combination vehicles contribute to lane change/merge crashes which are a significant portion of crashes involving tractor semi-trailer vehicles. As a result, performance specifications have been developed for camera/video imaging systems (C/VIS) and a system utilizing commercial off the shelf technology has been developed to provide 360 degree all-weather vision for the driver. A follow-on field test has been initiated to determine the potential safety benefits, driver acceptance, and overall system performance for C/VIS technology.

Intelligent Technology Research

Overview

NHTSA's crash avoidance research mission seeks to advance the scientific knowledge of how to save lives, prevent injuries, and reduce economic costs due to road traffic crashes. The results of this research are used by the Agency to improve highway safety through the regulatory process, consumer information activities and other means. This program relies heavily on problem sizes estimated from crash data that are collected, reduced, and maintained by the National Center for Statistics and Analysis (NCSA). The crash avoidance research program is implemented through a combination of contracts with research organizations, cooperative agreements with industry and university safety organizations, and internal testing and analysis. The program includes three major inter-related components, as follows:

Developing a detailed understanding of driver performance

A critical component of vehicle safety research is to understand the interaction of the driver, the vehicle and the environment in pre-crash, crash, and post-crash conditions.

In the Office of Driver-Vehicle Performance Research, human factors and advanced technology research activities are integrated to determine which aspects of vehicle design may be modified to improve driver performance and to reduce unsafe behaviors. For example, the focus of one study was to understand how drivers benefit from existing or new in-vehicle technologies. This integrated research supports Federal Motor Vehicle Safety Standards, safety defects investigations, consumer information, and the advancement of knowledge about driver behaviors and performance. The program helps stimulate the industrial development of vehicle technology that is compatible with driver abilities and limitations.

To help identify critical safety issues, efforts have been underway to understand what problems drivers are actually experiencing. This work includes an analysis of crash data, studies of early adopters of advanced technologies, and the results of naturalistic driving studies. For example, we established a pre-crash scenario typology for light vehicles to provide a common foundation for vehicle safety research. This approach provided a reference to enable public and private organizations to estimate the potential safety benefits of crash countermeasures.

Developing the requirements for system performance

NHTSA undertakes programs to help it better understand of the driver-vehicle performance features of automotive systems in order to develop meaningful regulatory and other safety improvement policies. To this end, NHTSA regularly tests the performance of available systems, and helps define the performance requirements of future systems.

Evaluating the safety impact of advanced technologies

NHTSA co-sponsors research and collaborates with other modal administrations. This practice promotes the development of advanced technologies that have greater effectiveness, overall, while addressing additional problem areas. The combined investment helps provide observations over a longer period of time in order to estimate safety benefits. There are currently three major collaborative programs:

ADVANCED COLLISION AVOIDANCE TECHNOLOGIES (ACAT)

In response to increasing public concern about automobile safety and advances in technology, many manufacturers and their suppliers are developing and incorporating advanced safety into their vehicles that help drivers avoid crashes. These systems are intended to prevent or reduce the severity for many of the most significant crash types including rear-end, lane change, driver impairment, rollover, and road departure.

This program will develop and implement a framework to understand the safety potential for vehicles that are equipped with emerging advanced safety technologies. In 2009, NHTSA will complete cooperative agreements with four teams led by Automobile manufacturers focused on technologies that address pre-collision mitigation, back-over prevention, lane departure prevention and driver monitoring. These programs will results in objective information that can help consumers identify the most effective safety technologies.

In 2009, NHTSA launched a second phase of the ACAT program, in order to refine the Safety Impacting Methodology and to expand its scope to include the additional technologies of lane keeping assistance, blind spot detection and head-on collision warning.

INTEGRATED VEHICLE BASED SAFETY SYSTEMS (IVBSS)

About 3.6 million rear-end, road departure, or lane change crashes occur each year. Of these 3.6 million, 27,500 crashes result in one or more fatalities. These fatal crashes represent about ¾ of all fatal crashes.

The widespread deployment of advanced integrated driver assistance systems has the potential to reduce rear-end, road departure, and lane change collisions by 48 percent. Integrated systems will provide better hazard information from multiple sensors and provide coordinated warnings to reduce driver distraction.

The Integrated Vehicle Based Safety Systems (IVBSS) initiative aims to demonstrate the technologies necessary to equip all new vehicles with advanced driver assistance systems that would help drivers avoid the most common types of deadly crashes. The goal of the IVBSS program is to assess the safety benefits and driver acceptance associated with a prototype integrated crash warning system designed to address rear-end, road departure and lane change/merge crashes on light vehicles and heavy commercial trucks. This initiative is the first attempt to fully integrate the individual solutions that address these three types of crashes. This research will combine existing research results, state-of-the-art commercial products and system integration efforts to develop and demonstrate an integrated solution to these problems.

The IVBSS program is a four-year initiative that began in November 2005. This two phase cooperative research program is being conducted by an industry team led by the University of Michigan Transportation Research Institute (UMTRI). The results from Phase I Vehicle Verification Tests determined that the prototype system met its performance guidelines and is safe for use by lay drivers in a field operational test planned for July 2008. The Phase II Field Operational Test started in January 2009.

VEHICLE SAFETY COMMUNICATIONS (VSC)

The U.S. Department of Transportation has conducted extensive research on the effectiveness of vehicle-based autonomous collision countermeasures for rear-end, road departure, and lane-change crashes. However, the systems have inherent limitations such as misidentification of stopped cars and out-of-path obstacles. VSC, paired with accurate vehicle positioning, may overcome these shortcomings and thus enable improved safety system effectiveness by complementing or, in some instances, providing alternative approaches to autonomous safety equipment. NHTSA is exploring how both vehicle-to-vehicle (V2V) and vehicle-to-infrastructure communications can enable improved effectiveness of active safety systems.

NHTSA is conducting a collaborative research effort with a consortium of automobile manufacturers to facilitate the development and deployment of effective V2V communication safety systems. This project is developing safety applications, addressing interoperability issues and evaluating safety benefits.

In 2009, NHTSA will complete a program to develop and evaluate a system that communicates between the road way and vehicle to warn the driver of potential stop sign and traffic signal violations. The Cooperative Intersection Collision Avoidance System (CICAS) initiative employed a combination of vehicle –based technologies and systems, infrastructure-based technologies and systems and communication systems focused on detecting and avoiding potential crossing path crashes at intersections. A prototype that was validated against the system performance specifications was demonstrated. Driver acceptance and overall safety effectiveness can not be measured unless a field operational test is conducted.

Human Factors Research

NHTSA's human factors research is integrated with intelligent technologies research to examine the interaction of driver, vehicle, and environment in order to improve driver-vehicle performance. The research supports Federal Motor Vehicle Safety Standards, safety defects investigations, consumer information, and the advancement of knowledge about driver behaviors and performance. Findings are applied to the development of vehicle technologies, which are compatible with driver abilities and limitations. NHTSA focuses this research in three main safety areas: 1) Developing and applying methods to better define the safety problem; 2) Enhancing visibility from the vehicle and lighting; 3) Evaluating advanced driver assistance systems and technologies that can reduce unsafe behaviors.

Safety Problem Assessment

Many higher-end vehicles are offered with advanced technologies before they become common to all vehicles. To learn about how drivers interact with these technologies NHTSA has conducted research on these "Early Adopters." We completed an analysis of surveys of drivers who purchased integrated navigation systems, parking aids, high intensity discharge headlamps, and adaptive cruise control. The findings show that drivers appreciate the benefits of these technologies, but may not fully understand their capabilities and limitations. The full reports are available on the NHTSA website.

Back-over Crashes

The problem of passenger vehicles backing over pedestrians is a small but significant problem. Last year, NHTSA prepared a report to Congress describing our current estimates of the extent and nature of the problem as well as our test results of current parking aids. The size of this safety problem is difficult to determine because many of the back-over crashes that occur on private property are not recorded in State or Federal crash databases, which focus on crashes occurring in traffic-ways. NHTSA has developed the Not-in-Traffic Surveillance (NiTS) system (discussed below) partly to allow the agency to better estimate the size of this safety problem.

Based on data from the NiTS system, back-over crashes involving all vehicle types are estimated to cause 292 fatalities annually in the U.S. Testing showed that the performance of sensor-based (ultrasonic and radar) parking aids in detecting child pedestrians behind the vehicle was typically poor, sporadic and limited in range. Because of the potential that camera-based systems appear to offer in addressing the risk of back-over, NHTSA plans to conduct additional work to estimate the effectiveness of such systems and to develop specifications of performance for any technology that could be developed to address this risk. Further, the Agency plans to encourage vehicle manufacturers to continue to develop systems that can be effective in addressing this risk at a reasonable cost to the consumer.

Headlight Research

Driver complaints about headlamp glare affecting their vision continue to be a concern in the U.S. To address this concern and look for solutions that balance the need for increased visibility with the glare consequences that can result, NHTSA funded research to identify the factors affecting glare. Among the topics addressed are the effects on driver performance of light spectrum, glare exposure, misaim, mounting height, and beam pattern. The research results indicate that adaptive headlight systems (i.e., systems that automatically adjust light levels in response to the needs of both the driver and oncoming drivers) have the potential to increase visibility and minimize glare. The full reports are available on the NHTSA website.

Rear Signaling Research

A major difference in lighting regulations between U.S. and other countries is that the U.S. allows both amber and red rear turn signals. We completed analyses of crash data to look for any differences in the crash rates associated with turn signals and found that amber turn signals led to fewer crashes. The analyses are available on the NHTSA website.

Alcohol Detection Research: Driver Alcohol Detection System for Safety (DADSS)

Since 1997, about a third of all fatally-injured passenger vehicle drivers had blood alcohol concentrations at or above the legal limit. In order to address this problem, NHTSA entered into a five year cooperative agreement with the Automotive Coalition for Traffic Safety (ACTS) in early 2008 aimed at developing alcohol detection technologies that could have widespread deployment and are non-invasive, reliable, accurate, and precise. These technologies would be less intrusive than ignition interlocks. To achieve this goal the project aims to: (1) assess the current state of alcohol detection devices, and (2) support the development and testing of prototypes and subsequent hardware that may be installed in vehicles. The prototypes would then undergo extensive laboratory and field testing. This five year effort will result in prototypes installed in actual test vehicles. However, the ultimate end goal at this point is anticipated to be voluntary acceptance and integration of these technologies into all vehicles.

Belt Minders

NHTSA has completed its assessment of the effectiveness and acceptance of enhanced safety belt reminder systems. We observed belt use in thousands of recent model vehicles and compared belt use in vehicles with and without an enhanced reminder system. The results found that on average reminder systems increased belt use by 3 percent. We also explored the tradeoff between reminder effectiveness and acceptability to drivers. The full reports are available on the NHTSA website.

Vehicle-based technology to reduce unsafe teen behaviors

Crashes of novice teen drivers continue to be a major part of the safety problem. While education and the increased use of Graduated Licensing programs are effective, additional solutions are needed. The increasing availability and shrinking costs of vehicular technologies that can detect and provide feedback about unsafe teen driving behaviors offers a new avenue to explore. NHTSA completed a study that reviewed the concept of vehicle-based teen monitoring and analyzed data from a naturalistic study of novice teen drivers. The purpose was to identify feasible technologies, unsafe teen driving behaviors, and approaches for further research to evaluate the effectiveness and acceptability of this type of countermeasure.

Tire Safety

Tire Aging Research

NHTSA remains concerned about the endurance of older tires. The agency determined that the thermo-oxidative degradation that occurs in tires during service is accelerated with higher temperatures and is a contributing factor for tire failures, such as tread separations. Therefore the agency completed a field study to evaluate the rate of change in the tire material properties and road wheel performance after increasing durations of service, followed by development of an accelerated laboratory tire aging test protocol. The agency is currently further analyzing the safety problem, studying tire aging as a casual factor in crashes, and estimating potential benefits and costs of a combined oven-aging and road wheel durability test.

Tire Rolling Resistance and Traction Research

NHTSA has been mandated to establish a national tire fuel efficiency consumer information program for passenger vehicle replacement tires to educate consumers about the effect of tires on automobile fuel efficiency, safety, and durability. As part of this effort, the agency has conducted research to examine possible correlations between tire rolling resistance levels and vehicle fuel economy, wet and dry tire traction, and outdoor and indoor tire tread wear.

Tire Bead Unseat Research

The current tire bead unseat test equipment used in the US Federal Motor Vehicle Safety Standards for tires, which dates to the 1960s, cannot physically test tires with rim codes larger than 18. The radius of the bead unseating block is too small to accommodate larger rim codes, often contacting the rim before a valid compliance test can be completed on the tire. Therefore, NHTSA conducted research on the evaluation of larger prototype bead-unseat blocks designed by ASTM that would facilitate testing tires up to rim code 30.

Data Collection and Analysis

NHTSA conducts a motor vehicle crash data collection program through the National Center for Statistics and Analysis (NCSA). It is composed of: the data collected from the states, including Fatality Analysis Reporting System (FARS) and the State Data Program, crash investigations, which includes the National Automotive Sampling System (NASS) and the Special Crash Investigations (SCI) programs.

FARS is a census of all fatal crashes occurring on public roads in the United States. The **NASS** is comprised of the General Estimates System (GES) and the Crashworthiness Data System (CDS). The GES provides national estimates of characteristics of all motor vehicle crashes. The CDS conducts detailed investigations into a nationally representative sample of crashes involving towed passenger vehicles to investigate injury-causing mechanisms and to evaluate countermeasures.

The NASS infrastructure was utilized in two surveys to collect nationally representative data on the events and factors related to the causation of crashes. The **Large Truck Crash Causation Study** (LTCCS) was conducted by the National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Carrier Safety Administration (FMCSA) from 2001 to 2003 to collect information on the causes or contributing factors for large truck crashes. From 2005-2007, NHTSA conducted the **National Motor Vehicle Crash Causation Survey** (MMVCCS) which, unlike the previous Tri-Level Study, collected nationally representative information on the events and factors related to the causation of light motor vehicle traffic crashes. The SCI program provides in-depth data on crashes where emerging issues may be of interest.

The Not-in-Traffic Surveillance (NiTS) system is a virtual data collection system designed to provide counts and details regarding fatalities and injuries that occur in non-traffic crashes and in non-crash incidents. The NiTS 2007 system produced an overall annual estimate of 1,747 fatalities and 841,000 injuries in non-traffic crashes and non-crash incidents. The NiTS 2007 system provided information about an estimated 1,159 fatalities and 98,000 injuries that occurred in non-traffic crashes such as single-vehicle crashes on private roads, collisions with pedestrians on driveways, and two-vehicle crashes in parking facilities. The NiTS 2007 system also provided information about an annual average of 588 fatalities and 743,000 injuries in non-crash incidents involving passenger vehicle occupants or otherwise involving passenger vehicles. More than half of the non-crash fatalities occurred when a vehicle fell on a person who was under it or from unintentional carbon monoxide poisoning. The most common types of non-crash injuries seen in emergency departments were injuries while entering or exiting a vehicle (estimated 164,000 per year), injuries from closing doors (estimated 148,000 per year) and injuries from overexertion such as while unloading cargo or pushing a disabled vehicle (estimated 88,000 per year).

NCSA also conducts key analyses of the collected data and publishes reports, including the Traffic Safety Facts Annual Report and Traffic Safety Fact Sheets. Copies of the most recent reports can be found at NCSA's web site using the following URL: http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.a0bd5d5a23d09ec24ec86e10dba046a0/

Significant Rulemaking Actions

Door Locks and Door Retention Components

On February 6, 2007, the agency amended our safety standard on door locks and door retention components in order to add and update requirements and test procedures and to harmonize with the world's first global technical regulation for motor vehicles. The final rule adds test requirements and test procedures for sliding doors, adds secondary latched position requirements for doors other than hinged side doors and back doors, provides a new optional test procedure for assessing inertial forces, and extends the application of the standard to buses with a gross vehicle weight rating (GVWR) of less than 10,000 pounds, including 12-15 passenger vans. The final rule also eliminates an exclusion from the requirements of the standard for doors equipped with wheelchair platform lifts.

Electronic Stability Control Systems; Controls & Displays

On April 6, 2007, as part of a comprehensive plan for reducing the serious risk of rollover crashes and the risk of death and serious injury in those crashes, the agency established a new Federal motor vehicle safety standard (FMVSS) No. 126 to require electronic stability control (ESC) systems on passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating of 4,536 Kg (10,000 pounds) or less. ESC systems use automatic computer-controlled braking of individual wheels to assist the driver in maintaining control in critical driving situations in which the vehicle is beginning to lose directional stability at the rear wheels (spin out) or directional control at the front wheels (plow out).

Side Impact Protection

On September 11, 2007 NHTSA published this final rule incorporating a dynamic pole test into Federal Motor Vehicle Safety Standard (FMVSS) No. 214, "Side impact protection." To meet the test, vehicle manufacturers will need to assure head and improved chest protection in side crashes. It will lead to the installation of new technologies, such as side curtain air bags and torso side air bags, which are capable of improving head and thorax protection to occupants of vehicles that crash into poles and trees and vehicles that are laterally struck by a higher-riding vehicle. The side air bag systems installed to meet the requirements of this final rule will also reduce fatalities and injuries caused by partial ejections through side windows.

Fuel Economy

On May 2, 2008, the Agency proposed substantial increases in the Corporate Average Fuel Economy (CAFE) standards for MY 2011-2015 passenger cars and light trucks that would enhance energy security by improving fuel economy. Since the carbon dioxide

(CO2) emitted from the tailpipes of new motor vehicles is the natural by-product of the combustion of fuel, the increased standards would also address climate change by reducing tailpipe emissions of CO2. Those emissions represent 97 percent of the total greenhouse gas emissions from motor vehicles. Implementation of the new standards would dramatically add to the billions of barrels of fuel already saved since the beginning of the CAFE program in 1975.

Convex Cross View Mirrors (Withdrawn)

On July 21, 2008 the National Highway Traffic Safety Administration (NHTSA) issued a notice terminating a rulemaking that was initiated in 2005in response to a petition. This rulemaking, to amend Federal Motor Vehicle Safety Standard No. 111, "Rearview Mirrors" to require straight trucks with a gross vehicle weight rating (GVWR) of between 4,536 kilograms (10,000 pounds) and 11,793 kilograms (26,000 pounds) to be equipped with a system capable of providing drivers with a view of objects directly behind the vehicle. More refined data generated since the 2005 NPRM shows that the sub-population of mid-sized trucks accounts for only four of the estimated 292 fatalities per year due to back-over accidents. In addition, the recently signed Cameron Gulbransen Kids Transportation Safety Act of 2007 \1\ (K.T. Safety Act of 2007) requires NHTSA to revise the Federal standard for rearward visibility, specifically to reduce backing crashes involving children and disabled people. Considering these developments, the agency believes it more appropriate to address the backing safety of straight trucks as part of the comprehensive effort to address backing safety generally, and that solutions should be formulated after the completion and review of ongoing research and data gathering on backing safety. We therefore withdrew this rulemaking.

Designated Seating Position

On October 8, 2008 NHTSA published a final rule amends the definition of the term, "designated seating position," as used in the Federal motor vehicle safety standards (FMVSS), to indicate more clearly which areas within the interior of a vehicle meet that definition. The final rule also establishes a calculation procedure for determining the number of designated seating positions at a seat location for trucks and multipurpose passenger vehicles with a gross vehicle weight rating less than 10,000 lbs, passenger cars, and buses. Further, this document eliminates the existing exclusion of auxiliary seats (i.e., temporary or folding jump seats) from the definition of "designated seating position." The final rule encourages manufacturers to use a variety of visual cues in the design of the vehicle interior to help improve occupant awareness as to which areas of a vehicle are not intended to be used as seating positions. This will help to ensure that occupants sit in locations where they are afforded the crash protection required by the FMVSS sections.

Evolving Vehicle Safety Strategy

NHTSA's Vehicle Safety Program consists of rulemaking, enforcement, research, and data collection activities. Through a productive mix of these activities we are developing a 10-year strategic vision for improving vehicle safety. The plan lays out a clear direction for short term research and the data needs to support ongoing regulatory and enforcement efforts. Moreover, the strategy provides the accountability for establishing long term Vehicle Safety Program initiatives.

The main theme of the 10 year vehicle safety strategy is to: **Identify, research, and address critical issues that affect motor vehicle safety, highway traffic safety, and fuel economy**.

To achieve this goal, five strategic outcomes have been developed:

1. Address safety and environmental challenges related to motor vehicles and equipment including those posed by global trade.
2. Identify and address emerging safety issues.
3. Foster the use of effective advanced technologies that improve safety.
4. Ensure the integrated improvement of fuel economy and safety.
5. Respond effectively to issues identified by parties outside of NHTSA.

Collaborative Approach

Safety technology continues to evolve at a fast pace. Government agencies, acting alone, cannot expect to keep up with this pace. NHTSA believes it must continue to explore collaborative models with all stakeholders, such as OEMs, suppliers, research centers, advocates, and other government agencies.

These collaborative models provides for a more transparent technology development and implementation process, which significantly reduces the time for advanced safety technologies to reach the consumer.

Short Term and Long Term Priorities

Short and long term priorities are integrated into a single evolving strategic plan. Short term priorities cover issues over a one to two year horizon and long term priorities cover issues over a three to ten year horizon. Both paths integrate mandates from Congressional, industry, and advocacy groups that emerge onto the forefront as immediate needs.

Mechanisms for Addressing Priorities

Specific short term activities are actively updated as needed on the specific priority plans of the office directors for each activity. Longer term activities are developed by coordinating current efforts and identifying new areas that should be explored through research and data collection. The long term horizon extends beyond what NHTSA is currently doing by actively coordinating with manufacturers and suppliers, outside researchers, and other national and international entities.

It is imperative that our plan is proactive on the international stage to monitor the development of new technologies in terms of what they are, when they might enter the fleet, what impact they might have on safety, how they should be evaluated, whether they should be encouraged, and the implications of these on fuel economy.

As part of our proactive response, we especially recognize public concerns about special populations of drivers, even where the perceived risk exceeds risk quantified in crash data. One mechanism for responding to these 'calls to action' includes the development of white papers, which are regularly updated with analyses that are used to clearly articulate a plan to address immediate and future directions.

Structures for Building a Foundation for the Evolving Vehicle Safety Strategy

NHTSA is implementing management structures that support the evolving Vehicle Safety Strategy, including a Strategy Coordinating Council (SCC) composed of representatives from our Research, NCSA, Rulemaking, and Enforcement offices.

The core purpose of the SCC is to establish and maintain this 10-year strategic vision, as well as to engage and coordinate existing teams and groups working on relevant topics to carry out the short term priorities. The SCC is the focal point for raising, validating and coordinating follow-up work on potential emerging concerns as identified through crash data, staff experts, Artemis data, defects investigations, research, and external sources such as Congress, industry, and advocacy groups.

Evolving the Strategy

In sum, our Vehicle Safety Strategy is designed to proactively expand our focus on vehicle safety needs and to dynamically manage our safety programs in a culture of accountability and global leadership. It constitutes a method for managing our responses to vehicle safety needs through a flexible but disciplined approach that keeps pace with changing vehicle safety priorities over time. As new opportunities for vehicle safety emerge from our strategy, our methods will help to ensure a clear path of transition of these to main stream vehicle safety programs, such as those described through the body of this paper.