

## GOVERNMENT STATUS REPORT - UNITED STATES

Raymond P. Owings, Ph.D.  
National Highway Traffic Safety Administration  
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### OVERVIEW

In 2001, the United States had a resident population of 285 million people and over 191 million licensed drivers. An estimated 2.8 trillion miles were traveled by the 221 million registered vehicles in the U.S. This is approximately 14,700 miles of travel per licensed driver. This high degree of mobility is accompanied by safety consequences. A study, published by the National Highway Traffic Safety Administration (NHTSA or Agency) in 2000, estimates the economic impact of motor vehicle crashes to be \$231 billion annually. Table 1 provides a breakdown of the major elements of this cost.

**Table 1.**

#### Economic Impact of Motor Vehicle Crashes 2000

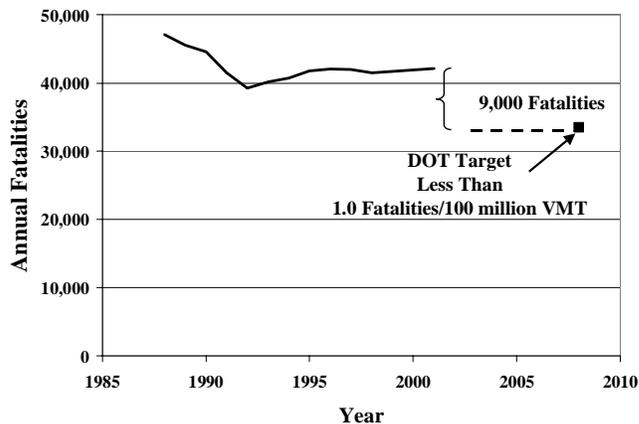
Elements of Cost	Billions	Percent
Market Productivity	\$61	26%
Property Damage	\$59	26%
Medical	\$33	14%
Travel Delay	\$26	11%
Household Productivity	\$20	9%
Insurance Admin	\$15	7%
Others	\$17	7%
<b>Total</b>	<b>\$231</b>	<b>100%</b>

Source: The Economic Impact of Motor Vehicle Crashes 2000, NHTSA, May 2002

This is approximately \$820 for each person in the U.S. or \$1,210 per licensed driver. The \$231 billion represents 2.3% of the gross domestic product of the United States.

The U.S. Department of Transportation has established a target of reducing the fatality rate to 1.0 or less fatalities per 100 million vehicle miles traveled (VMT) by the year 2008, down from 1.5 fatalities per 100 million VMT in 2001. Responsibility to meet this target is shared by operating agencies of the department (NHTSA, the Federal Motor Carrier Safety Administration (FMVSA), the Federal Highway Administration (FHWA) and the Federal Railroad Administration (FRA)), the States, automobile manufacturers and many other organizations. Based on the recent trend in vehicle miles traveled projected into the near

future, this will require a fatality reduction of 9,000 by 2008. Figure 1 shows the recent fatality history and the 2008 goal.



**Figure 1. Recent Fatality Count and U.S. DOT Goal.**

The NHTSA traffic safety programs consider engineering, along with its educational and enforcement programs, essential to continue its goal to reduce fatalities, injuries, and crashes on the U.S. highway system. This 3-pronged process relies on a strong educational program to inform drivers and passengers, an enforcement program to determine compliance with U.S. regulations, and vehicle safety, rooted in engineering, science and data.

The NHTSA has identified five priority areas to maximize its effort in achieving this goal:

- Increased safety belt usage
- Reduction in the number of alcohol related crashes, fatalities and injuries
- Reduction in the number and seriousness of rollover crashes, fatalities and injuries
- Improved compatibility in vehicle fleet
- Improved data addressing highway safety

### CRASH ENVIRONMENT

In 2001, over 42,000 fatalities occurred in the United States 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 2001 was 1.51. This is contrasted to 5.5 fatalities per 100 million VMT in 1966, the highest in the past 35 years. The current rate is the lowest over the past 35 years.

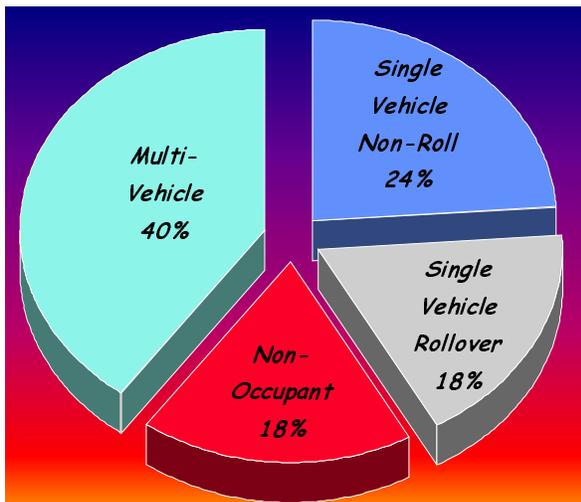
Similarly, the fatality rate on a person basis was 14.8 fatalities per 100,000 population in 2001. This compares to 26.4 fatalities per 100,000 population in 1969 the highest in the past 35 years. Like the fatality rate, the current rate is the lowest over the past 35 years.

The distribution of fatalities by crash type has changed somewhat over the past two decades. These are compared in Table 2.

**Table 2.**  
**Percent change in fatalities by crash type**

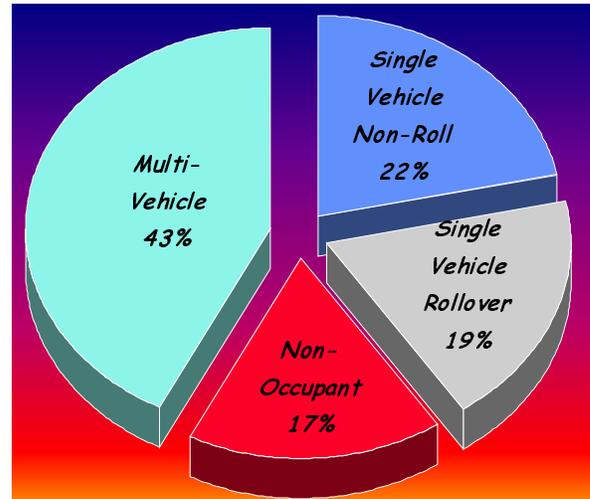
Segment	1980	2001	Change
Multi-vehicle	40%	44%	+10%
Single Vehicle (Non-rollover)	24%	21%	-12%
Single vehicle (Rollover)	18%	21%	+17%
Non occupant	18%	14%	-22%

Figures 2, 3, and 4 present the distribution of fatalities for 1980, 1990, and 2001, respectively.

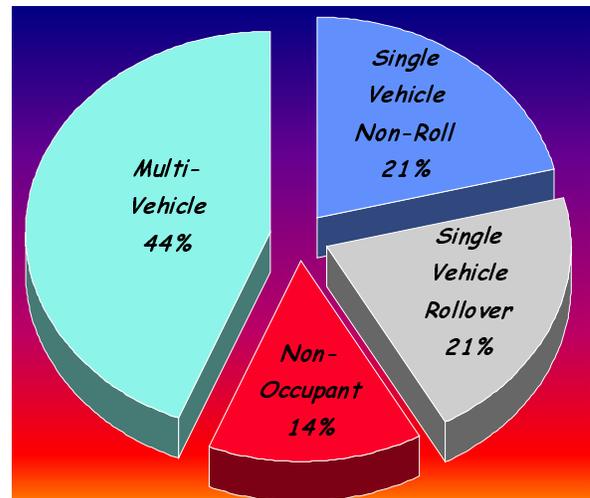


**Figure 2. Distribution of fatalities by crash type in 1980.**

Motorcycle fatalities, after a major decrease in the 1980s and early 1990s, have increased steadily since 1998. In 2001, motorcycle fatalities numbered 3,249, an increase of over 1,000 fatalities annually from the 1998 level.



**Figure 3. Distribution of fatalities by crash type in 1990.**

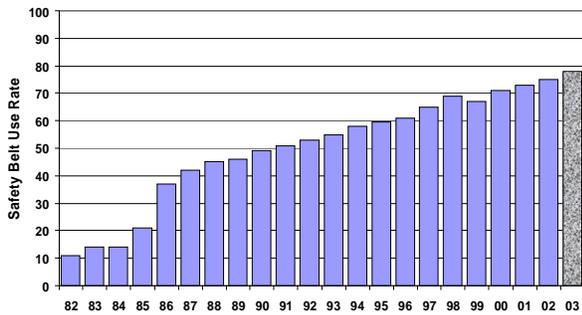


**Figure 4. Distribution of fatalities by crash type in 2001.**

Child fatalities and injuries in motor vehicle crashes continue to decline and age appropriate restraint use has increased.

The total number of police-reported crashes in the U.S. in 2001 was estimated by the National Automotive Sampling System (NASS) General Estimates System (GES) to be 6.3 million. These police reported crashes resulted in slightly more than 3 million persons being injured. In recent years, the estimated number of injuries has decreased, as has the injury rate, based on VMT. In 2001, the injury rate reached 109 injuries per 100 million VMT.

In 2002, safety belt use reached an all time high in the U.S. Current estimates indicate front outboard-seated occupants during daytime hours have a usage rate of about 75 percent. The recent safety belt estimate, by observation year, is shown in Figure 5. Also shown is the target goal for the U.S. DOT (bar on the extreme right) for 2003. Despite increases in safety belt use, current crash statistics indicate that 60 percent of fatally injured occupants were unbelted.



**Figure 5. Safety belt use in the U.S. by year (1982 to 2002) and target goal for 2003 (shown on the extreme right).**

#### DATA COLLECTION AND ANALYSIS

NHTSA conducts a motor vehicle crash data collection program through the National Center for Statistics and Analysis (NCSA).

FARS is a census of all fatal crashes occurring on public roads in the United States. FARS funds State agencies to identify fatal motor vehicle crashes and collect information about them. This information is coded into a common format and transmitted to NCSA. Data from FARS have been used to assess the effectiveness of numerous programs, including those that increase seat belt use and to evaluate the performance of occupant restraint systems. NCSA data are complemented by state crash data files provided through the State Data Program. Each year, the crash data files from 17 states are obtained, documented and provided to the Agency. Also a specialized crashworthiness database is created from several of the state data files. State data files have been used in studies of driver error, antilock braking systems, and center high mounted stop lamps, among others. In another component of the State Data Program, NHTSA continues to work with states to develop Crash Outcome Data Evaluation Systems (CODES). CODES projects link statewide police-reported crash data to medical outcome data.

The NASS is comprised of the General Estimates System (GES) and the Crashworthiness Data System (CDS). Using contractors for data collection, 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 SCI program provides in-depth data on crashes where emerging issues may be of interest, such as air bag or safety belt systems, crashes involving alternative fuel vehicles, crashes involving children in restraints, and serious school bus crashes not investigated by other Federal agencies. SCI data are being used to track trend data related to fatal and seriously injured children and adults in air bag deployment related crashes.

The mathematical analysis section conducts key reviews of the collected data and publishes many studies, research notes, and annual traffic records, including the annual traffic safety facts book.

Copies of these reports can be found at NCSA’s web site using the following URL:

<http://www-nrd.nhtsa.dot.gov/departments/nrd-30/nca/AvailInf.html>

#### CRASHWORTHINESS RESEARCH

##### Vehicle Aggressivity and Compatibility

The increased popularity of light trucks and vans (LTVs) - pickups, sport utility vehicles (SUV), and minivans - presents a growing safety problem that needs to be addressed. While LTVs account for about 38 percent of all registered vehicles, they are involved in half of all fatal (multi-vehicle) crashes with passenger vehicles. The safety problem for occupants of passenger cars can be attributed to some inherent design differences in LTVs. Those differences are due to disparities in size (weight and height) and stiffness. Overall, these differences make LTVs more “aggressive” than passenger vehicles in their interaction with other vehicles. Based on a NHTSA analysis, weight incompatibility and impact location (struck vehicle) were determined to have a large effect on vehicle aggressivity. Furthermore, when controlling for impact location, LTVs, as compared to passenger vehicles of comparable weight, were determined to be twice as likely to cause a fatality in the struck vehicle.

NHTSA is continuing research to identify vehicle characteristics that affect compatibility and evaluate their effects in real world crash performance. The agency also is using sophisticated computer models to assess the impact of changes to vehicle size on safety performance. While the agency has identified a number of improvements to LTV characteristics that can be readily made to improve compatibility, the research program is also focused on evaluating the impact of what changes made to the entire fleet (i.e., both LTVs and cars) on safety. It is anticipated that the results of our research will find that changes not only to LTVs but also to automobiles will improve the overall fleet safety. Since the last ESV, considerable progress has been made in using the load cell data collected in the frontal crash tests of the Agency's New Car Assessment program to assess vehicle characteristics to define aggressivity and evaluate their effects in real world crash performance. Additional efforts are underway for developing test procedures using a load cell moving deformable barrier that provides the possible benefit of directly accounting for the effects of mass.

### **Frontal Crash Protection**

Even after full implementation of driver and passenger air bags, as required by Federal motor vehicle safety standard (FMVSS) No. 208, it has been estimated that frontal impacts will account for up to 8,000 fatalities and 120,000 AIS  $\geq 2$  (i.e., moderate to critical) injuries annually in light vehicles. This program focuses on the intrusion-type injuries and fatalities and the costly lower extremity injuries observed in crashes involving air bag-equipped vehicles. A frontal offset test best represents the real world crashes that produce the intrusion-related injuries and fatalities and the severe lower extremity injuries. The Agency is also developing test procedures to simulate those crashes taking into account the injury modes and using suitable injury criteria and test surrogates that are necessary. Since the last ESV Conference, the research focus has been on evaluating the fixed deformable offset barrier test for use in the near term. As part of this effort, we have been exploring the use of the THOR Lx dummy lower legs. The Agency is also planning research to develop a moving deformable barrier test for use in the longer term.

### **Side Impact Research**

An analysis of the 2001 NASS/CDS and FARS files indicates that side crashes result in over 9,700 fatalities and 3/4<sup>th</sup> of a million injuries each year to occupants of passenger vehicles and LTVs. Since the

last ESV conference, side crash protection research has mainly focused in three areas; evaluation of the Eurosid II dummy as a potential test device in side impacts, the continued development of a pole side impact test procedure to address the single vehicle side crashes into narrow objects such as trees and utility poles.

### **Advanced Air Bag Technology Research**

In recent years, a number of crashes have been reported where injuries and fatalities have been the result of aggressive air bag deployment; that is, the severity and crash environment did not warrant the severity of injury/fatality sustained by the occupant. Those most susceptible to injuries/fatalities from aggressive air bag deployments include out-of-position child passengers (almost always unrestrained), out-of-position adult drivers (usually unbelted and small stature), and infants in rear-facing child safety seats.

Since the last ESV, we have been conducting research to monitor the advanced systems that have been introduced to meet the requirements of the agency's rulemaking that addressed the aforementioned safety issues. With the introduction of new-generation air bag equipped vehicles into the fleet, NHTSA's SCI program has been investigating the field performance of production, new-design air-bag-equipped vehicles through crash investigations. NHTSA also has conducted laboratory testing to evaluate both the effectiveness and the aggressiveness of redesigned production air bag systems in new vehicles. High-speed crash tests and static out-of-position tests were conducted on a sample of production vehicles. In addition to our fleet evaluation efforts, NHTSA has funded the development of optical and ultrasonic occupant classification and out-of-position occupant detection systems, and has installed these prototype systems in production vehicles. Evaluation of such systems is currently underway.

### **CRASH AVOIDANCE RESEARCH**

#### **National Advanced Driving Simulator**

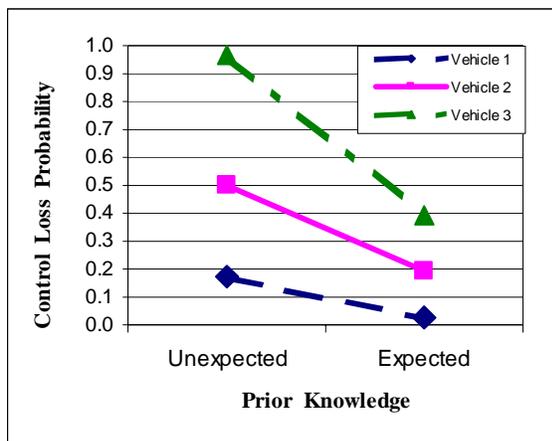
Following completion of the National Advanced Driving Simulator (NADS) development, the facility began full-scale operations in January of 2002. The first major research study performed was an investigation of driver response to tire tread separation failures. This effort evaluated the effects of vehicle understeer gradient, vehicle velocity, prior knowledge of an impending tire failure, instruction

on how to respond to a tire failure, driver age, and failed tire location, on the response of drivers, and the likelihood of control loss following the failure. A total of 108 subjects were run and each subject experienced two tire failures, the first unexpected and the second expected, while driving a straight divided highway at approximately 75 mph. Three vehicle understeer gradients were used as illustrated in Table 3.

**Table 3.**  
**Linear range understeer gradients**

Clockwise Slowly Increasing Steer Maneuver Values from NADS Runs		
	4 Normal Tires	Left Rear Detread
Vehicle 1	4.72 deg/g	1.10 deg/g
Vehicle 2	3.42 deg/g	0.09 deg/g
Vehicle 3	2.40 deg/g	-1.17 deg/g

Figure 6 illustrates the effect of prior knowledge on the probability of control loss for the three values of understeer gradient.



**Figure 6. Effect of prior knowledge on probability of control loss for different understeer gradients.**

Results indicated that decreasing vehicle understeer was strongly associated with the likelihood of control loss following both expected and unexpected tire failure, although knowledge of the impending failure reduced the overall probability. It was concluded that under complete rear tire detread conditions, the resulting difficulty in vehicle handling and the increased likelihood of loss of vehicle control with decreasing understeer do generalize to the real world experience.

Two additional research programs currently underway on NADS include driver distraction and alcohol-impaired driving. These programs are

focusing on issues that cannot be safely addressed on the open highway in controlled studies.

The first of three driver distraction studies is currently underway. This effort is examining the effects of different wireless phone interfaces on dialing, talking and answering phones in situations that vary in task demand. This initial effort is addressing the hand-held/hands-free issue, the influence of conversation characteristics on driving performance and in developing new approaches to measuring driver distraction.

The second study will examine the effects of various characteristics of conversation, including content, emotional intensity and duration. The third study in this series will address drivers' willingness to engage in wireless phone calls as a function of the driving context.

NHTSA has also initiated a three-year, four phase program of research on alcohol consumption and driving. The first phase of the program will concentrate on impairment associated with various levels of blood alcohol concentration (BAC) ranging from 0.02% to as high as 0.10% and will establish baselines for drivers of various ages and different drinking practices.

In later phases, drivers will experience variations in environmental conditions and roadway situations such as denser traffic and roadway types, and will be given realistic in-vehicle tasks such as talking on a cell phone, eating, drinking, or changing a CD while at various BAC levels. A final study will examine how time of day and fatigue influences the degree to which the BAC level degrades driving performance. Studies will be conducted throughout the day, including nighttime, to realistically assess these effects.

### Heavy Vehicles

NHTSA's Heavy Vehicle research program continues to be directed toward improving the collision avoidance capabilities of these vehicles. Agency research has shown that major improvements in braking performance can be achieved by a combination of disc brakes and more powerful front axle brakes. Stopping distance improvements of up to 30 percent or more have been demonstrated. Electronic control of brake systems (ECBS) on heavy vehicles also offers opportunities for faster brake applications and more precise control, including independent braking of individual wheels for balanced braking and stability control. Advanced

disc brake systems with ECBS are currently being tested on the test track and in fleet use. The fleet test program also includes forward collision warning systems. Research on improving indirect visibility from heavy trucks is also underway. Future research will study not only mirror systems but also alternative technologies such as video mirrors and virtual video.

### **Intelligent Vehicle Initiative (IVI)**

The theme of the Intelligent Vehicle Initiative (IVI) is "Saving Lives through Advanced Vehicle Safety Technology." The mission of the IVI is the prevention of highway crashes and the fatalities and injuries they cause. The IVI addresses three driving conditions where there is the greatest opportunity to improve safety: (1) Normal driving condition, by encouraging the design of in-vehicle communications and information systems that drivers can operate without distraction, (2) Degraded driving conditions, such as conditions of reduced visibility or driver fatigue, by encouraging accelerated commercialization of advisory systems, and (3) Imminent crash situation by encouraging accelerated commercialization of crash avoidance warning systems.

The IVI program addresses four classes of vehicle platform: light vehicles (passenger vehicles and LTVs), commercial vehicles (heavy trucks and interstate buses), transit vehicles (intra-city buses) and specialty vehicles (highway maintenance vehicles and emergency response vehicles). The objectives of the IVI program include development of performance specifications for effective safety-enhancing systems and evaluation of the safety impact of developmental systems.

A critical aspect of normal driving is driver workload. Workload is the combination of physical and cognitive effort needed to drive a vehicle in a safe manner. Workload increases as environmental conditions such as congestion and distraction increase. One of the current projects is studying various factors that may influence driver workload. A key element in this research is an evaluation of non-intrusive measurements that can be made while a person is driving and an assessment of whether they accurately reflect the level of workload. Another aspect is a search for laboratory experiments that can serve as surrogates for driving on public highways as a means of understanding the effect of various systems on driver workload. This work will be completed within two years.

The problem of fatigued drivers is being addressed in a field operational test of a driver drowsiness advisory system. The system that will be tested is the result of several previous laboratory, simulator, and field studies that have focused on validating the measurement of fatigue and technologies that can be used to sense driver fatigue in real time. This project will utilize a fleet of heavy trucks that are in revenue service. The project began last year and will continue for the next three years.

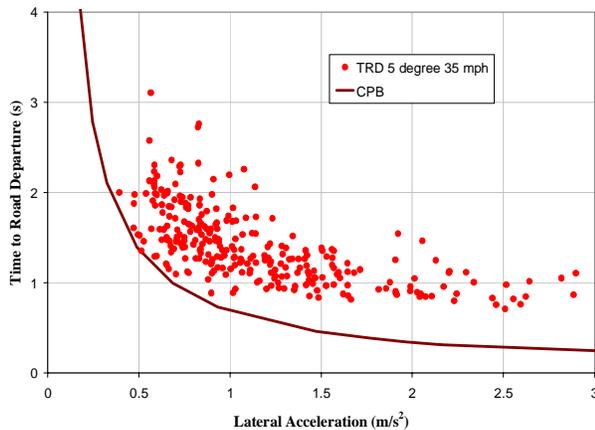
There are currently two field operational tests of light vehicles underway. One is evaluating the safety performance of a warning system for rear-end crashes. The test vehicles will also include an adaptive cruise control system. This fleet will consist of 10 vehicles that are equipped with a sophisticated data collection system in addition to the crash warning system. The crash warning system includes a state-of-the-art forward looking radar, a forward looking camera, a differential global positioning system (GPS) receiver, and a digital map data base as well as extensive monitoring of in-vehicle controls. Any warnings for the driver will be provided through a head-up display and through auditory messages.

The second field operational test will evaluate the safety performance of a road-departure crash warning system. This system will provide warnings if the driver is following a path that will lead to a departure from the paved roadway or if the driver is approaching a curve at a speed that is excessive for that curve. The system will utilize a forward-looking camera, a state-of-the-art radar that looks forward, a second radar that looks to the side, a GPS receiver, and an advanced digital map.

Another major problem area being addressed in the light vehicle program is crashes at intersections. Three new projects have recently been initiated to study vehicle-based systems to address this problem area. These projects are coordinated with parallel projects that are studying infrastructure issues. The projects are jointly developing performance requirements for cooperative communication between vehicles and the infrastructure for systems that address this problem.

In addition to developing performance requirements and evaluating the safety impact of pre-production crash warning systems, there is a need to develop new analytical techniques for analyzing data. One such new method is called the crash prevention boundary. This approach separates the space of driver performance into zones of performance that avoids a crash and zones of performance that in a

crash. This methodology provides new insights into the safety impact of new technologies. The method is described in more detail in two additional papers at this conference. One example drawn from a road departure experiment is shown in Figure 7. The line separates performance into no-crash and crash zones, and the points indicate the performance of individual drivers during the experiment. In this case no drivers crashed.



**Figure 7. Best-fit lateral acceleration vs. best-fit time to road departure (TRD) approach angle 5 degrees, and 35 mph.**

### Driver/Vehicle Performance

From a human factors viewpoint, crash prevention can be achieved through a better understanding of how various vehicle subsystem characteristics affect drivers' ability to perform the driving task. Any weak links in the driver's ability to perceive, understand, decide, and react to the stimuli in the roadway environment are likely to increase the probability of a crash. Among the vehicle subsystems that can influence these aspects of driver performance are headlights, mirrors, in-vehicle displays/controls, rear signal lights, and advanced driver aids. NHTSA has been pursuing human factors research on all of these crash avoidance systems using test track, simulator, and field-testing methodologies.

Due to the large number of complaints concerning headlamp glare, NHTSA is sponsoring research to identify the role of headlamp performance characteristics on driver vision and comfort. One potential means to reduce rear end crashes is to enhance the attention getting qualities of rear brake lights. Ongoing research is identifying the potential rear signal enhancements that might meet this goal.

Driver distraction continues to be a concern due to the increasing number of information systems in vehicles. A new project was initiated to investigate ways to monitor and assess distraction in real time as a basis for developing an adaptive interface to aid drivers in safely using multiple in-vehicle systems. An ongoing cooperative research study with the automotive industry is attempting to identify safety relevant tests to quantify the degree to which a driver's use of in-vehicle devices impacts their ability to perform the driving task. This effort will be completed in 2004.

While conventional research methodologies are useful in generating data needed to quantify how vehicle subsystem parameters influence driver performance, the ability to measure the behavior of drivers in the real world can provide an understanding of how drivers actually interact with the vehicle and what factors influence the sequence of events that can lead to a near miss or actual crash. To obtain this knowledge, NHTSA has initiated a study of "naturalistic driving." This project will equip 100 private vehicles with instrumentation that will record many aspects of driver behavior over a one year time period. The findings will be used to help identify human factors problems and potential countermeasures as well as to decide whether this methodology should be extended to a larger, more representative sample of the driving population.

### Tire Research

Several research projects have been conducted to address the problem of tire failures. Updated requirements for tire endurance testing have been developed. Under-inflation problems are being addressed by tire pressure monitoring systems (TPMS). Current research is investigating the ways to simulate accelerated aging of tires. Future research will also investigate TPMS and/or central tire inflation systems for heavy trucks.

### BIOMECHANICS RESEARCH

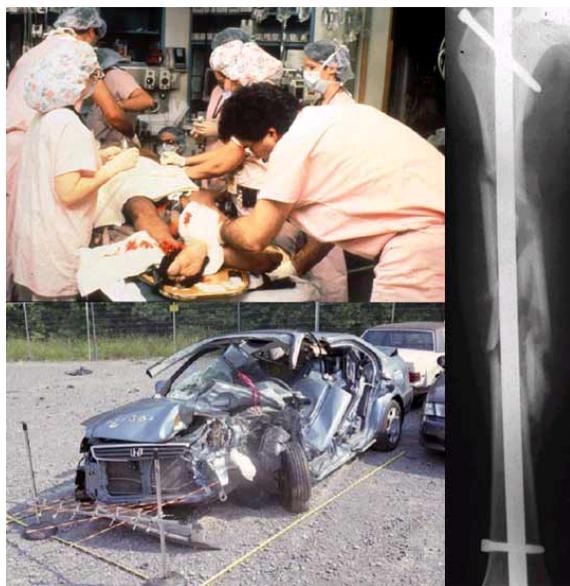
Research efforts by our National Transportation Biomechanics Research Center continue to focus on improving the basic science that quantifies our understanding of occupant crash injury mechanisms. By combining the results of state-of-the-art experimental and analytical efforts with our advanced and more realistic anthropomorphic test devices, it is expected that our capabilities to accurately detect and evaluate potential injury threats will be greatly enhanced thereby allowing automotive safety

engineers to more effectively design new injury mitigating safety systems.

### **CIREN**

The Crash Injury Research and Engineering Network (CIREN) is now composed of 10 level one trauma hospitals. Froedtert Hospital at the Medical College of Wisconsin joined CIREN on November 2001. In January 2003, Honda R&D Co., Ltd, replaced Ford Motor Company as the sponsor of the Inova Healthcare Services/Inova Fairfax CIREN Center.

CIREN continues to produce “real-world” research findings on crashes, injuries, treatments, and outcomes. CIREN medical researchers, working with engineers at NHTSA and in the automotive industry and research universities, have produced more than 100 scientific papers and presentations analyzing the basic causes of more than 1,500 cases of serious crash injuries. Figure 7 illustrates the CIREN system, from crash, to treatment to injury.



**Figure 7. CIREN data is gathered at the crash site, during treatment, and long-term follow-up.**

CIREN has researched injury patterns and a long-term outcome related to the older population and is currently conducting research on the complex issue of peri-prosthetic fractures secondary to motor vehicle crashes.

Life threatening internal occult injuries, resulting from motor vehicle crashes, continues to be a major focus of several CIREN Centers. CIREN research findings have created a heightened awareness of critical injuries to the liver, cervical spine, and aorta

caused by motor vehicle crashes that may not be immediately and accurately diagnosed by current medical protocols.

The benefit of partnership between the various CIREN centers is continuing to grow. Education and outreach are an important and expanding part of the research that is being conducted by the participating centers. These outreach activities provide unique training opportunities for emergency medical services (EMS) professionals, police and fire department personnel, and emergency room (ER) physicians on the nature of impact injury mechanisms and ways to improve triage, transport, treatment and ultimate outcome.

### **Analytical Modeling and Simulation**

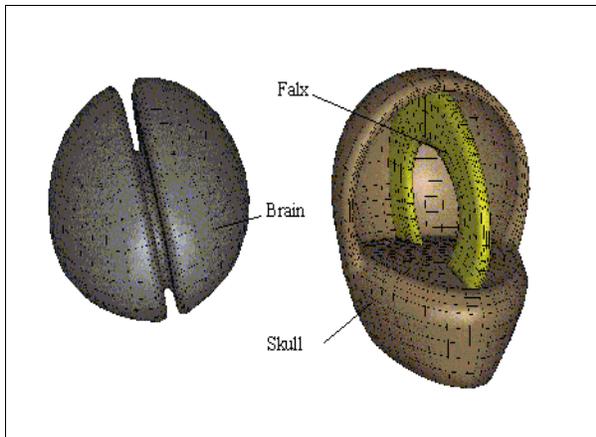
The rapidly expanding capabilities and sophistication of analytical modeling techniques continue to hold out the promise of both improving our understanding of the basic underlying mechanics of injury producing processes.

In addition, analytical approaches are enhancing our capabilities to detect and evaluate human risk by employing sophisticated human models to interpret crash dummy responses.

For example, rather than using empirically derived relationships linking specific gross features derived from measured force and acceleration time histories to predict injury severity, the same time histories can be used as inputs to detailed analytical models of the human. This allows researchers to predict and interpret detailed local structural responses and to assess their potential for inducing injury.

Our Simulated Injury Monitor concept (SIMon), introduced at the ESV 17, offers an improved injury evaluation capability. By applying measured dummy head accelerations to a brain model and monitoring local stress and strain responses for injurious conditions, the extent and severity of various types of brain injuries, e.g., diffuse axonal injury, focal lesions, and bridging vein rupture, can be evaluated (see Figure 8).

Initial successes with SIMon (head) program have led to applications of this concept to the prediction of injury in other body areas such as the neck, thorax, and lower extremities.



**Figure 8. SIMon skull and brain model.**

### **Experimental Impact Injury Research**

Experimental impact injury research efforts continue to be the cornerstone upon which the science of biomechanics is built. With the continuing, extremely rapid, implementation of new and diverse safety technologies, the demand for accurate biomechanical evaluation of their interaction with human occupants, from infants through the elderly, has increased enormously. To address this expanding demand for basic biomechanical knowledge, the NTBRC has enlarged both the depth and breadth of its experimental program to encompass research efforts in almost every major body region—from addressing both skull and brain injury to pursuing improved understanding of injury processes in the neck, thoracic, abdominal, and lower extremities all under the ever expanding universe of possible impact scenarios.

### **Anthropomorphic Dummy Development**

The agency continues to believe that the design features of its advanced frontal dummy, THOR, offer a significantly improvement over current injury assessment devices. To insure that THOR concepts can be broadly applied, the development of a 5<sup>th</sup> percentile female (see Figure 9) version of 50<sup>th</sup> percentile male THOR dummy was also undertaken.

These efforts have resulted in the first prototypes now being available for testing and evaluation. Additional efforts to rapidly apply THOR technology to safety evaluation have taken various subcomponents of THOR, such as the head/neck and the lower extremities, and adapted them to easily replace the corresponding components on the Hybrid III.



**Figure 9. Prototype of THOR 5<sup>th</sup> female dummy**

### **INTERNATIONAL HARMONIZATION**

The harmonization of regulations continues to be a matter of increasing importance to the United States and NHTSA. Efforts to coordinate regulatory practices on a global scale have resulted in establishment of fora and agreements to promote and guide the process of harmonization both at the bilateral and multilateral levels. NHTSA has been and continues to actively participate in many of these fora, ensuring that all harmonization activities take into account best safety practices and best available technologies.

### **International Harmonized Research Activities (IHRA)**

NHTSA continues to work with its international partners to coordinate research, establish priorities, and to carry out the agreements reached during the 15<sup>th</sup> ESV Conference in Australia. The International Harmonized Research Activities uses a steering committee to review recommendations and research plans, and working groups to coordinate research in five emphasis areas: frontal-compatibility protection,

side impact protection, intelligent transportation systems, biomechanics research, and pedestrian safety. The status reports for each working group can be found in the proceedings for this conference as the first papers under each of the respective topics. The 5-year term for IHRA ended in May 2001, and the steering committee decided to renew the term of the agreement for another six years with a status review to be undertaken every two years. In addition, the participants agreed to combine the advanced frontal offset protection and compatibility groups under the chairmanship of the United Kingdom.

### **World Forum for the Harmonization of Vehicle Regulations (UN/ECE/WP.29)**

**1998 Global Agreement:** On August 25, 2000, the United Nations/Economic Commission for Europe (UN/ECE) Agreement Concerning the Establishment of Global and Technical Regulations for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted And/or Be Used On Wheeled Vehicles (the "1998 Global Agreement") entered into force. There are currently 21 contracting parties to this Agreement. The 1998 Global Agreement provides for the establishment of global technical regulations regarding the safety, emissions, energy conservation and theft prevention of wheeled vehicles, equipment and parts. The Agreement contains procedures for establishing global technical regulations by either harmonizing existing regulations or developing new regulations. The establishment of global technical regulations is expected to lead to a significant degree of convergence in motor vehicle regulations at the regional and national levels. However, while in some instances the result may be the adoption of identical or substantially identical regulations at those levels, in other instances, the result may be regulations that differ but do not conflict with each other. The Agreement recognizes that governments have the right to determine whether the global technical regulations established under the Agreement are suitable for their own particular safety needs. Those needs vary from country to country due to differences in the traffic environment, vehicle fleet composition, driver characteristics and seat belt usage rates.

**Implementation of the 1998 Global Agreement:** In August 2000, the United States (NHTSA) published a final rule which adopts a policy statement describing the Agency's activities and practices for facilitating public participation concerning issues that arise in the implementation of the 1998 Global Agreement. The final rule, which took effect on September 22, 2000, sets forth the various stages at which NHTSA will issue notices and hold public

meetings for the purpose of disseminating information, seeking comments and providing opportunities for discussion.

On July 18, 2000, NHTSA published in the Federal Register (65 FR 44565) a notice seeking public comments on its preliminary recommendations for the first motor vehicle safety technical regulations to be considered for establishment under the Agreement. On January 18, 2001, the agency, after consideration of the comments, published in the Federal Register (66 FR 4893) a notice outlining its final recommendations. In that notice, the agency stated that it would present those recommendations to WP.29 and propose them for consideration by other contracting parties of the 1998 Global Agreement concerning the adoption of a program of work under the Agreement. In March 2001, NHTSA submitted to WP.29 and the Executive Committee of the 1998 Global Agreement its final recommendations for the first motor vehicle safety technical regulations to be considered for establishment under that Agreement. The Administrative Committee for the Coordination of Work of WP.29 (AC.2) reviewed the recommendations made by various contracting parties, including the United States, Canada, the European Union, Japan, and Russia, as well as those made by other interested parties and reached agreement on a Program of Work, taking into account the workload of the working parties of experts under WP.29. AC.2 then submitted the Program of Work to the Executive Committee of the 1998 Global Agreement (AC.3). The AC.3 approved the Program of Work and requested that contracting parties volunteer to sponsor each listed regulation by submitting a formal proposal as required by Article 6 of the 1998 Global Agreement. WP.29 formally adopted the Program of Work at its session in March 2002. During the June and November 2002 sessions of WP.29, several contracting parties stepped forward as sponsors for the individual work items. The U.S. indicated that it will take the lead in advancing several of the areas on the Program of Work, including door retention components and head restraints.

### **Asia Pacific Economic Cooperation (APEC)**

NHTSA continues to be involved in APEC harmonization projects, as a regular participant in meetings and a contributing member to the development and administration of harmonization activities. Of significance is the Road Transport Harmonization Project (RTHP), which began in 1994, and whose objective is to promote the harmonization of standards within APEC region.

Within the last few years, APEC has stepped up its efforts in promoting regional and global harmonization of vehicle standards in light of the 1998 Global Agreement's entry into force in August 2000. As of January 2003, there were seven contracting parties among the APEC economies (United States, Canada, Japan, Russian Federation, People's Republic of China, Korea and New Zealand). It is anticipated that other APEC economies will become contracting parties within the next few years.

### **North America Free Trade Agreement (NAFTA)**

NHTSA has been actively involved in NAFTA harmonization efforts through the Automotive Standards Council (ASC). The Council has been seeking for the last eight years to identify incompatibilities in standards among NAFTA countries and set up a process that addresses these incompatibilities. Working groups, which comprise government and industry representatives, have been established to facilitate the process. During the past two years, the focus of the group has been primarily on the cross-border commercial vehicle traffic and the safe entry of commercial vehicles into the three jurisdictions. Several workshops were organized to bring greater understanding of the various regulatory and enforcement systems within NAFTA. NHTSA published three Federal Register notices geared towards opening the U.S.-Mexican border to commercial vehicles consistent with the requirements of the U.S. laws regarding motor vehicle safety. All comments to the notices have been considered and the Department of Transportation will likely announce final decision on these matters soon.

### **RULEMAKING**

Since the last ESV Conference in Amsterdam, NHTSA has published many final rules. The following is a compilation of these final rules ordered in the following three areas: Crash Avoidance, Crashworthiness, and Planning and Consumer Standards.

#### **Crash Avoidance**

- On August 14, 2001, NHTSA amended FMVSS 122, "Motorcycle Brake Systems," by reducing the minimum hand lever force from 5 pounds to 2.3 pounds and the minimum foot pedal force from 10 pounds to 5.6 pounds in the fade recovery and water recovery tests. Effective date: August 14, 2002.

- On August 17, 2001, in response to petitions for reconsideration, NHTSA made several substantive changes in the October 20, 2000, FMVSS 401, "Interior Trunk Release," Final Rule. It excluded hatchbacks and station wagons. It also excluded sub-compartments that are formed within the trunk compartment when a convertible top folds down into the trunk.
- On December 12, 2001, NHTSA amended FMVSS 121, "Air Brake Systems," to correct an inconsistency between two provisions concerning emergency brake stops, provided that single-unit truck axles should not be overloaded, clarified the wheel-lock provisions by adding a definition of a tandem axle, and permitted the use of roll bars on vehicles undergoing brake testing. Effective date: January 11, 2002.
- On April 22, 2002, in response to petitions for reconsideration, NHTSA issued a final rule regarding new FMVSS 401 requiring passenger cars with a trunk to be equipped with a release latch inside the trunk compartment.
- On June 5, 2002, in response to Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act, NHTSA issued a two-part final rule. The first part established a new FMVSS that required the installation of tire pressure monitoring systems (TPMSs) that warn the driver when a tire is significantly under-inflated. The second part of this final rule will be issued by March 1, 2005.
- On December 27, 2002, NHTSA adopted a new rule establishing two new safety standards: an equipment standard specifying requirements for platform lifts and a vehicle standard for all vehicles equipped with such lifts.

#### **Crashworthiness**

- On August 30, 2001, in response to petitions for reconsideration, NHTSA made several minor changes to the March 31, 2002, Part 572, "Anthropomorphic Test Device," Final Rule. These included adding a channel frequency class specification if a rotary potentiometer is used for measuring head rotation, revising the impact probe specifications to include provisions for mounting suspension hardware if a cable system is used for impacts, adopting a lower minimum mass moment of inertia, clarifying the specification for free air resonant frequency;

revising the material specifications in several drawings, and correcting several minor errors in these drawings, and in the Procedures for Assembly, Disassembly and Inspection (PADI). Effective date: October 29, 2001.

- On October 11, 2001, in response to a petition for rulemaking, Part 572, “Anthropomorphic Test Device,” NHTSA amended the neck lateral calibration specifications for the SID/HIII dummy. The dummy is used in side impact pole tests, which assesses the effectiveness of dynamically- deployed head impact protection systems. Effective date: December 10, 2001.
- On December 3, 2001, in response to petitions for reconsideration, NHTSA clarified amendments to FMVSS 305, “Electric-powered Vehicles,” regarding the application of the standard and the test conditions for battery state of charge and electrical isolation.
- On December 13, 2001, in response to petitions for reconsideration, NHTSA made several changes/clarifications to the 3-year old child test dummy. Effective date: January 14, 2002.
- On December 13, 2001, in response to petitions for reconsideration, NHTSA amended FMVSS 221, “School Bus Body Joint Strength,” to extend the applicability of the standard to small school buses, narrowed the exclusion of maintenance access panels from the joint strength requirements, and made other changes to the standard. Effective date: January 1, 2003.
- On December 18, 2001, in response to petitions for reconsideration, and required by TREAD, NHTSA issued a final rule regarding a number of technical details including test speed, measurement duration, positioning procedures, and phase-in to FMVSS 208, “Occupant Crash Protection.” Effective date: January 17, 2002.
- On April 19, 2002, NHTSA amended FMVSS 217, “Bus Emergency Exits and Window Retention and Release,” to reduce the likelihood that wheelchair securement anchorages to be installed in locations that permit wheelchairs to be secured where they block access to emergency exit doors. Effective date: April 21, 2003.
- On June 18, 2002, NHTSA amended the schedule for compliance by manufacturers of

vehicles built in two or more stages with the upper interior head protection requirements of FMVSS 201, “Occupant Protection in Interior Impact.”

- On October 22, 2002, NHTSA amended its child restraint standard to facilitate the safe transportation of preschool and special needs children through the manufacture and use of a vest that holds the children in place during a crash.
- On January 6, 2003, in response to petitions for reconsideration, NHTSA responded to those portions of FMVSS 208, “Occupant Crash Protection,” regarding the length of time during which data will be collected during low risk deployment tests, a change in dummy positioning procedure for one of the driver position low risk deployment tests, issues related to the air bag warning label, and the telltale that indicates when the passenger air bag has been automatically suppressed.

#### **Planning and Consumer Standards**

- On August 3, 2001, NHTSA announced determination for model year (MY) 2002 high-theft vehicle lines that are subject to the parts-marking requirements of the Federal motor vehicle theft prevention standard, and high-theft MY 2002 lines that are exempted from the parts-marking requirements because the vehicles are equipped with antitheft devices. Effective date: August 14, 2002
- On October 24, 2001, NHTSA updated Appendices A, B, and C of Part 544, “Insurer Report Requirement.” These appendices list those passenger motor vehicle insurers that are required to file reports on their motor vehicle theft loss experience.
- On April 4, 2002, NHTSA established the average fuel economy standard for light trucks manufactured in the 2004 model year. Chapter 329 of Title 49 of the United States Code requires the issuance of this standard. The standard for all light trucks manufactured by a manufacturer is set at 20.7 mpg for the 2004 model year.
- On July 1, 2002, NHTSA announced determination for model year (MY) 2003 high-theft vehicle lines that are subject to the parts-

marking requirements of the Federal motor vehicle theft prevention standard, and high-theft MY 2003 lines that are exempted from the parts-marking requirements because the vehicles are equipped with antitheft devices determined to meet certain statutory criteria pursuant to the statute relating to motor vehicle theft prevention.

- On July 16, 2002, NHTSA updated regulations on insurer reporting requirements. The regulation lists those passenger motor vehicle insurers that are required to file reports on their motor vehicle theft loss experiences.
- On October 1, 2002, NHTSA was mandated by Congress to consider whether to prescribe clearer and simpler labels and instructions for child restraints. The rule amended the requirements for child restraint labels and the written instructions that accompany child restraints. This rule made changes to the format, location and contents of some the existing requirements.