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BEFORE THE SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
REGARDING ADVANCED VEHICLE-HIGHWAY TECHNOLOGY
AND HUMAN FACTORS RESEARCH

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Mr. Chairman and Members of the Committee.

I am pleased to appear before you today to discuss the National Highway Traffic Safety Administration's (NHTSA) views on advanced vehicle-highway technology and human factors research.

Motor vehicle crashes are a leading cause of death and injury in the United States. For a person under the age of 34, in fact, a motor vehicle crash is the leading cause of death. In 1988, motor vehicle crashes resulted in 47,093 deaths, an estimated 3 1/2 million injuries, and total economic costs in excess of $75 billion. As the number of vehicles on the road and the number of miles travelled increase, the number of deaths and injuries will also increase unless effective safety measures can intervene. While we have made great strides in highway safety -- the fatality rate in 1988 of 2.4 fatalities per 100 million vehicle miles travelled is the lowest ever recorded -- more must be done to reduce the magnitude of the highway safety problem.

We believe that the new occupant crash protection devices that will be required in all passenger cars for the 1990 model year will help to reduce the crash toll. These devices, including air bags and a variety of automatic safety belts, are helpful in preventing injury once a crash

has occurred. They are the product of research which showed how people were injured in frontal crashes and how specific safety improvements could help prevent injury.

We would like to be able to apply similar techniques to the prevention of crashes, but we face the difficulty that most crashes do not have a single cause. Studies show that human factors are involved in virtually all crashes, as either the sole cause or a contributory cause, but while these factors can be described -- as lapses in detection, perception, judgment, risk assessment, manuever execution, and so on -- we frequently do not fully understand the sources of these lapses or what type of countermeasures would prevent them.

The continuing development of innovative technology by the scientific and engineering communities has the potential to provide solutions to some of the human factors problems. It may be that the new developments in electronic technology will give us a better means of analyzing the driving task and lead to improvements in the vehicle that will expand the driver's margin of safety in high-risk environments. A number of electronic innovations, such as antilock brakes, are already on the road in large numbers. We anticipate that a driver's margin of safety could be further increased by developing "smart" vehicles and highways that give the driver a better sense of impending dangers and that compensate for lapses in judgment or skill.

The European effort

The major, existing advanced technology program in this area--Europe's PROMETHEUS program--is designed to strengthen the European Economic Community's (EEC) role in the global automotive electronics

market, to promote the intelligent use of road space and vehicle safety while reducing emissions and energy consumption, and to integrate traffic systems with vehicle management. Safety is a key element of this program.

The goal of the PROMETHEUS research effort is to design "intelligent vehicles" and electronic traffic flow detectors that improve communications between drivers and provide automatic crash avoidance. The general objectives of this effort are to improve traffic safety, efficiency, and convenience, and to reduce the environmental effects of automobile travel, such as air pollution. The guiding principle behind this eight-year, $800 million program is the gradual development of the automobile from an individual guided vehicle to one which operates as an integral part of a more efficient and safe traffic network.

PROMETHEUS involves all the leading European-owned car companies, over 100 automotive suppliers, and 70 research institutes. Since one of the program's goals is to achieve European dominance in the electronics industry within the next decade, non-European firms have been strictly prohibited from participating in the program. The research topics for the program have been published and the research is scheduled to be completed in 1994.

Status of U.S. efforts

A major goal of the embryonic U.S. intelligent vehicle-highway system (IVHS) program (also referred to as the advanced vehicle-highway system, or AVHS) is to help reduce the road congestion that is already a serious problem in many parts of the country and is predicted to spread to other areas in coming years. Another goal is to improve the safety of the

highway system. The testimony presented by the Federal Highway Administration has focused on these efforts. The National Highway Traffic Safety Administration's principal focus and responsibility has been on the vehicle and the driver/vehicle interaction.

The agency has begun to address IVHS issues. We are actively participating in the deliberations of Mobility 2000--the ad hoc committee formed to provide a focus for U.S. IVHS efforts. NHTSA, together with the FHWA, is contributing to DOT's report to Congress on IVHS programs that was requested in the Conference Report on the FY 1989 DOT Appropriations Act. On the State level, we have provided seed money for initial planning studies on IVHS-related issues with the University of California at Berkeley, the University of Michigan, Texas A&M University, and the Massachusetts Institute of Technology.

In addition, the agency is involved in a cooperative program with the California Department of Transportation, Ford Motor Company, and Radar Control Systems to evaluate the application of collision avoidance technology as a means of enabling vehicles travelling in a group to maintain a safe interval. Within the agency, we have initiated a series of crash-data analyses to better understand the distributions of crashes, fatalities, and injury levels versus location, time of day, etc., in order to maximize potential safety improvements through advanced technology developments that have the highest probability of pay-off.

Although it may be assumed that some reduction of the risk of crashes would accompany a reduction in traffic congestion, care must be taken in the implementation of new vehicle-highway systems to avoid degradation of safety, particularly through the creation of human-factor problems. For example, it is possible that a proliferation of information channels and displays could distract a driver, rather than help. One research task,

therefore, is to evaluate the ability of drivers to assimilate more information so that no loss of safety will occur as new driver aids, control resources, and crash avoidance systems are implemented.

A major prerequisite for the development of intelligent vehicle-highway systems is research to improve the understanding of driver-vehicle interaction issues. Part of the reason for our limited understanding of the contribution of human factors to crashes is the great difficulty in conducting human factors research safely under controlled and repeatable conditions. As a result, our efforts to understand pre-crash events and develop safety countermeasures are hampered by the lack of knowledge and understanding of the factors determining the effects of driver predisposition, response and performance in potential crash situations.

Let me illustrate this problem with some examples:

* We know that visual performance, information evaluation and timely decision-making are critical to driving, but we do not know what specific, visual capabilities are required, what measures of visual or cognitive workload are meaningful, or what measures and criteria of acceptable driver performance should be used in the conduct of research.

* We know visibility from a vehicle is requisite for safe driving, however, we really do not know how to quantify this value and thus find it difficult to estimate a minimal requirement.

* We know that the driver uses many visual, auditory, and tactile cues to control the vehicle while driving, but we have little understanding of what these cues are, how to quantify them, how the driver utilizes them, or how the driver adjusts to changes in these cues.

Critical to the success of human factors research will be projects to develop and validate research and analysis tools to obtain data, evaluation protocols for assessing potential safety degradation or benefits of intelligent vehicle systems, and decision-aids to support

choice of research directions and agency actions. We are currently working through the National Science Foundation with the University of Iowa to examine the technical and economic feasibility of developing a state-of-the-art driving simulator.

At this point, the Department has not determined whether there needs to be a national program for the development and implementation of IVHS programs. Recently, the Department distributed a discussion paper on IVHS programs to solicit comments from the transportation community and the public at large on this subject and on the merits of a commitment to a coordinated national IVHS research deployment program and the approach that should be taken to fund an IVHS program. The comments on this paper will be used in the preparation of the report to Congress that I mentioned earlier.

If a national research, development and demonstration effort for IVHS programs is warranted, a strong organizational framework would be needed to bring together the public and private interests in this area. The organizational options to provide this cooperative framework are also being reviewed. When the Administration's review is completed and the Department's report to Congress is submitted, we will be better prepared to discuss any recommendations for legislative or programmatic changes that seem advisable.

Mr. Chairman, this concludes my remarks. I will be glad to try to answer any questions you may have.