Workshop Report

Joint Workshop on Liability Issues in Advanced Vehicle Control and Automated Highway Systems

Washington, DC
February 5 - 6, 1997

Co-Sponsors:
National Automated Highway System Consortium
ITS America
American Association of State Highway & Transportation Officials

150361

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Summary

The National Automated Highway System Consortium (NAHSC), ITS America and the American Association of State Highway & Transportation Officials (AASHTO) co-sponsored a two-day workshop in Washington, DC on February 5-6, 1997 to examine the liability issues associated with crash-avoidance (automated vehicle control systems, or AVCS) and automated highway systems (AHS). The goal of the workshop was to bring together the various stakeholder groups in these technologies -- including, among others, federal and state transportation officials, vehicle and product manufacturers, plaintiff and defense attorneys, academics, and researchers -- to identify and analyze the critical liability issues associated with crash-avoidance and automated highway systems. Plenary speeches provided background for these discussions. Steering committee members involved in the production of this workshop were: Janie Page Blanchard of Bechtel Corporation/NAHSC, John Donaldson of National Highway Transportation Safety Administration, Charles Fairfax of General Motors, David Hensing of American Association of State Highway & Transportation Officials, Mark Johnson of ITS America, Chuck Leone of Diversified Risk Insurance Brokers, and Manuel Puentes of American Automobile Association of Southern California.

Key Conclusions

- There are significant safety and economic benefits attributable to AVCS and AHS technologies.
- From the point of view of each of the major interest groups represented at this meeting, there is no present belief that liability concerns *per* se will stop the development and preliminary deployment of either AVCS or AHS.
- There is little direct evidence that liability concerns are presently hindering the development and deployment of ITS generally, nor of either AVCS or AHS specifically.
- While liability is often cited as a barrier to the development and introduction of new technology into the marketplace, all groups except Industry/Manufacturers believed that competition within industries was a bigger factor.
- Fear of liability, particularly concerns about possible changes in the allocation of liability as control of the vehicle becomes more automated, is a reality. Consideration of this fear may likely influence designs of future products.
- If it can be proven that AHS enhances both the intended and actual safety of the product, then the reality of liability issues will be substantially reduced.

Recommendations

- Potential liability problems can be managed, if addressed early on, with such techniques as consulting legal counsel throughout the development phase of AVCS and AHS technologies.
- In order to control potential exposure to liability, it is essential to manage expectations of new technology through realistic public education about the actual limits, capabilities, and benefits of the proposed technology.
- More education and outreach to the insurance industry and to safety groups is needed to promote understanding and acceptance of these emerging technologies.

Acknowledgments

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Sponsoring Organizations

National Automated Highway System Consortium (NAHSC)

ITS America

American Association of State & Highway Transportation Officials (AASHTO)

Steering Committee Co-Chairs

Janie Page Blanchard, *Bechtel Corporation*

Mark Johnson, *ITS America*

Steering Committee Members

John Donaldson, *National Highway Transportation Safety Administration*

Charles Fairfax, *General Motors*

David Hensing, *American Association of State Highway & Transportation Officials*

Chuck Leone, *Diversified Risk Insurance Brokers*

Manuel Puentes , *American Automobile Association of Southern California*

Nominal Group Technique

John Bagby, *The Pennsylvania State University*

Dennis Gioia, *The Pennsylvania State University*

Plenary Sneakers

John Bagby, *The Pennsylvania State University*

August Burgett, *NHTSA*

John Donaldson, *NHTSA*

Jim Rillings, *NAHSC/General Motors*

Craig Roberts, *ITS America*

Stephen Roberts, *Nossaman, Guthner, Knox & Elliott*

Preuaration of Final Report

John Bagby, The *Pennsylvania State University*

Janie Page Blanchard, *Bechtel Corporation*

Mark Johnson, *ITS America.*

Alicia Kershaw, *Bechtel Corporation*

Stephen Roberts, *Nossaman, Guthner, Knox & Elliott*

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List of Acronyms

Participant Affiliations

- National Automated Highway System Consortium (NAHSC)
  - Bechtel
  - California PATH
  - Carnegie Mellon University
  - Federal Highway Administration (FHWA)
  - General Motors
  - National Highway Traffic Safety Administration (NHTSA)
  - Parsons Brinckerhoff
- Departments of Transportation
  - California
  - Houston METRO
  - Maine
  - Minnesota
  - Minnesota Guidestar
  - New York State Throughway Authority
  - Other Public Transportation Agencies
- Plaintiff and Defense Attorneys
- Auto Manufacturers
- Parts and Components Manufacturers
- Transportation Associations and Interest Groups
  - American Association of Motor Vehicle Administrators (AAMVA)
  - Automotive Occupant Restraints Council
- Insurance Industry
- Transportation Consultants
- Legal Academics
- Transportation Research Institutions

What is AHS?

Automated highway systems do not yet exist. AHS refers to a study effort being conducted by a consortium of ten organizations (Bechtel, California Department of Transportation, Carnegie-Mellon University, Delco, DOT/FHWA, General Motors, Hughes, Lockheed-Martin, Parsons Brinckerhoff, and the University of California PATH). Eighty percent of the work is sponsored by the U.S. Federal Highway Administration, and the remaining 20% supplied through a cost sharing agreement with each of the other nine companies. The goal of the AI-IS effort is to find ways to improve access to and throughput on our surface transportation network by enabling suitably equipped vehicles to travel on limited access, possibly specially equipped, roads. As presently envisioned, AHS would ultimately automate all driving tasks associated with those vehicles while on AHS equipped roads. Further, AHS would do this without any physical connection between vehicles or between any vehicle and the roadway. AHS vehicles are anticipated to be capable of fully manual operation on non-AHS roads, but the AHS roads as presently envisioned may or may not accept non-AHS vehicles.

The following areas were identified during analyses prior to the workshop as the critical attributes of an AHS requiring further analysis:

- dedicated lanes vs. mixed traffic operations

- deployment sequences and timing
- distribution of intelligence and communication links
- individual vehicle operations vs. platoons
- obstacle detection
- driver role(s) and degree of participation.

For the purposes of the liability conference, participants were asked to consider how liability might influence future decisions in each of these areas. No *a priori* assumptions were made about the possible results of future technical analyses.

Workshop Structure

Plenary speakers provided participants with critical background information each of the two mornings of the workshop. Notes from those plenary talks are provided in this report. After the plenary sessions, participants were assigned to specific breakout groups, each of which was presented with a set of focus questions around which to structure the group discussions. Summary presentations from each group are in the main body of this report and full notes from each breakout group are included as an appendix to this report.

Session 1: ***Issues Clarification*** **Wednesday morning (2/5/97)**
Session 2: ***Identification of Conflicts*** **Wednesday afternoon (2/5/97)**
Session 3*: **Resolving the Conflicts & Identifying Missing Pieces*** **Thurs. morning (2/6/97)**

Within assigned groups, participants identified key liability issues in AVCS and AHS using a form of a structured discussion process known as Nominal Group Technique (NGT). This process was developed in the 1970's as a way to allow diverse constituencies to contribute to and arrive at decisions regarding the identification of needs, the development of solutions, and the specification of priorities on a topic, despite the widely varying backgrounds, conceptual orientations and language structures of the participants. During this process, participants were encouraged to negotiate on the merits of the ideas by focusing on basic (and likely diverse) interests, mutually satisfying options between different interest groups, and fair standards in evaluating ideas generated. Details of this process are in the Appendix.

Summary of Critical Issues Identified in Breakout Groups

(compiled from plenary discussions afer presentation of group deliberations)

Session One: Issues and Fears

- Standards Development

  States do not normally enact or pass vehicle standards. Either the government or industry groups do. There are at present no standards for these new ITS technologies. However, standards could be a double-edged sword: standards permit the technologies to work, but the degree of protection they offer the manufacturer, or any other entity, from liability is not clear. One may comply with the standards, but it is not clear what legal protection compliance offers if someone uses the product in a manner that seems reasonable but is not according to the designer's intent. Well drafted standards can protect a manufacturer to a large degree if the manufacturer complies. In fact, manufacturers often seek such standards.

- Tort Reform

  There may be a need for some tort reform in order to permit the safe harbor concept for compliance with standards. It is not clear, however, that tort reform will provide uniform protection as each state is likely to enact different, and possibly conflicting, reforms. Further, wide spread tort reform does not appear likely at this time.

- Public Education

  Liability is expected to be reduced when customer expectations are more consistent with what the particular product can actually do.

- Deployment sequences

  Customer expectations can be expected to evolve with the technology. Deployment sequences that are consistent with driver expectations are most likely to reduce liability exposure for manufacturers and transportation organizations.

Sessions Two and Three: Identifying and Resolving Conflicts

- The fear of liability is a reality, but there is no evidence to say that liability is an outright showstopper to deployment of AHS <u>as long as</u> this fear is continually monitored and addressed as needed.

  DOT group: foresees issues on liability, but not a showstopper
  Public entities: not a showstopper
  Manufacturers of Products: not a showstopper, but maybe some hindrances
  Others: not a showstopper

  There is an analogous situation with privacy and ITS: at first privacy was considered a likely showstopper, but aftermore detailed study, researchers found it could be managed through attention to the issue during product development and deployment cycles.

- In some manufacturing industries, liability is cited as the reason development or marketing was stopped when in reality market forces appear the more likely reason.

- An actual purpose of tort liability is to hinder development of products that should not be promulgated because of safety reasons. If AHS can be proven to enhance both the intended and actual safety of the product, then liability issues will be substantially reduced.

  In Pennsylvania, it is possible to reduce insurance premiums by signing away the right to litigate.

  In California, a recently enacted law states that uninsured drivers waive their right to sue for punitive damages arising from an accident by virtue of their lack of insurance.

- In testing whether AHS should proceed (from a liability defense perspective) it is important to recognize that the safety benefits (cost-benefit) of AHS and AVCS could represent a net savings to the industry.

- Further progress on this issue will require more involvement with insurance industry and safety interests.

Workshop Proceedings

1. Plenary Talks

What is AHS?

Jim Rillings, Program Manager, NAHSC

AHS, like all of ITS, must balance conflicting mobility, safety and environmental requirements. As the US population continues to grow, mostly in inner cities and suburbs, we have observed a rise in urban and suburban congestion: at present 80% of urban rush hour traffic is congested, at an estimated annual cost of more than $50 billion in lost time and fuel. At the same time, there is a continued need to improve the safety of highways. Costs associated with highway safety presently stand at nearly 40,000 deaths annually, with expenditures of approximately $150 billion. The interstate highway system is essentially complete, with not much new construction expected to occur.

In 1991, Congress in ISTEA directed the US DOT to develop a prototype AHS system, with a demonstration of its technical feasibility in 1997. DOT organized this effort through a competitive and cooperative program leading to a consortium consisting companies from auto, highway, electronics, and other industries. AHS is a set of one or more lanes on a limited-access highway where specially equipped vehicles can operate under completely automated control. The vehicles and roadway cooperate to coordinate vehicle movement, avoid obstacles, and improve traffic flow. The AHS Consortium has ten core participants representing auto manufacturing (General Motors), auto electronics (Hughes, Delco), aerospace (Lockheed Martin), academics (Carnegie Mellon University, University of California at Berkeley PATH), highway construction (Bechtel. Parsons Brinckerhoff). a state department of transportation (California Department of Transportation), and US DOT (FHWA). There are also presently 103 associate participants: not just technical players, but organizations which deal with societal and institutional issues.

The potential for AHS is great. Its goal IS to improve highway safety with no collisions, absent a malfunction in the fail-safe system design. We expect to increase greatly – by two or three times -- today's capacity per lane of throughput. resulting in enhanced mobility for people and freight. and shorter and more predictable traveling times. even in inclement weather. All of this will help lessen environmental impacts of vehicle transportation.

The AHS program encompasses technical areas as well as societal and institutional ones. Its main theme is the development, testing, evaluation and selection of AHS concepts. This will result in an operating prototype and a validated set of specifications for a deployable system. If the program is successful, an operational test of AHS would follow. The effort is also dealing with adaptation of technologies to AHS. such as obstacle detection, collision warning and collision avoidance, and lateral/longitudinal control of vehicles. All of this will be supported by a communications system between the vehicle and highway. The demonstration in August 1997 will show the technical feasibility of AHS.

Currently, the AHS program is an eight-year effort running to 2002. This is the system definition phase of the program. An earlier analysis of AHS concluded that there are no

showstoppers to deployment: neither technical, legal, social nor economic. US DOT has put up 80% of the cost of the program; the Consortium has contributed the remaining 20%. Liablility is only one of the many profound societal and institutional issues we are studying. Others issues include the changing public and private sector relationships, the question of AHS highway ownership, and social equity.

We are in the middle of a three-stage, five-year effort to produce a complete concept that is technically feasible. The first two stages are completed. We are now moving into Stage 3, focusing on the selection of a specific concept, determining its specific attributes and producing a design for that prototype.

The first key concept attribution in Stage 3 is the distribution of intelligence: where does the intelligence lie in the system? how much in individual vehicles? in clusters of vehicles? in the roadway? how much altogether? and how is the information communicated throughout the system?

The second attribute is the vehicle separation policy: Do vehicles operate independently? loosely? in tightly coupled platoons? Safety and capacity issues are implicated. One of the biggest hurdles to overcome is obstacle detection and avoidance. The potential scenarios range from operating in a tunnel, thus obstacle free, to operating in a normal environment where the vehicle and highway work together to detect and avoid obstacles. In addition, there are many roles to be played by the driver: entering the system, turning over control, resuming control, and exiting the system. The system needs to be assured that the driver is capable of resuming control at the end of the trip. Another question is how to use the driver as an auxiliary obstacle detector.

The third attribute is deployment sequencing. It would be the most easy technically to develop AHS on dedicated lanes, isolated from normal traffic. It would also be more difficult economically and socially to do so. Thus, what is the proper sequencing of deployment?

The Consortium is running several case studies to evaluate the concepts and attributes in real-life situations to help understand and deal with some of the practical issues. For example, in Houston, the possible benefits of automating Houston Transit HOV lanes is being examined. Another study, in conjunction with the Western Transportation Institute, is looking at rural applications of AHS.

The object of the demonstration in August 1997 is to show the technical feasibility of highway automation. This demonstration is occurring relatively early in the research effort. Thus, no preferred technology will be showcased. The demonstration will take place on HOV lanes on I-15 north of San Diego. We will show several alternatives for highway automation, including several technologies that are close to being practicable and will soon be available: free-agent vehicles, vehicles platooned in groups up to eight, heavy trucks and buses, entry and exit, latitude and longitudinal control, traffic management, obstacle detection and avoidance, and maintenance.

A copy of the overheads shown during this talk is included in the Appendix.

National Highway Transportation Safety Administration's Role

John Donaldson, Senior Attorney, NHTSA

New technology is introduced into transportation on a daily basis, and NHTSA generally does not see any particularly unique aspects of liability inherent in AI-IS and AVCS. As a general rule, NHTSA does not involve itself with liability ***per*** se, but is more interested in improving overall safety, primarily focusing on vehicle/driver interaction issues. Historically FHWA is more concerned with safety issues related to the highway infrastructure.

NHTSA's mission is to reduce traffic crashes and resulting injuries and deaths by establishing federal motor vehicle safety standards and by engaging in safety research and development. As part of their ongoing research and development efforts, NHTSA is continually investigating new technologies, often in partnership with the private sector, with the goal of delivering qualified new safety and technology into the public.

The motor vehicle safety standards set by NHTSA are a series of performance standards, because NHTSA does not set design standards. Individual manufacturers are then free to establish designs to meet the performance requirements set by NHTSA. The overall process is one of self-certification: manufacturers test their vehicles to certify compliance with NHTSA's federal safety standards. NHTSA then periodically tests a variety of vehicles for compliance as a check of these tests. These safety standards are minimum standards that the vehicles must meet.

NHTSA also performs defect investigations related to the safety of vehicles on the road, independent of the safety standards. If a defect is found that has an impact on safety, manufacturers are notified that a recall or other corrective action may be appropriate.

NHTSA believes that congestion will be a continuing problem for at least the next two decades and that new technologies will be required to alleviate this problem. The key challenges predicted by NHTSA include: widespread congestion in the face of limited transportation capacity and constraints on environmental. and societal and human resources as a result of continuing growth in populations and economies. However, the future is expected to provide certain opportunities that will help us meet these challenges, such as the globally competitive marketplace which is forcing change at a rapid rate, the rapid stream of technologies and innovations becoming available on a daily basis, and an increased interdependence between the public and private sectors. By facilitating the appropriate use of new technologies, NHTSA is trying to increase efficiency of the transportation system. NHTSA's primary research concentrates on accident avoidance and accident survivability, of which human factors study is a large part. NHTSA's National Advanced Driving Simulator, presently under development, is expected to be running in late 1998, or early 1999. This facility will simulate a large variety of driving situations to help better understand human responses to changes in vehicles and the technologies used in those vehicles.

Crash Avoidance and Vehicle Control Technologies

August Burgett, Chief Light Vehicle Dynamics & Simulation Division, NHTSA

(Dr. Burgett is with the Office of ***Collision Vehicle Research. This division of NHTSA has two roles in ITS research: first, through the development of advanced technologies [especially as applied to collision avoidance], NHTSA believes that up to a million of the annual six million accidents can be avoided; second, by working with partners such as other federal agencies and the private sector, NHTSA hopes to ensure that the introduction of these new technologies does not compromise the safety of the present transportation system.)***

The major contributors to the overall accident rates are intersection collisions and single vehicles leaving the road. About 40,000 people are killed each year on highways, and more than 1.5 million others are injured. In addition, an estimated $150 billion a year is lost as a result of accidents. What is causing these accidents? NHTSA's research indicates that approximately three-quarters of all automotive accidents result from human error. Through a better understanding of how people drive, NHTSA hopes to better define how advanced technology can help to prevent accidents.

NHTSA's ITS Crash Avoidance research effort has been investigating several types of ITS systems that could be of use to drivers with particular focus on driver performance and injury mitigation. Of particular interest to NHTSA are extensions of intelligent cruise control to assist drivers, particularly in avoiding rear-end collisions; systems to reduce road departure; sensors to facilitate lane changes and merges; tests of heavy vehicle stability; technology to compensate for drowsy drivers (especially in heavy vehicles); vision enhancement; studies of general human factors of driving; and automatic collision notification. As an example of the scope of NHTSA's efforts, private drivers working with NHTSA are presently testing ten vehicles equipped with intelligent cruise control in common, everyday situations.

NHTSA. in conjunction with FHWA. is looking into what effects ITS technologies are having on human factors issues and vice versa. In each ITS safety system, there are three elements: a sensor, computational capability to understand the information provided by the sensor, and a driver interface. Recognizing that the driver interface can determine or undermine the ultimate utility of any new technology, NHTSA's goal is to help developers find designs that are compatible with human behaviors and capabilities. For example, a lane change/merge system may consist of visual indicators in some of the mirrors. either steady burning or flashing displays, with a possible audible message backup. By contrast, a visual display in a technology intended to prevent vehicles from running off the road is probably not as useful as a tactile stimulus, such as a device that would torque or vibrate the steering wheel, or one that would simulate the feeling of driving over a rumble strip.

If all vehicles had three of the ITS crash avoidance systems -- rear end collision avoidance, road departure warning, and systems to facilitate lane change/merge -- installed, NHTSA estimates that more than a million accidents could be avoided every year.

NHTSA is currently building four research tools to help develop a better understanding of how and should the ITS systems should work. These efforts focus on the relationship between vehicle characteristics and driver in various collision avoidance systems and include consideration of such ideas as data acquisition systems to be installed in individual vehicles.

A copy of the overheads shown during this talk is included in the Appendix.

What is Liability?

Craig Roberts, Director, Policy & Pertnerships, ITS America

Questions associated with liability may be primarily an issue of vocabulary. The two major groups represented in this meeting, lawyers and engineers, appear to have very different understandings associated with the term 'liability.' The goal of these remarks is to make explicit the general legal interpretation of this and related terms.

Tort Law: A tort is an accident or intentional harm to a person or thing. Within tort law there are two categories: injury law and damage law. In the United States, most tort law is formed and enforced at the state, not federal, level, with each state having a different set of laws and tradition. Also, tort law is common law, judge-made law that has evolved over hundreds of years, in contrast to legislative law in which committees negotiate their interests into a bill that may become law. Louisiana is distinct in that it follows a different tradition based on a legal code enacted into law by a political body. (Louisiana's legal system stems from France's Napoleonic Code put into place when Louisiana was a French colony.)

Although tort law has sometimes been modified by legislation, both at the state and federal levels, there is a huge sector of the economy with vested interests in the existing system of compensating people for injuries on the highway system as it has evolved over many years.

How then is it that tort law might impact the development and application of technologies for the highway system? Might it be a serious constraint to effectively applying the technologies and obtaining the potential benefits?

Presently, the primary burden of the cost of vehicle accidents rests with the drivers and the owners of the vehicles. This is reasonable when we consider that a vast preponderance of highway collisions are due to driver error. Thus it makes sense that the compensation responsibility rests primarily on the driver and owner of the vehicle(s). This general system is called negligence. Accidents caused by defects in the vehicle are assessed against the manufacturer and/or designer or whoever put the vehicle into the flow of commerce. Thus, we have two doctrines for compensation: negligence and products liability.

Negligence: To make a claim, a plaintiff must establish four elements: duty, breach, cause, and loss. The injured party must show that he/she was owed a duty of care and that duty was specifically owed by another. Duty is defined as what a reasonable and prudent person would have done under the circumstances to guard against the foreseeable harms. Duty having been established, the injured party must show a breach of that duty.In other words, there must have been a failure to take reasonable precautions or actions on the part of the party who supposedly caused the injury. The breach of the duty has to be shown to have been a cause of the harm shown by the injured party. Damages (or losses) must also have occurred.

Compensatory damages reimburse the injured party for actual harm: medical, economic, pain and suffering, damage to property. Punitive damages are intended to the punish the transgressor and act as a deterrent against future, similar action causing the harm. In many

states, punitive damages may be, and often are, linked to the amount of compensatory damages.

Defenses: If the party who is asking for compensation was also shown to have been negligent, contributory negligence may prevent the award of any compensation. Comparative negligence was developed to assign a proportion of negligence and compensate the injured party on a sliding scale relative to his or her own negligence.

Products liability is not fault attributed to a person/individual, but rather fault which is assigned to the product. This form of liability is not concerned with the conduct of the defendant, but focuses instead on the defectiveness of the product. Negligence is not a factor under this doctrine as the user is assumed to have acted with appropriate due care. Key elements of strict liability are: (1) the product has to have been sold in a defective condition; (2) the defective condition had to have made the product unreasonably dangerous; (3) the product cannot have been substantially altered in the stream of commerce; and (4) an unreasonably dangerous condition had to have caused some sort of injury. It is the plaintiffs burden to establish all of these elements before strict liability can apply.

The law recognizes two types of defects: an error in the manufacturing process and a fundamental design issue that could create a harm. There are two tests for determining a defect, either of which may establish a defect: (1) a reasonable consumer test (did the defect leave the manufacturer in a state to put a reasonable consumer at risk?), or (2) a risk-utility test (which balances the utility of the product against the risk of foreseeable harm).

Strict liability is applicable to designers, manufacturers, and sellers, (both wholesalers and retailers} of products. Often, defendants in a strict liability case will be joint and severally liable. That is, each defendant is individually liable for the full damages award, but may seek compensation from the other defendants as to each one's pro rata share. Strict liability may be imposed even though all reasonable care was taken in the design and manufacture of the product. The fact that a defendant shows no negligence is not sufficient to beat the claim. Manufacturers have a duty to supply an adequate warning against harms that are reasonably foreseeable through normal and expected use of the product. They are responsible to warn against foreseeable misuses of the product. This requirement is applicable only to products, not to services.

Strict liability is relatively new. It was created because of the difficulty for an injured party to show negligence during the manufacturing or design process. There was a recognition that manufacturers and sellers were in a better position to pay for the possible resulting injuries than the consumer.

Standards and customs: Typically, if a standard is followed in developing a product, its use can be taken as evidence of due care. In a few states, following a standard can be a bar to recovery of damages. On the other hand, failure to follow a standard may be evidence of the lack of proper care. In some states, state-of-the-art evidence (e.g. showing that the product was the most highly developed product available at the time) may vitiate a strict liability claim.

Res Ipsa Loquitur is a legal doctrine under which a determination of negligence is made if one can show that the injury could not have been caused any other way. Under *res ipsa loguitur,* the plaintiff shows that all of the other reasons why an accident took place do not apply so that only negligence could have been ***the*** cause. For *res ipsa loquitur* to apply, the defendant must have had exclusive control over the product at the time the negligence occurred.

Crash Worthiness: It is a given that all foreseeable and intended uses of vehicles will include the possibility of accidents. To reduce their exposure in liability suits, manufacturers must design vehicles so that no aspect of the vehicle design will enhance passengers' injuries in accidents. Otherwise, manufacturers can be held liable for aggravation of injuries caused by negligent design or defects. A simpler way to think of this might be: the more we ask the car to do, the safer the design must inherently be.

Failure to warn: Manufacturer may be held liable if it fails to warn adequately against a particular danger related to a use of the product. A warning is considered adequate if it is designed to inform a 'reasonably prudent user of the product' of the existence and extent of a particular danger. Failure to warn can be used as an element of negligence and strict liability suits.

Breach of Warranty: When a product is purchased, the purchaser(s) often get express (or explicit) warranties. However, there are also implied warranties built into the law. Essentially, the law says that it is reasonable for a consumer ***to*** expect a product to work the way a 'reasonable person' would expect it to work. If there are representations of how a product is to be used, and the product fails to perform as represented, then there can be a cause of action under misrepresentation or fraud. For example, if, as a result of advertising, expectations are created about the way a particular ITS system would operate, failure of the product to meet those expectations may set the stage for subsequent liability suits.

Sovereign Immunity: Because their mandate to provide public services could create a potentially huge liability exposure, the law allows governments to deny liability against themselves except for particular circumstances under which they specifically agree to be sued. For example, the federal government has agreed to be sued under the Federal Tort Claims act, but only in cases of negligence and not under cases of strict liability. In general, most states have some sovereign immunity, but do allow certain claims for injuries. This doctrine has been eroded to a certain extent based on the type of function the government is performing: traditionally a governmental one (not liable) or one traditionally done by others (government is liable).

This discussion of legal concepts shows that we have a difficult but important balancing act in attempting to create a system under which people can be fairly compensated when products do not perform as expected while encouraging manufacturers or deployers to develop or deploy new technologies. For the information-based ITS technologies, liability is not necessarily a showstopper. But it remains to be seen whether liability concerns will prevent or delay the development and deployment of AVCS and AHS.

Discussion following Wednesday morning plenary talks:

Emiliano Lopez, Virginia Department of Transportation: Currently, many ITS professionals are doing things outside their expertise, such as systems control and integration. As we go into AHS, those same professionals will also be asked to support the AHS infrastructure. Virginia DOT is presently concerned about just being able to support the deployment of ITS. As AHS comes along, Virginia DOT wonders about possible liability exposures when professionals in charge do not have sufficient expertise to support the technology.

August Burgett (NHTSA): This is a real problem for the future, but we are unable to answer the question. Within the ITS program, the training and ability to work with the cross-spectrum of ITS technologies is a key element of what the Joint Program Office is working on right now. Everyone recognizes this issue.

Ray Resendes (Federal Highway Adminisrrarion. Joinr Program Office): We have a significant effort in Professional Capacity Building, which is focused on the ITS communications services, and do not currently see a need to train professionals for AHS. But as AHS matures, training will need to occur.

Jim Rillings (National Automated Highway System Consortium): NAHSC recognizes that operations and maintenance are important issues in the possible future deployment of AHS and these are being actively studied by our societal and institutional task group, lead by Alan Lubliner.

Craig Roberts (ITS America): State DOT's are more important to deployment than U.S. DOT because it is with the states that the liability laws and the responsibility to deploy AHS lie. Each individual state needs to identify its own legal and training needs for ITS and AHS. Because of our existing legal and funding framework, this has to be addressed on a state-by-state basis.

Selwyn Berg (Transportation Research Board): State DOT's will be sued under the current legal framework if AHS or ITS is deployed without adequate training. One ground for liability would be having inexperienced people working on these new technologies. Future litigation will become more and more complex unless the basic legal framework is changed.

Charles Fairfax (General Motors): If business people such as yourselves are concerned about liability issues, then you should insist that your lawyers attend legal issues seminars such as this one.

Millie Garlington (Houston METRO): In the first stage of deploying new technologies, Houston METRO has had some difficulty with high occupancy vehicle (HOV) lanes. Within 90 days of opening these special lanes, we had two fatalities caused by someone entering the HOV lane going in the wrong direction. The largest judgments ever lodged against Houston METRO, along with TexDOT, Houston City, and Harris County, resulted. A primary focus of the trial was that there was technology available to make the lane entrances safer but, although it had been designed and planned, the new technology had not yet been Installed. TexDOT was sued as a joint enterprise with Houston METRO.

Steve Roberts (Nossaman, Guthner, Knox, and Elliott, LLP): There are real liability issues, particularly as related to the doctrine of sovereign immunity (which varies from state to state), for two large groups: (1) the highway operators, which are usually the state DOT's or (more and more often) some sort of consortium of private and local public interests, and (2) the construction and engineering groups, working with the state DOT's to design and/or build the highways. Each state must look at the implications of sovereign immunity when the technologies leave the hands of the drivers themselves and are turned over to the infrastructure/vehicle combination. Under sovereign immunity, for each of these two groups, the critical issue is that there may be immunity for design. but not for operations and maintenance of the highways. This is called design immunity for matters where the state has discretion over choosing a design as opposed to having established duties on how to operate and maintain highways. As the technology transfers more to the highway operators, states will face increasing liability. So, too, will the private engineers in designing the new systems. There are also privatization issues where public/private partnerships are being created to fund the construction of new systems.

Liability Lessons Learned About ITS

Stephen Roberts, Nossaman, Guthner, Knox & Elliott

(In addition to these remarks, there is a supplementary outline that summarizes some of the discussion on liability which has occurred in the ITS community is included in the Appendix. This outline is annotated with an explanation of some of the legal terms for non-lawyers.)

Introduction

ITS is quite new and the liability case law related to ITS is limited. Therefore we must look to sources other than ITS case law for help on liability issues.

For one source of ideas, it may be useful to look at some of the dialog going on in the community. Also, there are a number of technologies parallel to ITS which may be instructive. These deal with the introduction and use of devices such as cruise control, airbags, and antilock brakes. For the purposes of this discussion, the case law associated with these technologies can provide more useful analogies than will the few cases dealing with actual ITS technologies.

Procurement Litigation

At present, there are a few litigation matters associated with ITS, but these are mostly procurement matters. In legal terms, procurement matters are largely public contracting issues and therefore provide little insight on tort liability questions. There is a recent case with a toll road authority in Illinois (Amtech v. Illinois State Toll Highway Authority, 264 Ill.App.3d 1095 (1994)) in which one company claimed that procurement standards were too narrow and described only its competitor's product. While this is a common complaint in procurement cases, the lesson for ITS is to be particularly careful when setting procurement criteria to be certain the purchasing government authority is not limiting the number of possible competitors through focusing on one proprietary technology or architecture.

Another procurement case involves a recent New Jersey toll road authority's award to MFS Technologies. There is now a suit by the losing bidder, Lockheed Martin, claiming that what MFS Technologies proposed, adding fiber optics to the subject ITS project, went outside the bounds of the RFP. The procurement from New Jersey was not a simple invitation to bid but was instead an elaborate RFP inviting proposers to suggest ways to enhance the final result to the toll authority. It will be instructive to see how this case is resolved.

There are some procurement cases, actually alternative dispute resolutions, going on in southern California between an Orange County toll road authority and an ITS provider, but they are standard breach of contract cases without helpful lessons on liability.

Dallas / Fort Worth Airport Sign Case

Some might say one recent signage case is an example of the tort system being out of control. A recent case in Dallas (featured on the front page of the Wall Street Journal several months ago) involved a driver approaching an airport terminal. The driver said he was distracted by a big sign listing all flights for one airline out of Dallas Fort Worth Airport. He said the sign presented too much information, and he was distracted while trying to read it; that was the reason he got into a three car pileup. As a result of the accident, a man in the back seat (the driver's boss) lost an eye and sued American Airlines which operated the sign.

The plaintiffs argument was that the sign was not well designed and was distracting. It was also reported there was testimony that an American Airlines engineer had earlier questioned whether the sign might be too confusing. The resulting verdict was large. The jury had sympathy with the man who had lost an eye and decided on an award of $20 million, in the face of evidence he was wealthy and may not have been wearing a seat belt.

This case should serve as a cautionary tale for those who design new technologies. While some may not classify the Dallas Airport case as an ITS case per se, it may have relevance to any new technology involving information transfer to drivers, particularly in AVCS. Newly introduced technology should be designed so that it is not so distracting that it interferes with the safe operation of the car.

Recent Liabiiitv Cases Involving Pre-ITS Automobile Technologies

A review of cruise control cases may be helpful to the ITS designer. In many recent cases, people claimed that the cruise control system was not working as advertised. If the vehicle had been in for repair several times, the claim seemed credible; but that was not always true. A lesson from these cases is that some people WILL claim the technology was not working appropriately whether or not it actually was. The designer needs to take this into account.

Drivers will also abuse rhe technology. When the cruise control system is on, people will often look around and do other things. For example, some will put their leg(s) up so they are not able to react quickly. You can count on people using the technology inappropriately in other ways. The seller of ITS products will need to communicate the proper uses and limitations of systems to the consumer.

Cruise control with collision avoidance does add a safety factor to the convenience factor of cruise control. We can expect that such an ITS technology will be deployed successfully if it adds to the general public safety.

The history of air bag deployments may also be instructive here, especially with the concept of "consumer expectations. " One auto company counsel noted to me that air bag cases often arise from a situation in which the driver is generally not familiar with the technology because he or she is driving a rented car. Commercials have depicted air bag deployment as a soft cushion experience, when in reality it is a very violent event. Rental car companies have actually been sued for malfunction of equipment because of abrasions and other injuries due to air bag deployment, even when the air bags functioned as designed. One problem was that the airbags did not meet the expectations set up by advertising, and the driver did not have any more specific knowledge because the car was only rented. The lesson to be learned from this is that a great deal of effort and attention needs to be directed at realistic communication about how new ITS technology works and what to expect from it.

With anti-lock brakes (ABS) there is currently an ongoing dispute between insurance companies, product manufacturers, and other safety experts over the actual effectiveness of the "improved" technology. There is thus no general consensus in the industry about what ABS's impact is upon the actual risks of driving, let alone one that can be communicated to the consumer.

Privacy Issues

There is some connection between invasion of privacy concerns and the introduction of new ITS technologies. Privacy issues are potentially a greater concern for AHS than AVCS. The privacy questions arise when it is (for whatever reason) necessary to identify or track a particular vehicle, as might be the case with AHS. This is currently a problem with automatic toll collection procedures. where license plates are photographed to catch cheaters. While these kind of problems are interesting to lawyers, as a practical matter they are not too difficult to solve. Toll operators have been fairly conservative in their use of information about somebody's whereabouts and there is reasonable public communication about what is being done with that information.

In California. state statutes were changed to make the penalties for not paying tolls a civil instead of a criminal matter. This allows a toll road operator or contractor to photograph all licenses of vehicles passing through toil facilities without involving criminal law issues. If someone does not pay. that person can be tracked down and sent a civil demand for payment of tolls. We heard earlier from the FHWA that the industry should not expect the federal government to step in and facilitate ITS by indemnifying against all possible tort liability. However. at the state level. the lesson from modern toll taking technologies is that there are many things that can be changed in state law if needed to make a system work and if the changes are reasonable.

On the Orange County toll roads. one way some privacy issues have been resolved in a somewhat counter-intuitive manner is that the private contractor (Lockheed-Martin) maintains the records instead of the government toll authority. This offers protection from Freedom of Information Act type requests at the state level, because in private hands a formal judicial subpoena is required to get such information.

Analying Risks by Referring to the Experience of Others

Questions have been raised about whether engineers can realistically quantify the actual risk of an AHS or AVCS product. A quick look at the history of the industry reveals inconsistencies in what information is publicly available. Many companies keep information private, so it is hard to get relevant information. Nevertheless the published experience of others might be instructive to those with new products. One example of this comes from Greyhound, whose radar warning system on buses was reported to lead initially to a 21% drop in accident rates. But the bus drivers claimed that the increased safety was actually due to personnel changes. Despite the safety increase, Greyhound decided to take the radar out of buses, reportedly because it was too sensitive. According to Greyhound, the radar would set off detectors in private vehicles, causing them to stop and thereby creating a road hazard. The public record does not contain the entire story about the problems with this deployment.

The Argument that Liability Problems Will Stop AHS Development is Not Proved

When it comes to AHS, there appears to be a "mantra" repeated by the press that the more advanced technology will eventually be stopped by fear of tort liability. However, that fear is not justified by the case law to date. Unfortunately the mantra is repeated so many times that some begin to believe it, even though there is no evidence at present that it is true.

Asking lawyers general questions about the tort liability crisis is not going to be helpful in the ITS context. Generally speaking, as a lawyer, I cannot give you solid analysis about liability problems until you, as an engineer, can give me some idea of what the technology is that we are talking about, how it can be expected to operate, and what its likelihood for failure might be. Until lawyers and engineers sit down to discuss these specifics, there is no reason to believe AHS cannot overcome tort liability problems. We cannot successfully analyze liability problems as a barrier to ITS deployment in the abstract.

In analyzing the vehicle control issue, it appears that some people may be willing to give up control of their vehicles in exchange for improved safety. But first there is a need to analyze the costs and benefits of each new technology in order to get a realistic picture of its particular contribution, likely use, potential for misuse, etc., before lawyers can give an idea of changes that might be expected in liability exposure due to introduction of that technology. With less consumer control, we may in fact actually have fewer causes of accidents, and therefore a simpler analysis of liability. However, liability could become more concentrated on the manufacturers and highway owners. These are complicated problems and lawyers need specific information about systems before they can characterize whether such a system seems reasonable in the present legal framework.

Using Technology as a Liability Defense

One defense an ITS Manufacturer may have is to focus on engineering projects that make it harder to lie about how the product is actually functioning (e.g. black boxes, data screens that cannot be manipulated by user, etc.). The chips in air bags which report on whether their systems worked properly is an example.

Distribution of Risk

The financing of risks associated with the introduction of new technology can be accomplished by insurance, but will not solely be handled through the insurance system. For example, if future roads are financed not by (public) taxes but by (private) bonds, then underwriters will need to be convinced that the associated risk is not so risky before they will consider financing those bonds.

A copy of the outline handed out during this talk is included in the Appendix.

Analogs and Trends in Other Industries

John Bagby, Pennsylvania State University

We know that there are tremendous challenges to the development of ITS. The many technical challenges are being resolved and in doing so we are finding that in some cases there are a number of technical alternatives that may work alone or in concert with other technical solutions. Yet the institutional barriers remain. Among these institutional problems, is liability a key barrier to the development of ITS?

There are other institutional matters that may present significant barriers to ITS deployment as well. First, procurement of ITS will likely represent a different way of doing business. Second, the extent to which ITS is composed of complex and inseparable subsystems poses tough challenges for deployment. This will likely make qualification testing of the system much harder than if individual subsystems were separately tested prior to assembly. There is a greater probability that problems will be resolved when experimentation is possible with stand-alone subsystems that can be brought together to observe their behavior as interactive elements of a larger system.

Is there a tort and product liability crisis? In the 1980s, some people believed liability concerns had escalated to an untenable level. Other industry observers, notably the trial lawyers, believe it was more likely an issue of a highly effective publicity campaign and destructive price competition in the insurance industry that lead to serious declines in profits in that industry. In response to this, the National Association of Attorneys General (NAAG) settled charges of withholding coverages, particularly some coverages concerning public premises. Thus, the lack of availability of casualty insurance may not have been what it first appeared.

There have been efforts in the past to reduce liability risks via safety and environmental regulations. Also, efforts have centered on contractual or negotiated disclaimers. Finally, many potential defendants have sought state tort reforms, even federal preemption of state liability laws. Indeed there have been several specific examples of the latter: liability waivers, exceptions, exemptions, indemnifications, or limitations. These have included the Swine Flu Act, where federal liability replaced the drug manufacturers' exposure, the Warsaw Convention placing liability limitations on air crashes, the Price-Anderson Act limiting liabilities associated with nuclear power accidents, and various statutes of repose such as the General Aviation Revitalization Act of 1994.

Recent concerns about airbags provide a case study for how to deal with unplanned side effects of a new technology designed to improve transportation safety. Recall that air bag deployment is in fact a more violent event than is commonly depicted in advertisements. Airbags can pose a greater hazard for some vehicle occupants than if the air bags had not deployed. In response, NHTSA began the regulation setting process to allow cutoff switches for air bags in cars with essentially no back seat (60 FR 27233, 6/22/95). They are also considering depowering, or less aggressive inflation, options for air bags (49 CFR Part 571). All of these efforts are well documented in the NHTSA Third Annual Air Bag Report to Congress, released in December

1996 and available on the Internet **(http://www.nhtsa.dot.gov).** In addition, Transportation Secretary Pena recently announced the National Automotive Occupant Protection Campaign, a coalition of auto manufacturers, air bag suppliers, insurance companies, and safety organizations. This group will work on how to resolve the conflicting safety issues associated with air bag deployment. Further, the NHTSA workshop on Smart Air Bags held February 11-12, 1997 in Washington, DC was expected to contribute to a proposed rulemaking.

Are all of these efforts sufficient to shield from liability those manufacturers of vehicles and air bags, as well as vehicle repair shops which modify airbags? The NHTSA efforts to date do not provide an explicit exemption from or waiver of liability. Instead they represent technical and regulatory activities to preserve the air bag as a primary occupant protection device, but with fewer unwanted side effects. How effective will these efforts be in providing various groups exemption from liability? A review of Constitutional interpretation traditions is instructive in this regard.

Constitutional strict constructionism represents a point of view presently popular with the judiciary. These jurists attempt to confine the interpretation of statutes or regulations to only that which is clearly stated in the statutes or regulations. The proposed air bag deactivation regulation provides only that the deactivator will not violate NHTSA regulations for making an air bag inoperable. At present, this regulation is not yet in force so there would be regulatory liability for anyone who disables an air bag. A Constitutional strict constructionist would argue that the proposed regulation should be confined to exempt the vehicle repair shop or other disabler from violating the long-standing NHTSA airbag deactivation rule. Strict constructionists would not wish to see the proposed regulation broadened to exclude the disabler from liability under the states' tort systems.

An opposite approach to Constitutional strict constructionism would be to imply that the NHTSA regulation should also create an exemption from tort liability. Under this opposing theory, one who deactivated an air bag would not be held liable under state tort law for injuries to a vehicle occupant who's serious injury would have been less severe if the airbag had not been deactivated. The NHTSA regulation will likely be tested in litigation for such a strict or broad construction as soon as an occupant is injured and there is proof the air bag was deactivated. The claim will likely be made that the occupant would have survived the crash or would have sustained lesser injuries if the air bag had not been deactivated.

There are useful analogs in other industries for the kind of risk avoidance that many in the ITS community desire for AHS. For large risks, the concept of risk pooling is often used to spread liability exposure. Programs like the federal flood insurance program have established the federal government as the ultimate reinsurer. Other examples of risk spreading include workers compensation and unemployment compensation systems. Many states require auto insurance companies to establish assigned risk pools to provide coverage for higher risk drivers, effectively mandating a form of risk pooling.

Other methods have been used to reduce liability risk. Most notably there is tort reform legislation which has passed in some form in nearly all states. Reforms include such concepts as damage caps limiting the money a plaintiff can recover, changes in joint and several

liability, which generally prevents one defendant from paying the money damages owed by other codefendants, structured settlements which facilitate periodic payments to injured plaintiffs, the elimination of the collateral source rule which would permit juries to be told when the plaintiff's medical or other expenses were already paid for by other sources such as insurance, and sanctions against plaintiffs' counsel when the litigation is deemed unnecessary or frivolous.

Some states have passed product liability reforms to specifically address injuries caused by faulty products. For example, statutes of repose prohibit suits on products sold more than ten or fifteen years before the plaintiffs injury. Statutes of repose effectively set an expected useful life for products. Some states prohibit the development of new tort theories and some other states permit product sellers to use the state of the art defense, effectively negating liability if the product's design was state-of-the-art.

Turning to another difficulty in this area, there seems to be rather broad misunderstanding about the many differences between three predominant types of tort liability: premises liability, product liability and service liability. An example of service liability is professional malpractice. Product liability largely impacts sellers when a product's user or a bystander is injured by a failed product. By contrast, premises liability arises when there are safety problems with the design, construction or maintenance of highways. There are some significant differences between these three liability areas. For example, an important difference is that the strict liability in tort theory is often much easier to prove than any other tort theory. However, strict liability is generally applicable only for products. Generally strict liability is inapplicable to owners of premises or to providers of services.

In the ITS and AHS arena, the providers of services, such as data processing or communications systems, or the owners of the highway premises, such as states and municipalities, are often viewed as the ultimate parties responsible because of their pervasive control over products used in the services or installed into the highway premises. Right now it seems unlikely the strict liability theory would apply to AHS or other ITS systems unless they become viewed as ultrahazardous.

There has been much product liability and tort reform. Nearly every state has passed at least some reforms, many of which benefit the medical profession. For example, the most pervasive of the tort reforms are damage caps. These are upper limits on the dollar amount of money damages that can be paid to an injured plaintiff. However, there have recently been some setbacks to the tort reform and product liability reform movements. At present some seventy cases nationwide have rolled back reforms to some extent. This trend is sufficient to warrant several recent articles (Wall Street Journal (12/19/96).

Ultimately the tradition of civil engineering conservatism, including its focus on redundant safety systems, is the ultimate bulwark against liability. The carefulness of engineering practice includes various fail-safe systems, exhaustive testing of new products destined for the infrastructure, certification before permanent deployment on a broad basis, and demonstration projects of new technologies before or during certification. This practice generally affords sufficient time to assess the sources and costs of injury risk.

One metaphor for highway liability might be the onion. The outer layers of an onion would represent the premises operator, typically state or municipal governments. The innermost layers represent product suppliers. It is difficult and unlikely for injured plaintiffs to penetrate the onion to hold a product supplier liable for defective road conditions. Indeed, there have been few product liability cases dealing with products installed in the infrastructure. By contrast, the outside onion layers typically include the state department of transportation making them the most likely to be exposed to liability suits. Intervening layers have decreasing exposure to liability and often include construction contractors, designers, subcontractors, product wholesalers, etc.

What is important in all of this discussion is an understanding of how public policy balances innovation incentives with a socially optimal set of responsibility rules. Contrary to our long history of federalism, we are now again in the midst of a 'states rights' movement. Each of the fifty states represents an independent laboratory for experimentation with varying public policies. These 'fifty separate laboratories' (the fifty states) test differing approaches to governing and public policy. In the highway arena this translates into different systems in investment and responsibility for their highway infrastructure. This states rights approach permits public policy to become closely attuned to local needs. Federalism demands that our regional differences must be tolerated unless they seriously constrain interstate commerce or frustrate the success of national programs requiring consistency.

The federal government is generally respecting states rights in the ITS area and seems committed to developing private market-based solutions to ITS implementation. At this time there are few national ITS requirements, standards or guidelines imposed by the federal government. This is consistent with states rights and with the current budget realities in Washington. The cornerstone of our form of government is ultimately this dual-federalism system. Our history is replete with struggle over the tension between states rights and central government control. Historical examples of this tension abound: the Articles of Confederation, the Civil War, the states regulatory expansion during the industrial revolution, Franklin D. Roosevelt's New Deal, and the independent adoption of uniform laws by the states. Federalism is the fundamental underpinning of the United States' long-standing success in self-governing.

What lessons are there for ITS in this federalist/states rights tension? There is justification for federal preemption when it serves the common good. An example might be the Interstate Commerce clause. An argument can be made for federal preemption of state tort law in the ITS area. That argument might conclude that ITS deployment will work only if there is a simultaneous, coordinated multi-state efforts. Independent actions within different states might preclude a uniform interoperability that is critical for the national transportation network.

However. history suggests that such national reform can only occur with broad and general recognition of a crisis. There may be an inconsistency between the successes of ITS so far and the argument that national tort uniformity is needed. Successful but limited ITS demonstrations of sub-systems is inconsistent with arguments for national uniformity in the law. Policy-makers will likely perceive that no real 'crisis-level' imperative exists for federal intervention and

rulemaking if different or even incompatible ITS systems can flourish around the nation or are part of the experimentation needed to discover an optimal ITS system.

Historically, most contemporary tort reform has emerged when escalating costs create a crisis. The costs of medical malpractice, non-insurability, and potential loss of the U.S. civil aviation industry were considered to be so devastating for the nation that sufficient crisis was created to trigger reforms, sometimes even uniform, federal reforms. This suggests that ITS development will not need federal intervention until the costs of not having ITS are seen as a national concern. Further, national uniformity in laws applicable to ITS seems unlikely if predicated solely on the argument that individual ITS suppliers might become potential defendants. Mere fear of litigation costs is not sufficient crisis to justify national preemption. Given this reality, national tort reform efforts targeted to induce ITS investment seems unrealistic.

A copy of the overheads shown during this talk is included in the Appendix.

2. Group Summary Reports

Breakout Session One: Identification of Issues
Wednesday morning, 2/5/97

Goal:
Identify and ptiotitize the liability issues of each interest/perspictive group.

Group structure:
1: NAHSC core and associate members
2: Manufacturers of automobiles and related products
3: Insurance and Attorneys
4: State Departments of Transportation

Focus questions:
- ***Presently, what are the big liability issues for each interest group?***
- ***What are the greatest fears/concerns of each group?***

Group A 1: NAHSC (Alan Lubliner of Parsons Brinckerhoff)

Note: The National Automated Highway System Consortium is comprised of diverse interests. Even within the consortium, these interest groups have not reached a consensus about what the liability issues are. The Consortium instead considers its most important question is how is it going to address liability issues when and if they arise. Key points of this group's deliberations were:

1. Manufacturers see potential liability costs as a bar to entering the market. This could hinder the development of AHS. (fear of liability)
2. Are there stages in the development and deployment of AHS (before full automation) that pose unacceptable liability risks? For example, do the driver roles become ambiguous at any point? (AHS development process)
3. What is the difference in liability exposure based on changes in the distribution of intelligence proposed by the various technical concepts? NAHSC anticipates that it varies according to what intelligence is given to the vehicle versus the infrastructure.
4. Does deployment in dedicated lanes or mixed traffic represent greater liability risks to participants?
5. How to transition from personal driver liability to systematic liability?
6. How to proportion liability among the various participants in an automated system? (Stages of liability by sector)

Group B1 : Product Manufacturers (Kathleen Sheehan of Denso International)

1. Concern about user understanding and appropriate use of technology
2. Manufacturers' concerns about liability being attributed to them. Interested in having federal standards established to act as a safe harbor to alleviate manufacturers of some liability if possible, whether by regulation or legislation. Question if standards are effective as a safe harbor. Sometimes an additional responsibility is imposed.
3. Whose responsibility is it to maintain the vehicle? What responsibility do manufacturers have to maintain these automated vehicles? Sending out notices to owner is ineffective.
4. Concern/Interest: Mandating designs and specifications with evidentiary rules prohibiting introduction of evidence of design improvements and preempting states' evidence rules. But cannot overcome jurors changing perceptions of responsibility.
5. Education and certification of vehicle drivers. Looking back at history of such things as air bags and other restraint systems: what has happened through time as to litigation and educating the public as to users and limits of these technologies? Is there a need to certify the drivers?
6. Other issues: legal responsibility. Will the car manufacturers be ultimately liable for the product if there is a malfunction in the vehicle? How can this be avoided? How to keep out the introduction of "junk science" into the courtroom?
7. Manufacturers want some protection if they comply with standards.

Group Cl : Insurance & Attorneys (Paulette Brown of Brown, Lofton, Childress. and Wolfe)

1. Standards as they pertain to the product and liability. Lack of standards in industry because of lack of history. No one is willing to accept the risk of setting standards. No uniformity among manufacturers on how products are developed. Current liability standards: government standards create liability but do not provide preemption and immunity from liability for manufacturers. Jurisdictional differences among government levels and among states.
2. Tort reform: caps to liability; compensation policies; contractual considerations; federal and state preemption.
3. Risk allocation: contractual. transfer, joint venture. How is the risk going to be allocated? Inability to obtain insurance and lack of capital to pay for risk allocation. For example, many small companies cannot get into the game because they cannot get insurance.
4. Risk management.
5. Insurance.
6. Risk Financing Techniques: pools. co-sharing of risk. Acceptance of co-sharing of risk and payments by each entity. What coverages need to be procured and how broad should that coverage be?
7. Uninsurability of some participants.
8. Treatment of uninsurable risk. Cost of defense and coverage overlaps between multiple defendants.
9. Litigation paranoia. For defense, what claims are next? For plaintiffs, the cost of bringing a lawsuit.

10. Lack of mandatory dispute alternate resolution procedures. Where going to get the experts to defend the technology? Problem of newness of technology.

Group Dl : Departments of Transportation (Steve Roberts of Nossaman, Guthner, Knox, and Elliott)

1. Need to define and limit owner (of highways by DOT's) responsibility arising from these technologies. Implementation and failure of systems and adequacy of existing law.
2. Importance of development of standards. States recognize that it may be appropriate for the federal government to be promulgating standards for the states to live under; states will be promulgating their own standards.
3. Integration of traffic control devices currently in place with new AVCS and AHS technologies. How is this integration going to take place?
4. Identifying who is going to have the control and authority over these systems.
5. Training and education of system operators in an area where professional expertise does not yet exist. Also a question of who will be training the vehicle drivers.
6. Staging of implementation of AHS technology.

Breakout Session Two: Identification of Conflicts
Wednesday afternoon, 2/5/97

Goal:

Identify apparent clashes of interest on liability issues between different interest groups.

Group structure:

Four independent groups structured to contain members from each identified interest group. The same groups were used for both sessions two and three.

Focus questions:

- ***How has your interest group dealt with conflicts on liability in the past?***
- ***Interms of legal liability, what aspects of AHS (as presently envisioned) are seen as benefit? as burdens? Why?***
- ***How do you foresee AHS changing liability for your industry or interest group? Why?***
- ***What are your greatest concerns with the introduction of new technologies such as AHS?***

Group A23 (Michelle Bavouth of Carnegie Mellon University)

1. Consumer needs to be protected; producers are not inclined to take on that responsibility fully; in the middle there is regulatory agency that is responsible to both parties. The regulators are caught in the middle and short of funds. Paradigm shift needed.
2. Multi-party relationships are inherently adversarial. If pulled together, the various industries (such as developers and manufacturers) would have more power with a united front. This is probably not true, as the groups are naturally adversarial.
3. Every stakeholder group needs and wants to minimize its exposure to liability. And yet AHS cannot be implemented without one or more groups assuming much of this burden. This has implications for deployment and feasibility of entire system.
4. Cannot easily write standards for new technologies but standards are needed to expedite implementation.
5. Premature standards retard innovation. Uniform standards promote technology but uniformity cannot be attained with movement to states' rights and lessening federal government power. As move away from federalism, finding the need for federalist intervention on the liability issue.
6. Staged deployment assists in technology development and market acceptance but it creates the issue of passive negligence liability, i.e., liability assessed because something was not implemented that could have been implemented. Houston METRO example is illustrative.

7. Whether or not those receiving benefits of the technologies are those that are assuming the risks? Probably not the same party.
8. Cannot allocate liability without system definition, but cannot define the system without understanding the allocation of liability. Chicken and egg situation.

Group #B23 (Mike Briggs of General Motors)

1. Allocation and spreading of liability among the various players. There appears to be a conflict between the government agencies and the private sector and between the providers of the systems and the developers. There also appears to be a conflict between infrastructure and vehicle developers. All parties are trying to end up with as little liability as possible. Negotiated acceptance of liability is a possibility.
2. When trying to design a system, need to be able to predict the amount of exposure. This issue affects not only designers but the operators of the systems. At every step of development will want and need to know how much exposure each group is going to have. Must be able to predict the amount of exposure. If convert driver role to that of any other passenger, two of the major defenses against liability lawsuits on behalf of the designers/manufacturers disappear, mainly contributory and comparative negligence doctrines. Ability to predict the exposure to liability becomes all the more important where these two defenses are lost.
3. Federal preemption is needed to stimulate innovation in design of systems. If it is provided, is there still the maximum incentive to design the safest system?
4. Must decide who is responsible for the system development.

Grouo #C23 (Bill Bassett of California Department of Transportation)

1. Legislative and regulatory limitations of the respective risk of the parties. (Parties are at the mercy of the legislative and regulatory bodies.)
2. How would AHS deployment be scheduled?
   - Access to AHS by users, limitations on users imposed by operators and access to maintenance activities by training individuals?
   - Individual cost-benefit analysis results where a party will not come to the table to negotiate or compromise?
3. Ability and willingness to accomplish voluntary risk allocation in contractual process.
4. Design standards for AHS and interests of designers relative to the system, such as conflict between hardware vs. software vs. users.
5. Protection of confidential or proprietary information, related to exclusivity of information.

Group #D23 (Craig Roberts of ITS America)

1. Problem of designing now but being judged later with better information down the road.
2. Wanting benefits of using of the system but wanting others to take the risk and provide the protections; comes from all players.

3. Greater liability would be incurred with mixed-flow versus dedicated lanes, but more easy to deploy mixed-flow first. Definite conflict between deployment sequence and liability sequence.
4. Problem of getting the driver to use the system the way he/she is envisioned to use it. Training the driver how to use and comprehend the system and prevent misuse of the system.
5. To build the safety and security into the system costs money; need to try to develop systems that are attractive to the market both in features and in cost.
6. Conflict between trying to the sell the benefits and easy use of the products versus the need to warn against risk and improper use. May have an effect on ability to market the product.

Breakout Session Three: Resolving Conflicts and Identifying Missing Pieces
Thursday morning, 2/6/97

Goal:

Brainstorm and evaluate methods for resolving identified conflicts and identifying what additional informaton is needed to address liability question.

Group structure:

Four independent groups structured to contain members from each identified interest group. The same groups were used for both sessions two and three.

Focus ouestions:

- ***What impact do you think the recent reports on air bags and anti-brakes might have on AHS deployment?***
- ***What liability concerns might hinder deployment of AHS?***
- ***How might liability concerns influence the design of AHS?***
- ***What additional information is need to resolve liability questions?***
- ***What actions by other industries or interest groups might influence how each other interest group sees liability questions (e.g., users might be waiting to see how the insurance industry handles certain questions)?***

Group #A23 (Michelle Bavouth of Carnegie Mellon University)

1. Increased information and data makes the liability assignment more clear. Important in the issue of causation of accidents. Liability picture may become more clear.
2. Risk is managed more easily because it is more easily defined. A little more control because of not having the human as involved.
3. Incremental deployment aids in solving liability problems. If system deployment is done incrementally, we take each step and understand the liability ramifications before moving to the next step.
4. More uniform transportation system inherently contains less potential liability: fewer accidents, severity is lessened, less environmental impact.
5. There are benefits that mitigate the increase of liability to the manufacturers and other industries implementing these systems.

Group #B23 (Mike Briggs of General Motors)

1. Attributes of AHS system will be impacted in a major way by liability concerns.
2. How do we change the design process to incorporate concerns about liability?
3. Liability concerns will impact the timeliness of implementation. Perhaps done outside US first because of liability concerns.

Group #C23 (Bill Bassett of California Department of Transportation)

1. Need for consistent national system design standards (less opportunity for conflict). FHWA is best able to initiate this process.
2. Dedicated lanes appears to be the best design to reduce liability; mix-flow traffic and AHS has inherently greater liability concerns
3. Network and spread intelligence about liability; the greater the ability to distribute the AHS methodologies among the various parties through media and training the better the opportunities to solve the liability questions earlier.
4. What is the confidence level that the public can have with the system: automatic detection system responsive to types of different types of obstructions and weather conditions; distinction between the rules of the driver and the system operator in the case of the removal of disabled vehicles.

Group #D23 (Craig Roberts. ITS America)

1. No evidence that liability is a barrier to AHS and AVCS deployment; no hard evidence or reason to believe that liability is a "showstopper" to the development and deployment of these systems.
2. Should be emphasizing that liability is not a showstopper, rather than that it could be a showstopper; abandon the latter point.
3. AVCS and AHS have tremendous safety benefits that need to be emphasized; insurance premiums for the individual consumer should be accordingly reduced; safety is a net positive;
4. Fear of liability may be constraint; fear is the problem, not the reality.
5. Design the system to yield major safety benefits. But, as they are deployed, need to be sure that arrangements are in place to fairly compensate those who are injured due to malfunction of the technology. Deal with liability in the AHS business model and deployment plan.
6. Immunity or preemption from liability are not necessary at this time; address them again when there is clear evidence of societal cost requiring them.
7. If we manage from the beginning the program for compensation, then liability should not be a serious showstopper to deployment.
8. Appears to be greater liability risk with mixed traffic than with dedicated lanes.
9. Liability issues differ significantly between the infrastructure and vehicle technologies. Appears that there is greater risk to manufacturers of vehicle-based. Infrastructure does not face question of strict liability and it has a framework for sovereign immunity.
10. Design and deployment process should include consultations with legal counsel for every design under consideration; legal counsel should not have ultimate say but designers need to be aware of the liability issues particular to each concept.
11. Need to continue to do outreach to insurance and safety interests.
12. Need to do a survey of states' sovereign immunity procedures and requirements.
13. Need to have built into the systems a method for capturing how the technologies work in order to improve safety with experience and to develop a track record for how technology works if need to assess responsibility.
14. Examine the federal role in establishing standards.

15. For August 1997: seek waiver from those riding buses and vehicles; consult with insurance carriers.
16. In the ultimate deployment of AHS, owners and operators need to create cooperative enterprises so as not to have overlapping coverages and not to suffer overlapping defense costs.
17. Need to be careful in marketing reality vs. perception in what AVCS and AHS can and cannot do.

APPENDICES

Participant List

Joint Workshop on Liability Issues in AVCS & AHS
February 5-6, 1997
Participant List

John Bagby
Penn State University
403 Beam Business
Administration Bldg.
University Park, PA 10801
814/863 -0520
814/863-7261 (fax)
Facilitator

William Bassett
CALTRANS
1120 N Street
Mail Station 57
Sacramento, CA 95812-1438
916/654-2630
916/654-6128 (fax)
Groups: D1, C23

Michelle Bayouth
Carnegie Mellon University
5000 Forbes Avenue
The Robotics Institute - Smith
Hall
Pittsburgh. PA 15213-3890
412/268-7680
412/268-5571 (fax)
Groups: Al, A23

Selwyn Berg
National Research Council
2001 Wisconsin Avenue NW
GR212A
Washington. DC 20007
202/334-3347
202/334-3171 (fax)
Groups: C1, D23

Richard Bishop
Federal Highway
Administration
6300 Georgetown Pike
Room T-202
McLean, VA 22 10 l-2296
703/285-2680
703/285-2264 (fax)
Groups: A1, D23

Janie Blanchard
Bechtel
45-13-C61
50 Beale Street
San Francisco, CA 94105
415/768-2445
415/768-2743 (fax)
Facilitator

Michelle Brahaney
Mitretek Systems
6300 Georgetown Pike
Room T-202
McLean, VA 22101
703/285-1049
703/285-2263 (fax)
Groups: Al, B23

Dermis Briggs
General Motors Research &
Development
30500 Mound Road
M/S 480-106-390
Warren. Ml 48090-9055
810/986-3105
810/986-3003 (fax)
Groups: A1, B23

Paulette Brown
Brown Lofton Childress &
Wolfe
280 South Harrison Street
East Orange. NJ 070 18
20 l/678-5038
201/678-7512 (fax)
Groups: C1, A23

August Burgett
Office of Crash Avoidance -
Room 6220
NHTSA
400 7th Street. SW
Washington. DC 20590
202/366-5662
202/366-7231 (fax)
Groups: C1, D23

Ben Byerly
AAMVA
4301 Wilson Blvd.
Suite 400
Arlington, VA 22203
713/522-4200
703/522-7231 (fax)
Groups: D1, C23

Steve Carlton
Lockheed Martin
1470 1 Essington Rd.
Rockville, MD 20853
301/971-9563
301/971-4093 (fax)
Groups: A1, D23

Tisha Colvin
SRI International
1611 N. Kent Rd.
Arlington, VA 22209
703/247-8460
703/247-8569 (fax)
Groups: B1, C23

Evan Demick
Steptoe & Johnson
1330 Connecticut Ave., NW
Washington, DC 20008
2021429-30 19
202/429-3905 (fax)
Groups: C1, C23

Michael DiRenzo
JMRA America Inc.
1800 Diamond Rd.
Alexandria, VA 22314
703/684-3152
703/548-8679 (fax)
Groups: B1, D23

Hiroshi Doi
SRI International
1611 N. Kent Rd.
Arlington, VA 22209
703/247-8486
703/247-8569 (fax)
Groups: B1, A23

John Donaldson
NHTSA
NCC-30 Room 5219
400 7th street, SW
Washington, DC 20590
202/366-1834
202/366-3820 (fax)
Groups: C1, A23

Charles Fairfax
General Motors Corporation
3031 W. Grand Blvd.
New Center One Building
Detroit, MI 48232
313/974-1804
313/974-02 11(fax)
Groups: B1, B23

Millie Garlington
Houston Metro
P.O. Box 64 129
1201 Louisiana
Houston, TX 77208
713/739-4995
713/652-8006 (fax)
Groups: D1, D23

Dennis Gioia
Penn State University
425 Beam Business
Admin. Bldg.
University Park. PA 10801
81418656370
814/863-7261 (fax)
Facilitator

Edward Good
Automative Occupant Restraints Council
29963 Old Bedford
Farmington Hills. Ml
4833 l-2287
810/661-0272
810/661-0272 (fax)
Groups: B1, A23

Paul Harker
Federal Highway
Administration
Office of Highway Safety
HHS-10
400 7th Street, SW
Washington, DC 20590
202/366-2156
202/366-8518 (fax)
Groups: D1, C23

Bruce lbarguen
Maine DOT
Station 16
Augusta. ME 04333
207/287-3775
Groups: D1, B23

Ryoj Igarashi
Honda R&D North
America Inc.
1900 Harpers Way
Torrance, CA 90501
310/781-5823
310/781-5512 (fax)
Groups: B1, A23

Mark Johnson
ITS America
300 Virginia Ave.. SW
Suite 800
Washington. DC 20021
202/484-4582
202/484-3484 (fax)
Facilitator

Tim Kriner
Houston Metro
P.O. Bos 61129
120 1 Louisiana
Houston. TX 77208
713/739-4956
713/652-8006 (fax)
Groups: D1, B23

Robert Larsen
Raytheon E-Systems
7900 Arlington Blvd.
Falls Church. VA 22056
703/560-5000 x4315
703/876-1993 (fax)
Groups: B1, D23

George Lavin
Lavin, Coleman, O'Neil,
Ricci, Finarelli & Gray
510 Walnut Street Suite 1000
Penn Mutual Tower
Philadelphia, PA 19 106
215/627-0303
215/627-2551 (fax)
Groups: Cl, C23

Rodney Lay
Mitretek Systems
Turner-Fairbank Highway
Research Center
Room T202
6300 Georgetown Pike
McLean, VA 22102
703/285-2532
703/285-2264 (fax)
Groups: Al, A23

Chuck Leone
Diversified Risk
Insurance Brokers
133 5 Stanford Avenue
Suite 100
Emeryville, CA 94608
510/547-3203
510/547-5648 (fax)
Groups: Cl, A23

Eddy Llaneras
ITS America
400 Virginia Ave., SW
Suite 800
Washington. DC 20024
202/484-4547
202/484-3483 (fax)
Groups: D1, C23

Emiliano Lopez
Traffic Engineering
Virginia DOT
140 1 East Broad Street
Richmond, VA 232 19
804/768-0186
804/225-4978 (fax)
Groups: D1, B23

Alan Lubliner
Parsons Brinckerhoff
One Penn Plaza
New York, NY 10119
212/465-5412
212/465-5584 (fax)
Groups: Al, D23

Percy Luney
North Carolina Central University
School of Law
1512 South Alston Avenue
Durham, NC 27707
919/560-6427
919/560-6339 (fax)
Groups: Cl, B23

Dale Markland
Vinson & Elkins, L.L.P.
2001 Ross Avenue
3700 Crow Center
Dallas, TX 7520 l-2975
214/220-7700
214/220-7716 (fax)
Groups: B1, B23

Mike Martin
Martin Enterprises & Assocs.
2625 Steeplechase Drive
Reston, VA 20191
703/391-7330
703/48l-5667 (fax)
Group: B23

James McDaniel
Transportation Research Board
2101 Constitution Ave.. NW
Washington. DC 20118
202/335-3209
202/334-2003 (fax)
Groups: D1, B23

Rob Meinert
NAHSC
3001 West Big Beaver Road
Suite 500
Troy, MI 48084
8 10/816-3404
810/649-9569 (fax)
Groups: Al, D23

Francis Memole
Rockwell International
3370 Miraloma Avenue
P.O. Box 3 105
Anaheim, CA 92803-3105
714/762-7442
714/762-1755 (fax)
Groups: B1, C23

Marthand Nookala
Minnesota Dept. of Transportation
117 University Avenue
MS320
St. Paul, MN 55155
612/215-0402
612/215-0409 (fax)
Groups: D1, C23

Sharon O'Conor
NY State Thruway Authority
200 Southern Boulevard
P.O. Box 189
Albany, NY 12201-0189
518/436-2840
518/471-4340 (fax)
Groups: B1, B23

Mark O'Connor
Mazda (North America)
1444 McGraw Avenue
Irvine, CA 92614
714/852-7237
714/852-7229 (fax)
Groups: B1, B23

Edith Page
Bechtel
1015 15th Street. NW
Suite 700
Washington. DC 20005
202/828-7375
202/785-2645 (fax)
Groups: Al, D23

Katherine Poole
Kelly & Povich
1101 30th Street. NW
Suite 300
Washington. DC 20007
202/342-0548
202/312-0458 (fax)
Groups: B1, C23

David Raney
American Honda Motor Co.
955 L'Enfant Plaza SW
suite 5300
Washington, DC 20024
202/554-1650
202/488-3542 (fax)
Groups: Bl, B23

Ray Resendes
ITS Joint Program Office
U.S. Department of Transportation
400 7th Street, SW
Washington. DC 20590
202/366-2182
202/366-3302 (fax)
Groups: D1, A23

James Rillings
NAHSC
300 1 West Big Beaver Rd.
Suite 500
Troy, MI 48084
810/816-3408
810/649-9569 (fax)
Groups: Al, C23

Craig Roberts
ITS America
400 Virginia Ave., SW
Suite 800
Washington, DC 20024
202/484-2895
202/484-3483 (fax)
Groups: Cl, D23

Stephen Roberts
Nossaman, Guthner, Knox & Elliott
50 California Street
3 4th Floor
San Francisco, CA 94111
415/398-3600
415/398-2438 (fax)
Groups: D1, A23

Beverly Russell
Office of Chief Counsel
FHWA
400 7th Street, SW
Washington, DC 20590
202//366-1355
202/366-7494 (fax)
Groups: D1, A23

Kenneth Schlesinger
Navigation Technologies
10400 W. Higgins Rd.
Suite 400
Rosemont, IL 60018
847/699-8661
847/699-8057 (fax)
Groups: B1, C23

Kathleen Sheehan
Denson International
America, Inc.
24777 Denson Drive
Southfield, MI 48301
810/350-7535
810/350-7772 (fax)
Groups: B1, A23

Steven Shladover
California Path Program
1357 South 46th Street
Bldg. 452
Richmond. CA 94804
510/21-95473
510/231-9565 (fax)
Groups: Al, B23

Charles Smith
NC Central University
School of Law
1512 South Alston Avenue
Durham. NC 27707
919/560-6348
919/560-6339 (fax)
Groups: Al, C23

Ann Tallon
Volpe Center
55 Broadway
Cambridge. MA 02142
617/494-3437
617/494-2957 (fax)
Groups: Dl, D23

Harry Taylor
Office of Highway Safety
FHWA
400 7th Street, SW
Washington, DC 20590
202/366-2156
202/366-8518 (fax)
Groups: D1, A23

K. Thirumalai
Transportation Research Board
2101 Constitution Ave., NW
Green 212
Washington. DC 20418
202/334-3568
202/334-3471 (fax)
Groups: Dl, D23

Hiroshi Ueno
Nissan Resarch &
Development
39001 Sunrise Drive
Farmington Hills. MI 48331
810/488-4099
810/488-3914 (fax)
Groups: B1, D23

Edward Vanover
Bechtel-Gaithersburg
9801 Washingtonian Blvd.
Gaithersburg. MD
20878-5356
301/417-4917
301/869-0437 (fax)
Groups: Al, A23

Richard Washington
Lavin. Coleman. O'Neil.
Ricci. Finarelli & Gray
510 Walnut Street
10th Floor
Philadelphia. PA 19106
215/627-0303
215/627-255 (fax)
Groups: Cl, B23

William Whitney
Glass Applications Analysis
64 Antler Road
Big Flats, NY 14814
607/562-8657 (fax)
Groups: Bl, B23

Interested Others:

Robert W. Caston
Zexel USA Corporation
625 Southside Drive
Decatur, IL 62521
217/362-2513
217/362-6764 (fax)

Aubrey Davis
3804 Greenbriar Lane
Mercer Island, WA 98040
206/232-3170
206/236-2027 (fax)

Richard Easley
ITS America/Castle Rock Consultants
400 Virginia Ave., SW
Suite 800
Washington, DC 20024
202/484-4847
202/484-3483 (fax)

Eugene Farber
Ford Motor Company
330 Town Center Drive
Suite 400
Dearborn. MI 48126
313/845-5305
313/322-5457 (fax)

Ken Gluckman
Asst. General Counsel
Chrysler Corporation
800 Chrysler Drive East
Auburn. Hills. MI 48326
810/512-4176
810/512-4196 (fax)

Dave Hensing
AASHTO
Suite 249
444 North Capitol Street. NW
Washington. DC 20001
202/624-5800
202/624-5806 (fax)

Ronald D. Hochnadel
Intrass
234 27th Ave., East
SeattIe, WA 98112
206/322-8085
206/322-8085 (fax)

Carol Jacoby
Hughes Information Systems
1801 Hughes Drive
FU 675 MS P343
Fullerton, CA 92834-3310
714/446-2748
714/446-3137 (fax)

William Jeffrey
Mitretek Systems
Turner-Fairbank Hwy Research Center
Room T202
6300 Georgetown Pike
McLean VA 22102
703/285-2532
703/285-2264 (fax)

Allan Mertig
Mitretek Systems
600 Maryland Ave., SW
Washington. DC 20024
202/863-2982
202/863-2988 (fax)

Don Mueting
Minnesota DOT
525 Park Street
Suite 500
St. Paul. MN 55103
612/296-3369
612/297-1235 (fax)

David Oliver
Office of Chief Counsel
FHWA
400 7th Street. SW
Washington. DC 20590

Manny Puentes
American Automobile Association
815 Date Street
San Diego. CA 92101
619/233-1000
619/239-8221

Noah Rifkin
Calspan SRL
P.O.Box 400
Buffalo, NY 14225
716/631-6876
716/631-4152 (fax)

James R Sayer
Transportation Research Inst.
University of Michigan
2901 Baxter Rd., Room 305
Ann Arbor. MI 48109-2150
313/764-4159
313/764-1221 (fax)

Dwight Shank
Mitretek Systems
600 Maryland Ave., SW
Washington, DC 20024
202/863-5706
202/863-2988 (fax)

Wayne Sorenson
State Farm Insurance Cos.
Research D-4
One State Farm Plaza
Bloomington, IL 61710-0001
309/766-3663
309/766-3662 (fax)

Charles A. Taylor, III
National Assoc. of Independent Insurers
444 North Capitol Street. NW
Suite 801
Washington, DC 20001
202/639-0497
202/639-0494 (fax)

Pat Waller
Transportation Research Inst.
University of Michigan
Room 154
Ann Arbor. MI 48109-2150
313/936-1046
313/936-1081 (fax)

Presentation Overheads & Outline

Jim Rillings, ***NAHSC/General Motors***

August Burgett, *NHTSA*

Stephen Roberts, ***Nossaman. Guther. Knox & Elliott***

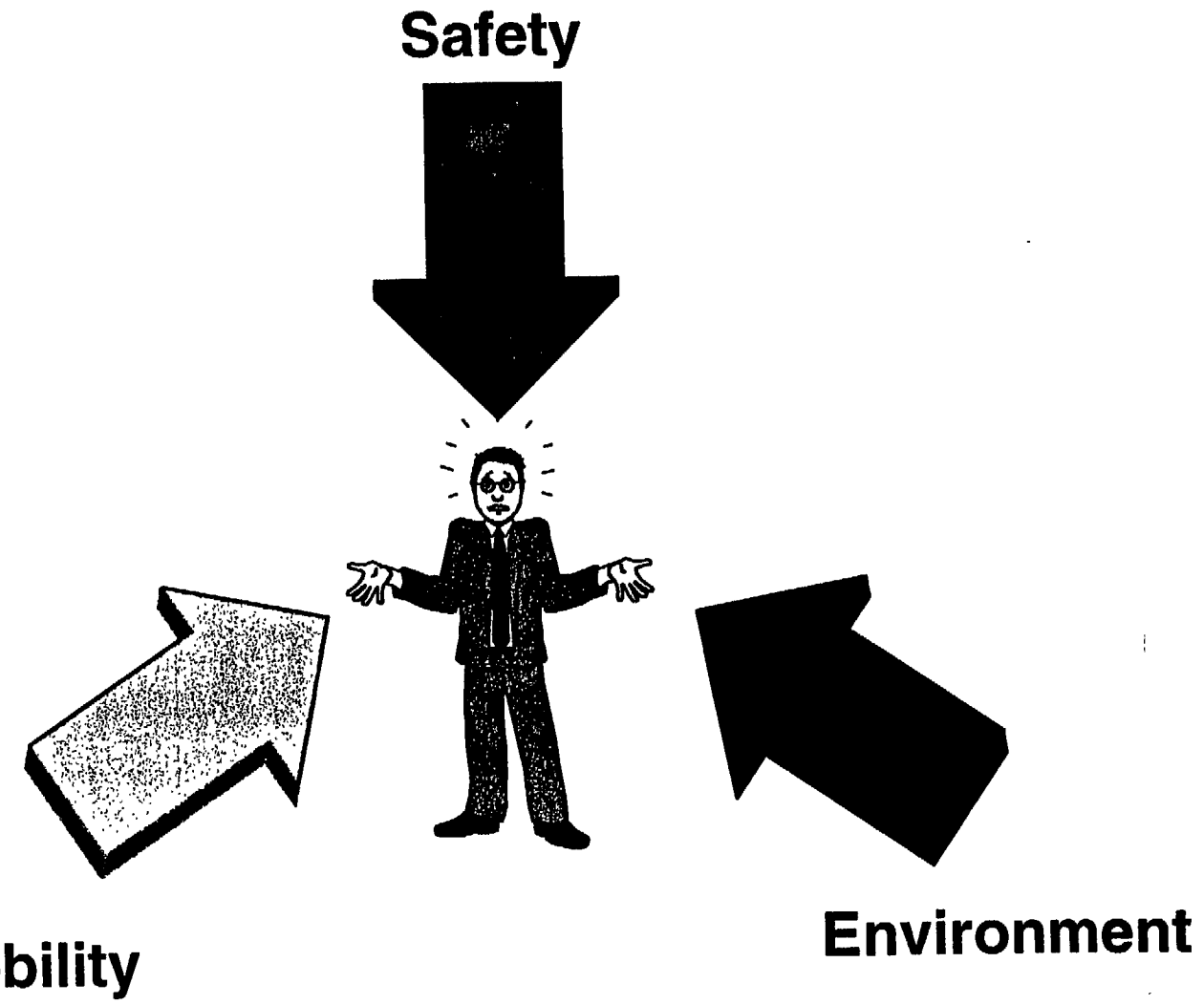
John Bagby, ***The Pennsylvania State University***

The National Automated Highway System Cooperative Program

February 1997

Jim Rillings
NAHSC Program Manager

Transportation's Conflicting Needs



The Challenge

NAHSC

- U.S. Population Continues to Grow
- Most Growth in Edge Cities and Suburbs
- Continued Rise in Urban/Suburban Congestion
  - 80% of Urban Peak Hour Traffic is Congested
  - $50 Billion Annual Loss
- Desire to Further Improve Highway Safety
  - 40,000 Fatalities, 1,700,000 Injuries Per Year
  - $156 Billion Annual Loss (1990)
- Interstate Highway System is Complete

Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA '91)

NAHSC

"The Secretary of Transportation shall develop an automated highway and vehicle prototype from which future fully automated intelligent vehicle-highway systems can be developed...."

"....The goal of this program is to have the first fully automated roadway or an automated test track in operation by 1997...."

An Automated Highway System Is . . .

NAHSC

. . . a set of designated lanes on a limited access roadway where specially equipped vehicles can operate under completely automatic control. Throttle, steering, and braking are automatically controlled to provide safe, convenient travel.

AHS LANES >

The vehicles and roadway cooperate to coordinate vehicle movement, avoid obstacles and improve traffic flow, providing benefits to safety, congestion and the environment.

National AHS Consortium

- 10 Core Participants
  - Bechtel
  - California Department of Transportation
  - Carnegie Mellon University
  - Delco Electronics
  - General Motors
  - Hughes Aircraft
  - Lockheed Martin
  - Parsons-Brinckerhoff
  - University of California PATH Program
  - U.S. Department of Transportation

- Plus 103 Associate Participants

103 Associate Participants

Stakeholder Category	Number of Associates
– Vehicle Industry	20
– Vehicle Electronics	14
– Highway Design & Construction	16
– Trucking	5
– Transit Operators	5
– Environmental Interests	3
– Transportation Users	13
– Government Agencies (Federal, State, Local)	25
– Insurance Industry	2

The Potential for AHS ...

* Improved Highway Safety
  - No Collisions In the Absence of System Malfunctions
  - Fail-Safe System Design
* Increased Highway Throughput
  - Double to Triple Today's Capacity per Lane
  - Less Capacity Reduction Due to Incidents
* Enhanced Mobility
  - Shorter, More Predictable Trip Times for People and Freight
  - Easier, More Reliable Travel in Inclement Weather
* Reduced Environmental Impact
  - Less Need for Additional Highway Lanes
  - Reduced Fuel Consumption and Exhaust Emissions

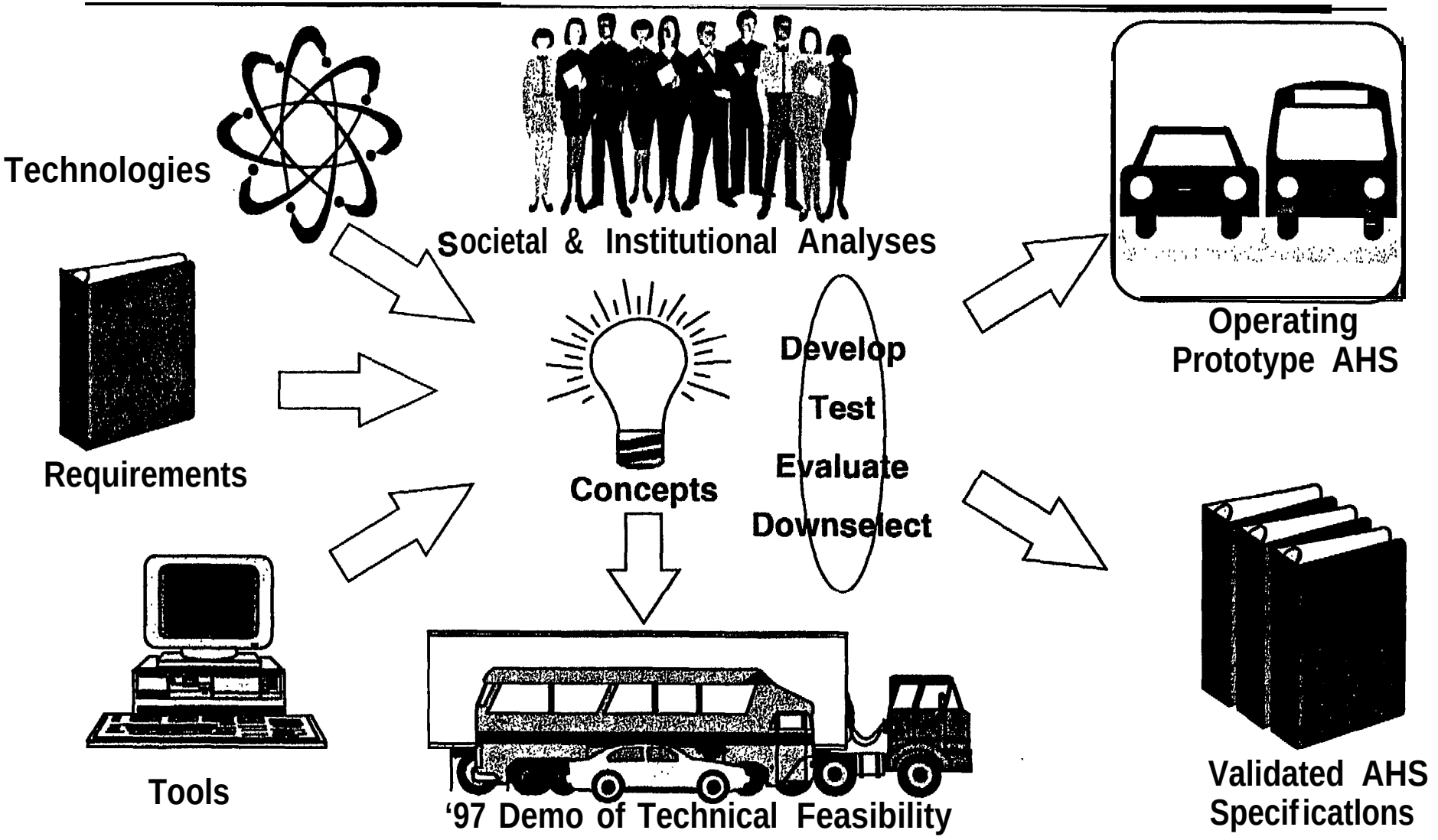
Milestones

	12/94	9/02
ANALYSIS PHASE	SYSTEM DEFINITION PHASE	OPERATIONAL EVALUATION PHASE

Milestones

1. **Performance & Design Objectives Established –Nov ‘95**
2. **Feasible AHS Concepts Selected – Oct ‘96**
3. **Proof of Feasibility Demonstrated – Sep ’97**
4. **Preferred AHS Concept Selected – Feb ’00**
5. **AHS Prototype Testing Completed – Aug ‘02**
6. **System Documentation Completed – Sep ‘02**

Program Elements



Concept Development

- A Three Stage, Five Year Effort to Produce a Complete AHS Concept That Is -
  - Technically Feasible
  - Economically Viable
  - Socially Acceptable
  - Meets Goals for Safety, Mobility and the Environment
- Stages One and Two are Now Complete
- Stage Three Is Focused on Selecting Specific Concept Attributes and and Producing a Concept Design for Prototype

Key Concept Attributes

- Distribution of Intelligence
- Vehicle Separation Policy
- Obstacle Management
- Role of Driver
- Deployment Sequencing

Societal and Institutional Analyses

NAHSC

- Focusing on Providing System Requirements
- Addressing Many Issues:
  - S&I Costs and Benefits
  - Market Demand
  - MPO/DOT Processes
  - Human Factors
  - Local Land Use
  - Sustainability
  - Liability
  - Environmental Effects
  - Operations & Maintenance
  - Public & Private Sector Roles
  - Transit Operations
  - Equity
- Initial Analyses:
  - Transportation and Land Use
  - MPO ISTEA Processes for AHS
  - Framework for Cost/Benefit Analysis
  - Lessons Learned from Elec Toll Coll
  - Public-Private Sector Roles

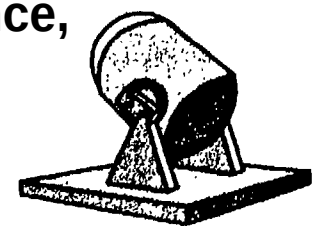
Case Studies

- Objectives:
  - Understand AHS Applications to Specific Transportation Needs
  - Help Evaluate Concepts and Attributes
  - Engage Associate Participants at State and Local Levels
- First Study Started April '96
  - Automating Houston Transit-HOV Lanes (Katy Freeway)
  - NAHSC Provides Seed Money and Technical Support
  - Determine Applicability, Benefits, Costs
- Other Candidates
  - Western Transp. Instltute (Rural)
  - Pennsylvania Turnpike
  - California Megalopolis (SCAG)
  - Multiple Applications - Seattle
  - Lincoln Tunnel Exclusive Bus Lane
  - Minneapolis Urban Corridor
  - I-75 Commercial Vehicles
  - Michigan Urban Freeway I-94

1997 Demonstration

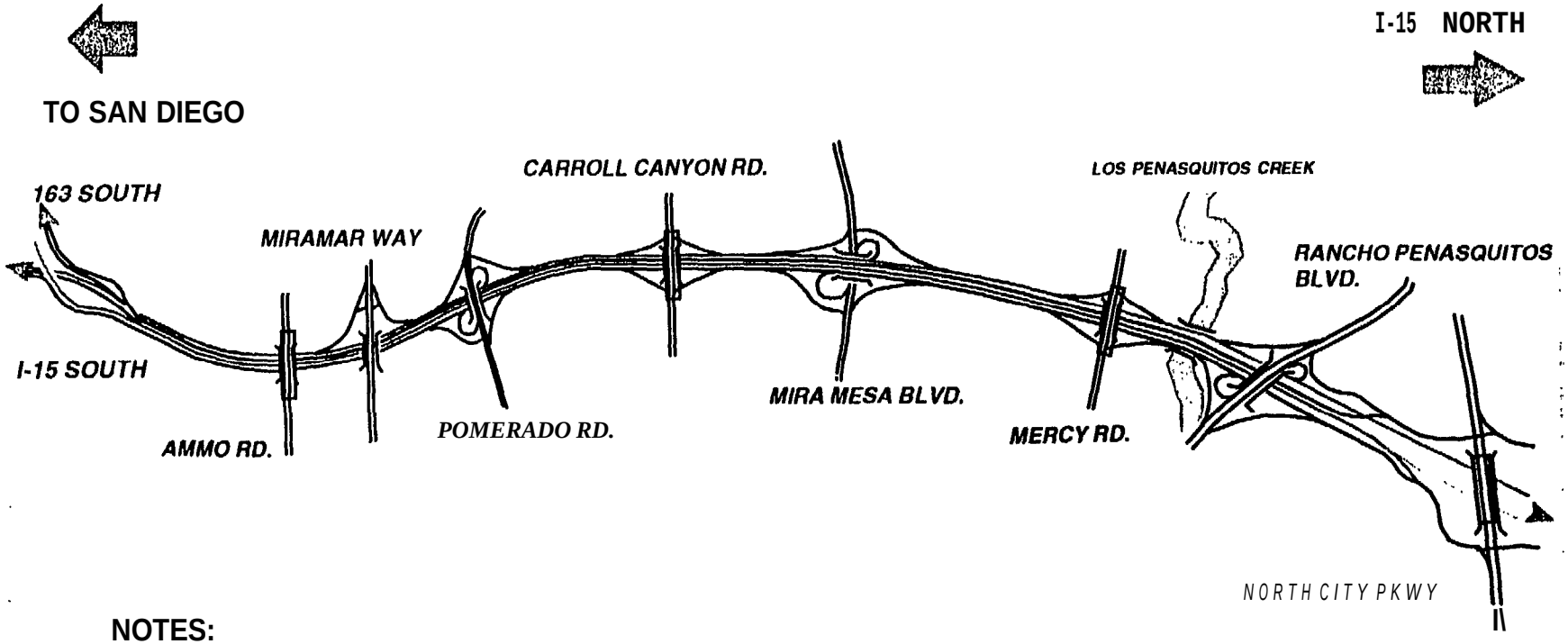
- Objective: Proof of Technical Feasibility
  - Demonstrate Alternative Approaches
  - Show Technologies are Available and Practical

    Show Social, Economic and Environmental Benefits
- Site: I-15 HOV Lanes in San Diego - August 7-10,1997
- Operational Demonstrations, Exposition and SAE FTT Conf
- More than 20 Vehicles Will Take Part in Operational Demos
  - Free Agent Vehicles
  - Platooned Vehicles
  - Maintenance Vehicle
  - Heavy Truck & Buses
- Will Demonstrate
  - Check-in/Check-out, Entry/Exit, Lateral & Longitudinal Control, Traffic Management, Obstacle Detection and Avoidance, Construction & Maintenance
- Includes Associate Participants



1997 Demonstration Site

I-15 HOV Lanes - San Diego



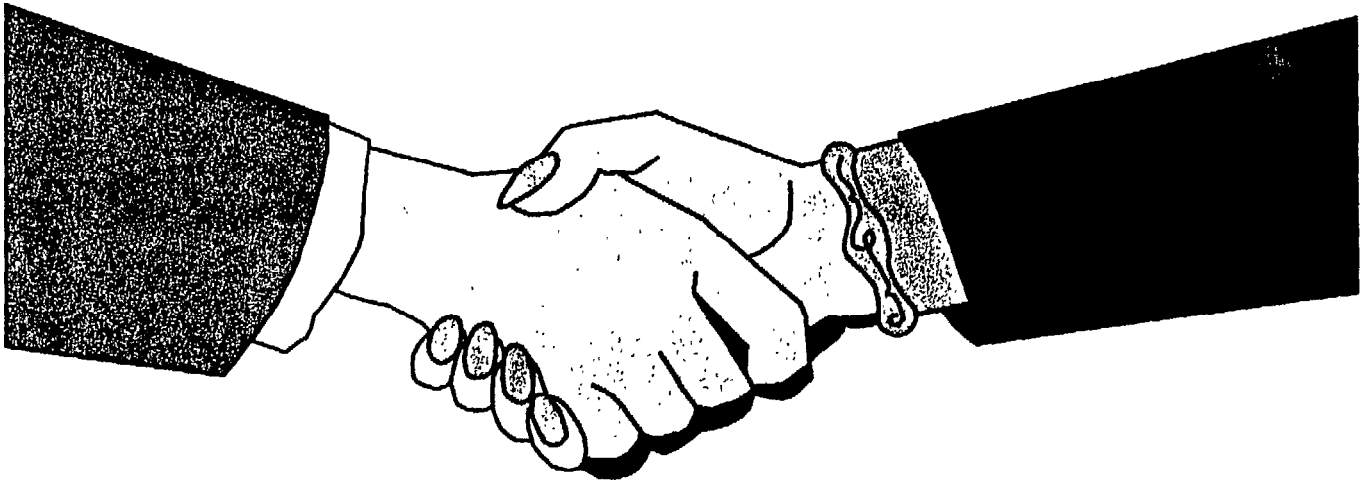
NOTES:

1. Interstate 15 test facility is located approx. 10 miles north of downtown San Diego.
2. Test facility will be two reversible high-occupancy vehicle (HOV) highway lanes - 7.6 miles long.
3. Lanes are located between the north and south bound lanes of I-15, separated by barriers.
4. Lanes consist of two 12, foot concrete lanes with two I0-foot asphalt shoulders.
5. On-off lanes are located at each end with no other access for the entire length.
6. Control yard located at south end will serve as staging area.

Associates' Demonstrations

NAHSC

- Houston Metro Autonomous Buses
- Eaton-Vorad Adaptive Cruise Control Class & Truck
- Ohio State University Free-agent Autos
- Honda Free-agent Autos Showing Transition of Control
- Toyota Free-agent Autos Showing Evolution to AHS



People Saving People

Presented By:

Dr. August Burgett, Chief

U.S.Department of Transportation

Office of Crash Avoidance Research

Light Vehicle Dynamics & Simulation Division

February 5, 1997

People Saving People

NHTSA's Role in the DOT ITS Program

Office of Crash Avoidance Research

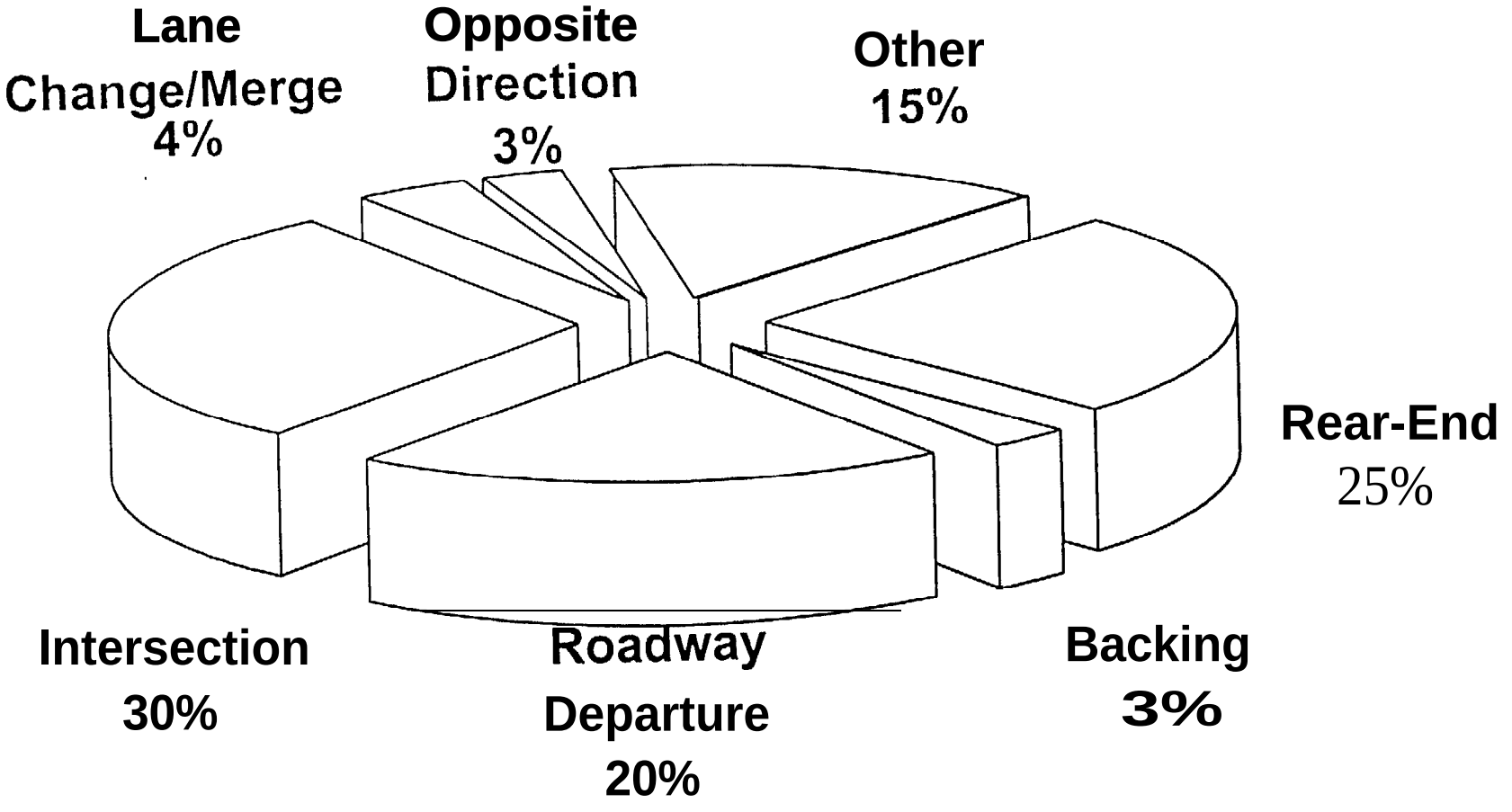
- Demonstrate that improved safety can be achieved by enhancing the crash avoidance performance of vehicles through the application of advanced technology

- Ensure no loss of safety as these systems are introduced into motor vehicles

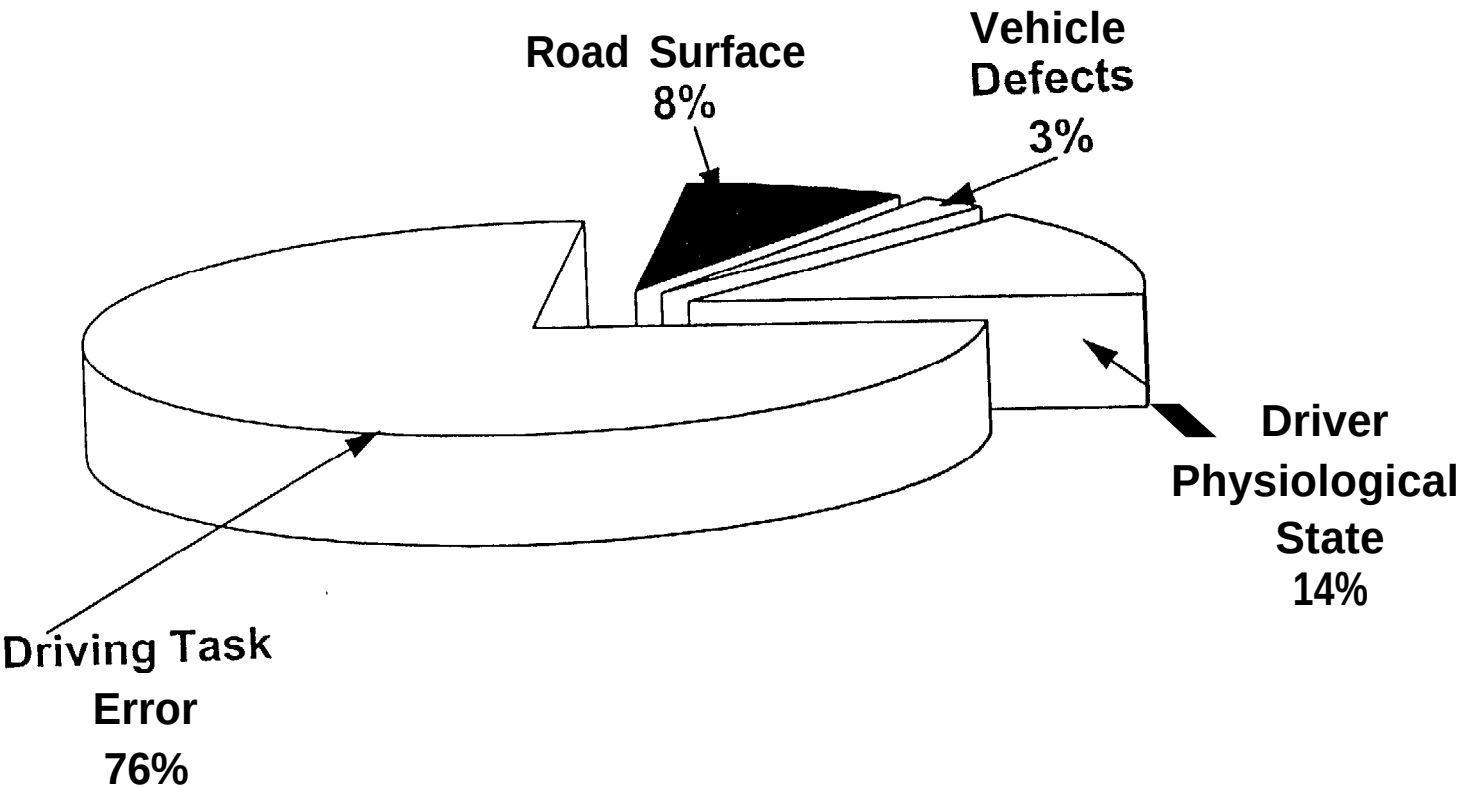
People Saving People

Target Crash Problem Size

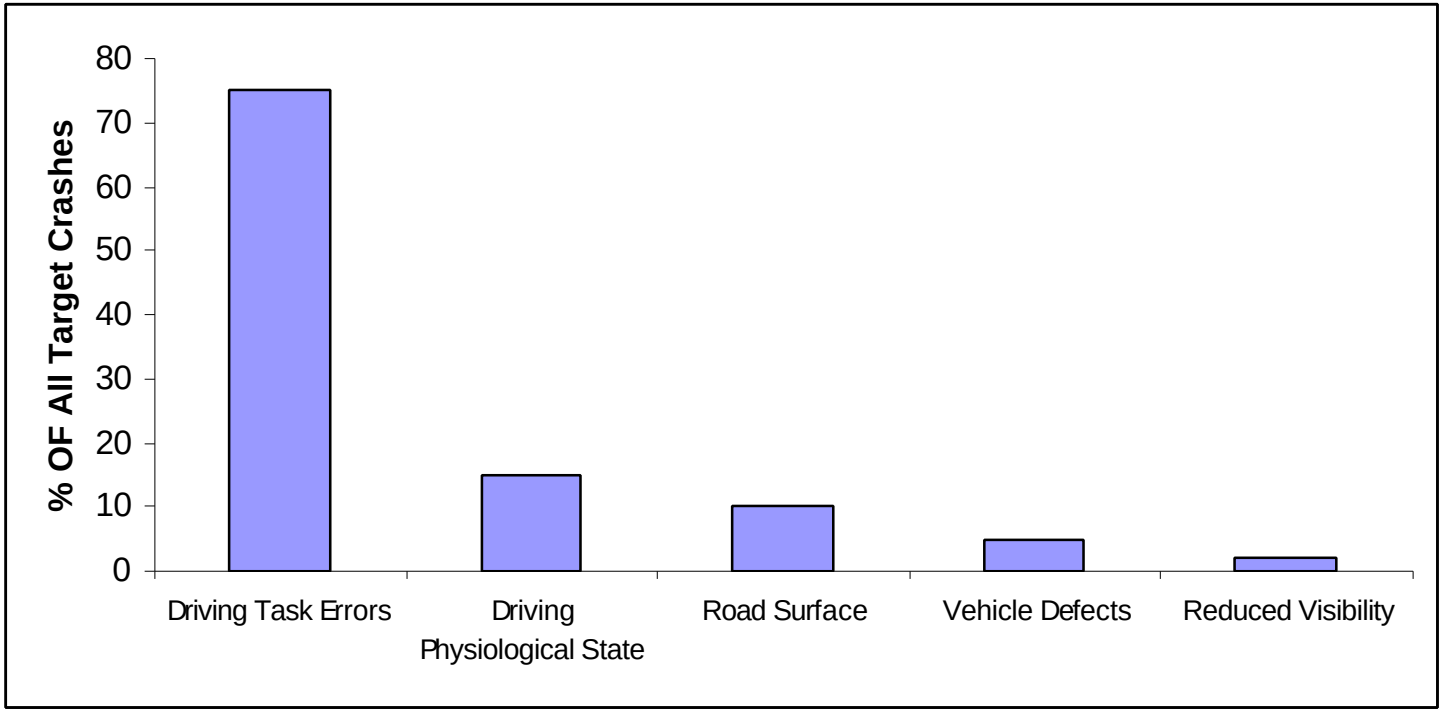
Office of CrashAvoidance Research



Causal Factor Distribution



Causal Factors Breakdown



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Causal Factor Distribution of Target Crashes

Office of Crash Avoidance Research

Crash	Driving Task Errors			Driver Physiological State			Vehicle	Road	Atmosp.	
Type	Rec. Er.	Dec. Er.	Err. Ac.	Drunk	Asleep	ILL	Defects	Surface	Visib.	Total
RE	56.7	26.9	1.1	2.1	0.0	9.6	1.2	2.3	0.1	100.0
BK	60.8	26.6	2.0	3.0	1.9	0.0	5.7	0.0	0.0	100.0
LCM	65.0	32.1	2.6	0.0	0.0	0.0	0.3	0.0	0.0	100.0
SVRD	15.5	17.8	15.9	10.1	11.8	3.5	5.3	20.2	0.0	100.1^
OD	17.5	7.0	19.6	31.7	0.0	1.1	4.5	18.3	0.0	100.0
SI/SCP	40.7	16.2	29.1	12.6	0.0	0.0	1.6	0.0	0.0	100.2^
UI/SCP	73.6	12.2	3.4	2.7	0.0	0.0	0.0	7.0	1.1	100.0
LTAP	49.0	41.2	9.1	0.4	0.0	0.0	0.0	0.0	0.1	99.8”
%*	43.6	23.3	8.5	6.0	3.5	4.5	2.5	8.0	0.1	100.0

* Percentage of all target crashes (71% of 1993 GES)

* Rounding error

Phase I : Objectives

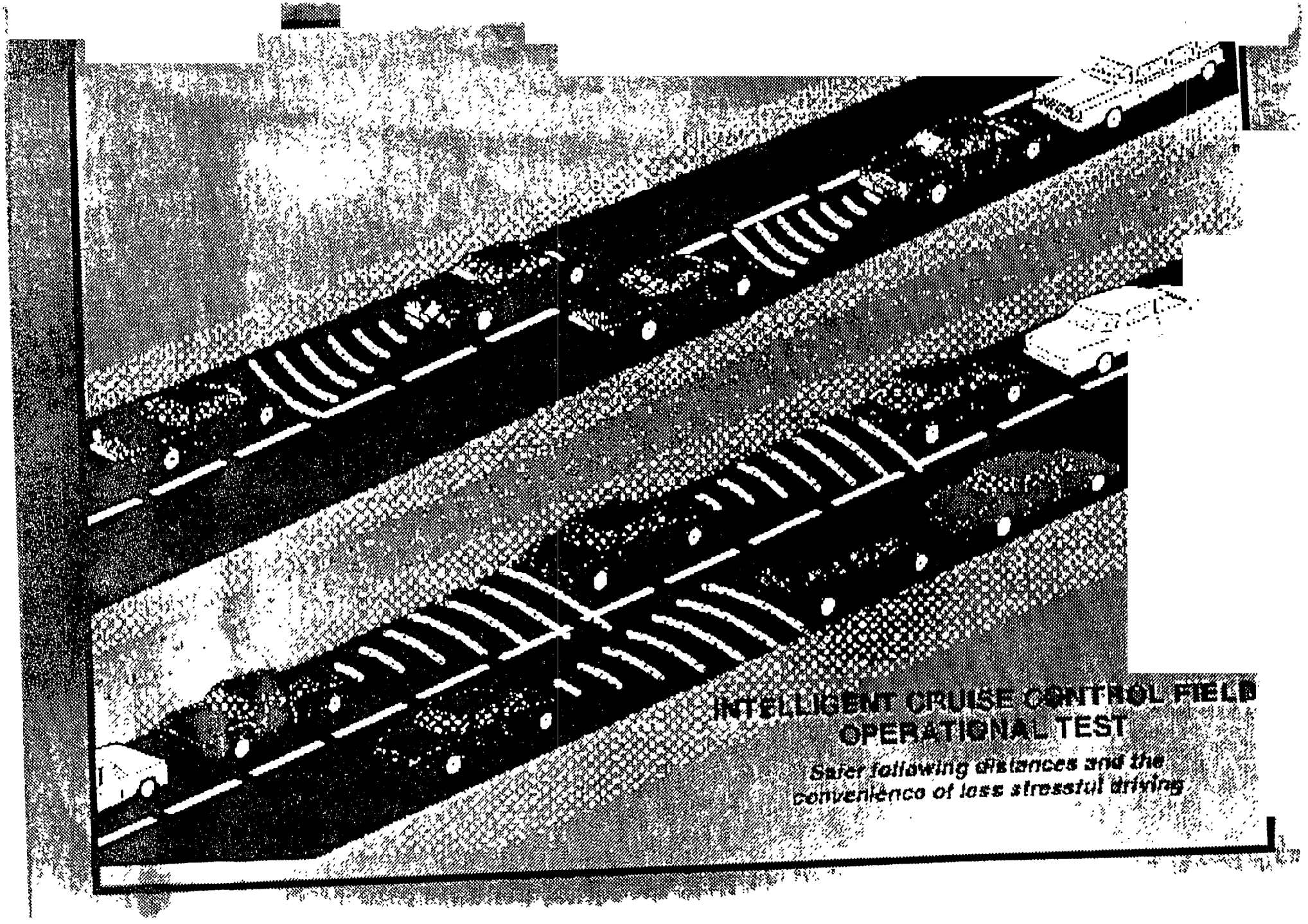
- Characterize nature of collisions and identify causes
- Develop research tools and improve knowledge base
- Identify promising collision avoidance opportunities
- Demonstrate collision mitigation concepts
- Assess safety impact of various systems

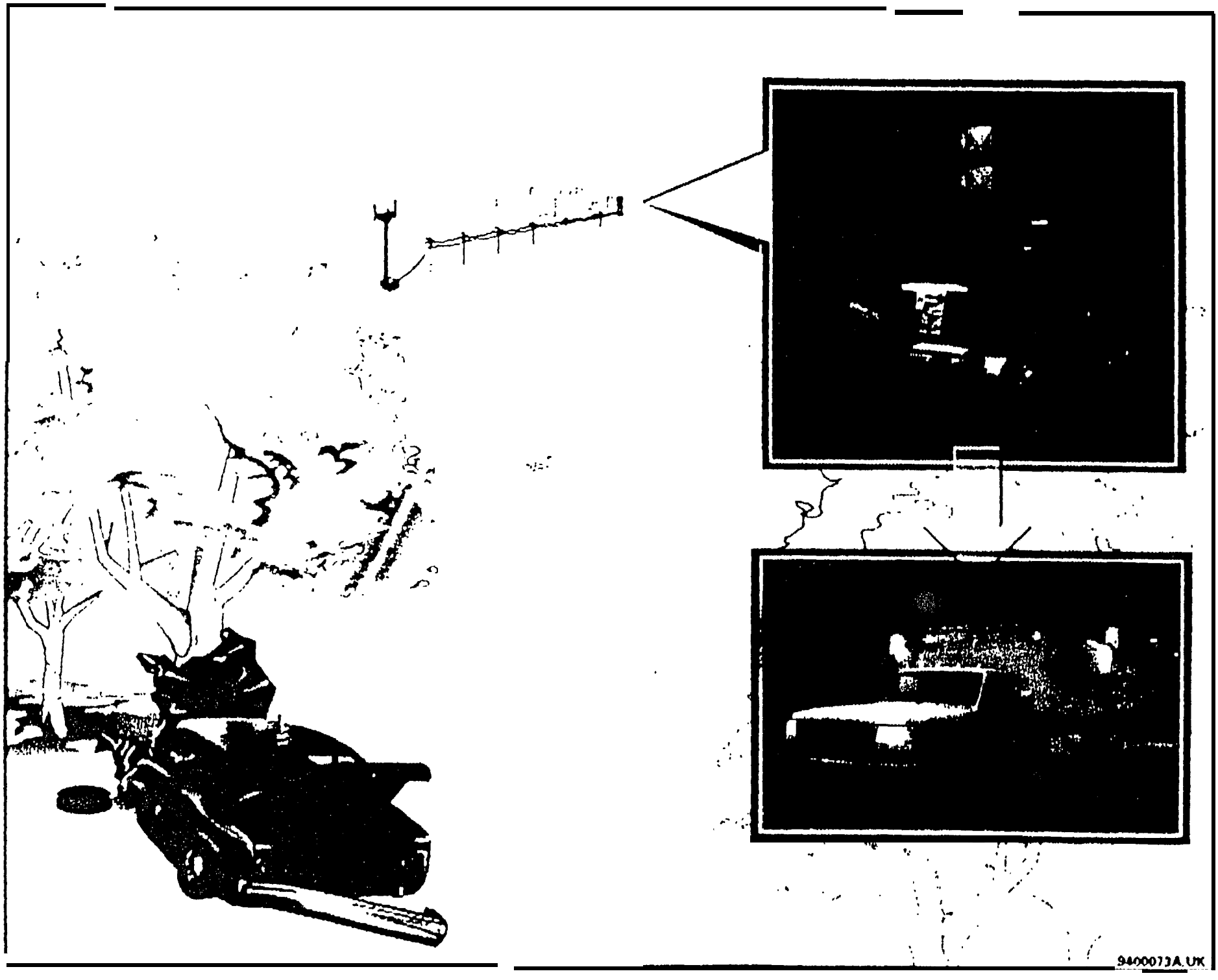
Current Projects

- Specific collision types
- Driver Performance
- Post-collision injury mitigation

Projects Related to Phase I Objectives

- Projects related to specific collision types
  - Rear-end
  - Road departure
  - Lane change & merge
  - Heavy vehicle stability
- Projects addressing driver performance
  - Driver status monitoring
  - Vision enhancement
  - Human-vehicle interaction
- Projects addressing post-collision injury mitigation
  - Automatic collision notification


INTELLIGENT CRUISE CONTROL FIELD
OPERATIONAL TEST
Safer following distances and the
convenience of less stressful driving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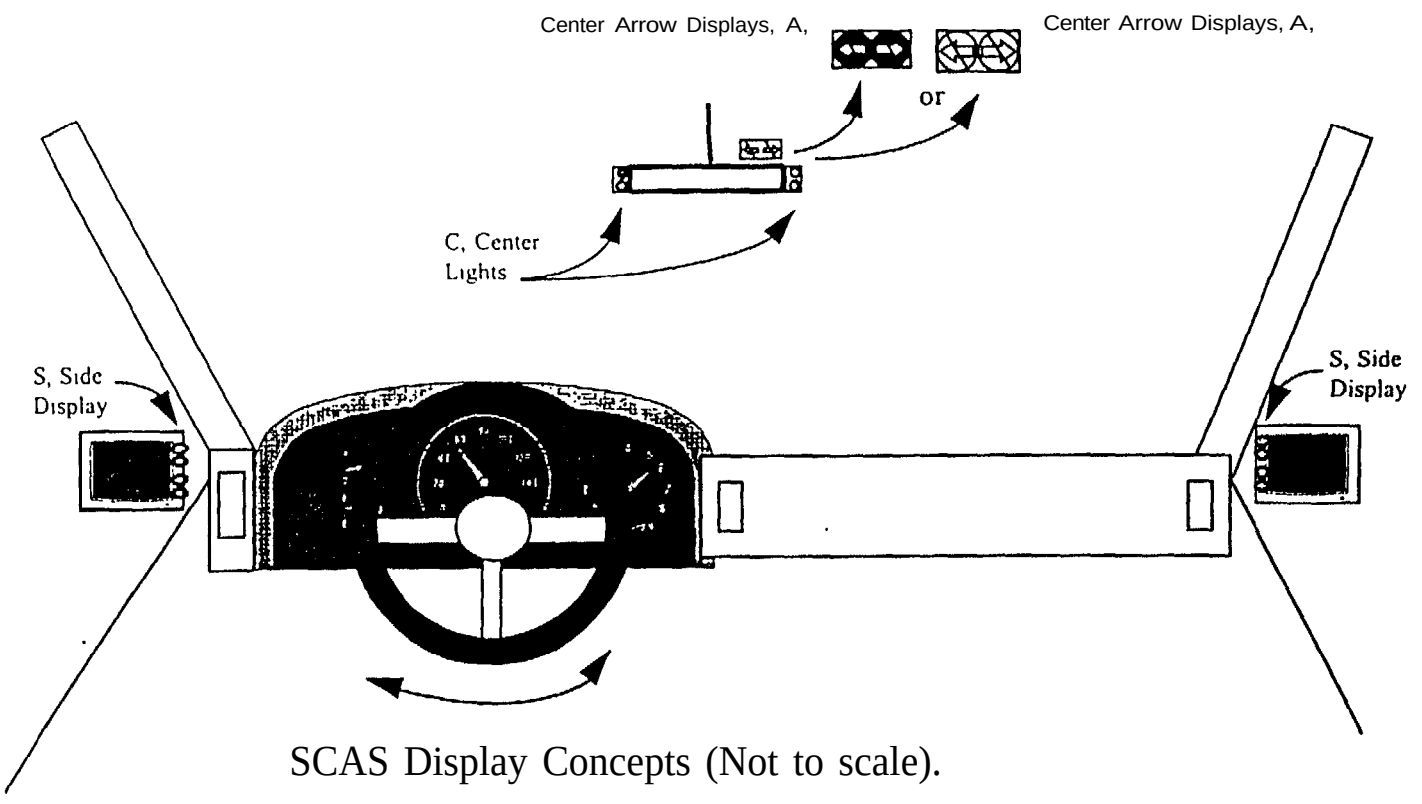
General Human Factors Guidelines

- Distinguish multiple levels of warning
  - Imminent collison, cautionary, status
- Unique, reserved features for imminent warning
- Dual mode needed for imminent warning
- Prioritizationa rules for simultaneous warnings
- Compatibility with driver behavior

Lane Change/Merge



SCAS Display Concepts (Not to scale).

Run Off Road Warning Systems

- Vibrating steering wheel warning system was evaluated in simulator study
- Examined both non-directional vibration & directional torque
- Results
  - Drivers reacted more quickly & appropriately with directional torque than with nondirectional vibration
  - Multiple warning attributes (vibration & audible sound) tend to overload driver

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Rear-End Collisions PRELIMINARY Driver Warning Systems Specifications

Office of Crash Avoidance Research

Description	Specificaiton
Driver Visual Display	Graduated perspective visual display
Sensor Beam	Multi-Beam or Scanned
Horizontal Field of Regard	± 8 degrees
Horizontal Angular Resolution	TBD degrees
Vertical Field of Regard	2-3 degrees
Acquisition Range	2130 meters
Range Rate Resolution	0.4 meters/second

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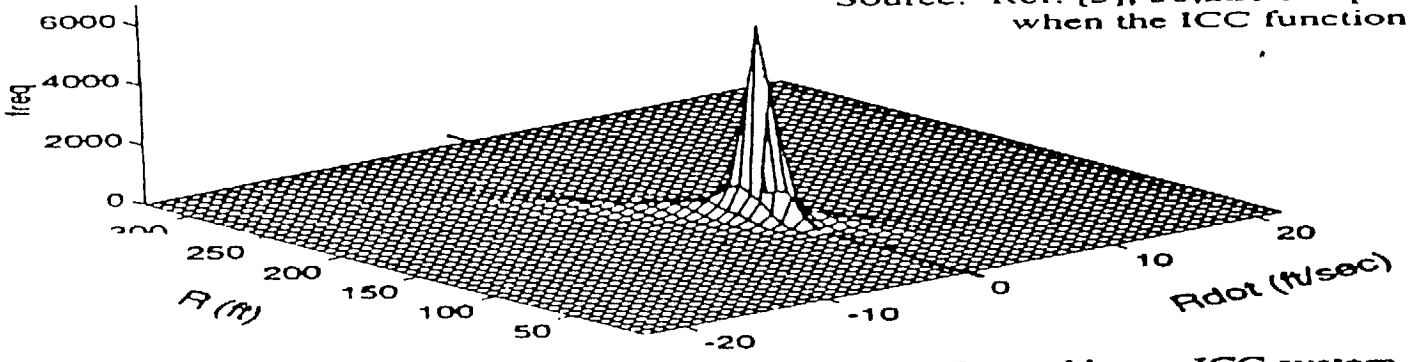
Intelligent Cruise Control Data

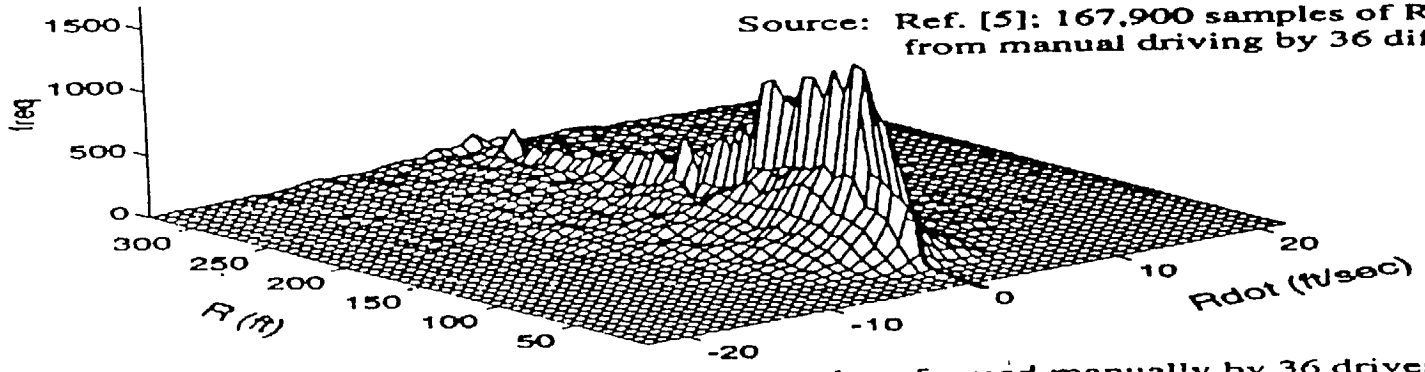
Office of Crash Avoidance Research

Source: Ref. [5]; 58,220 samples of R and Rdot when the ICC function is in operation.



Headway control performed by an ICC system

Source: Ref. [5]; 167,900 samples of R and Rdot from manual driving by 36 different drivers.



Headway control performed manually by 36 drivers

Crashes Prevented By Selected Crash Avoidance Systems

Crash Condition (1)	Total No. of Crashes (2)	Relevant Crashes Addressed by Countermeasures (3)	Effectiveness Estimates (4)	Number of Crashes Reduced (3) x (4)
Roadway Departure	1.2 million	458,000	0.65	296,000
Lane Change/Merge	0.2 million	192,000	0.20	39,000
Rear-End Crashes, Driver Warning	1.7 million	1,547,000	0.49	759,000

Future Objectives

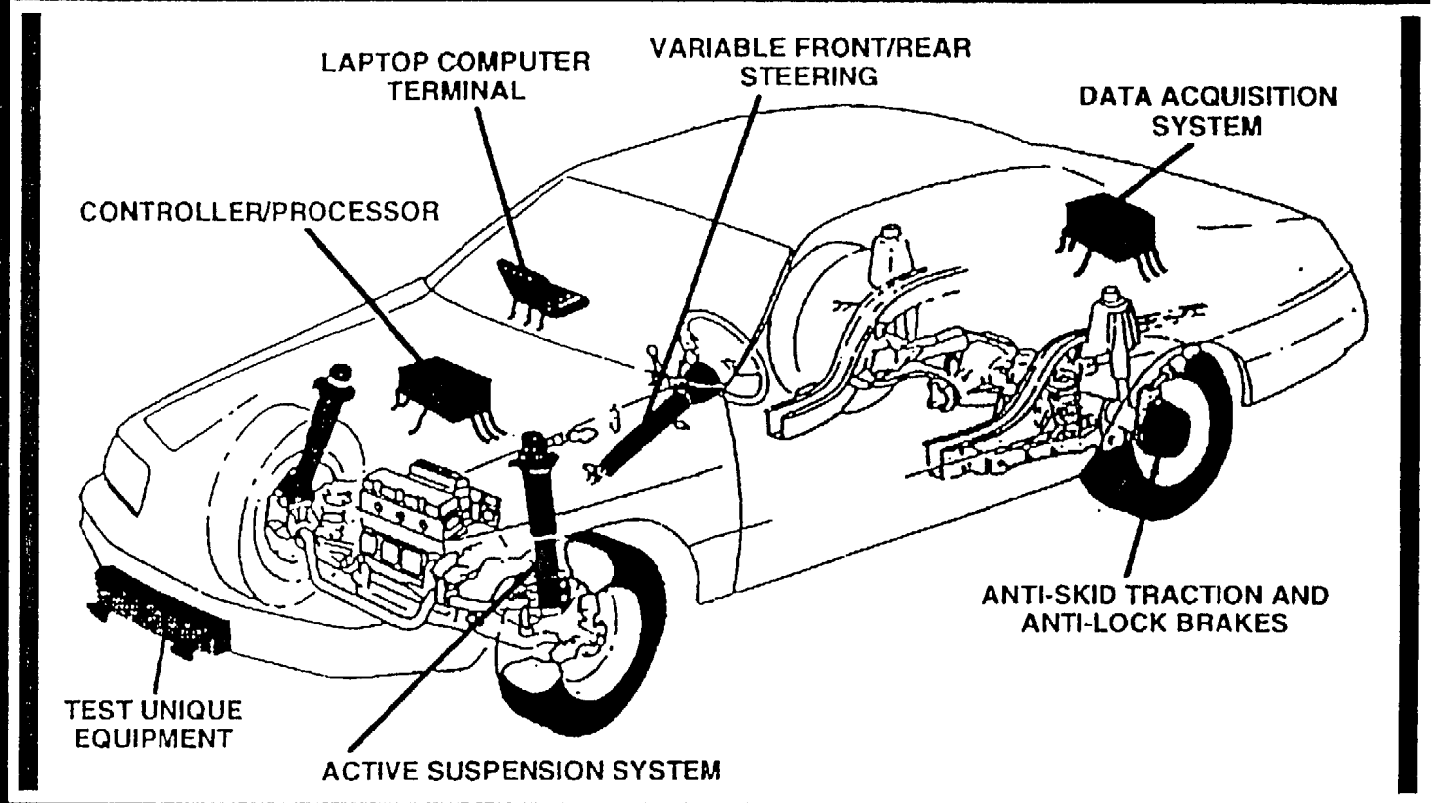
- Improve understanding of system capability
- Evaluate consumer acceptance
- Estimate realworld safety benefits
- Facilitate Deployment

System Features

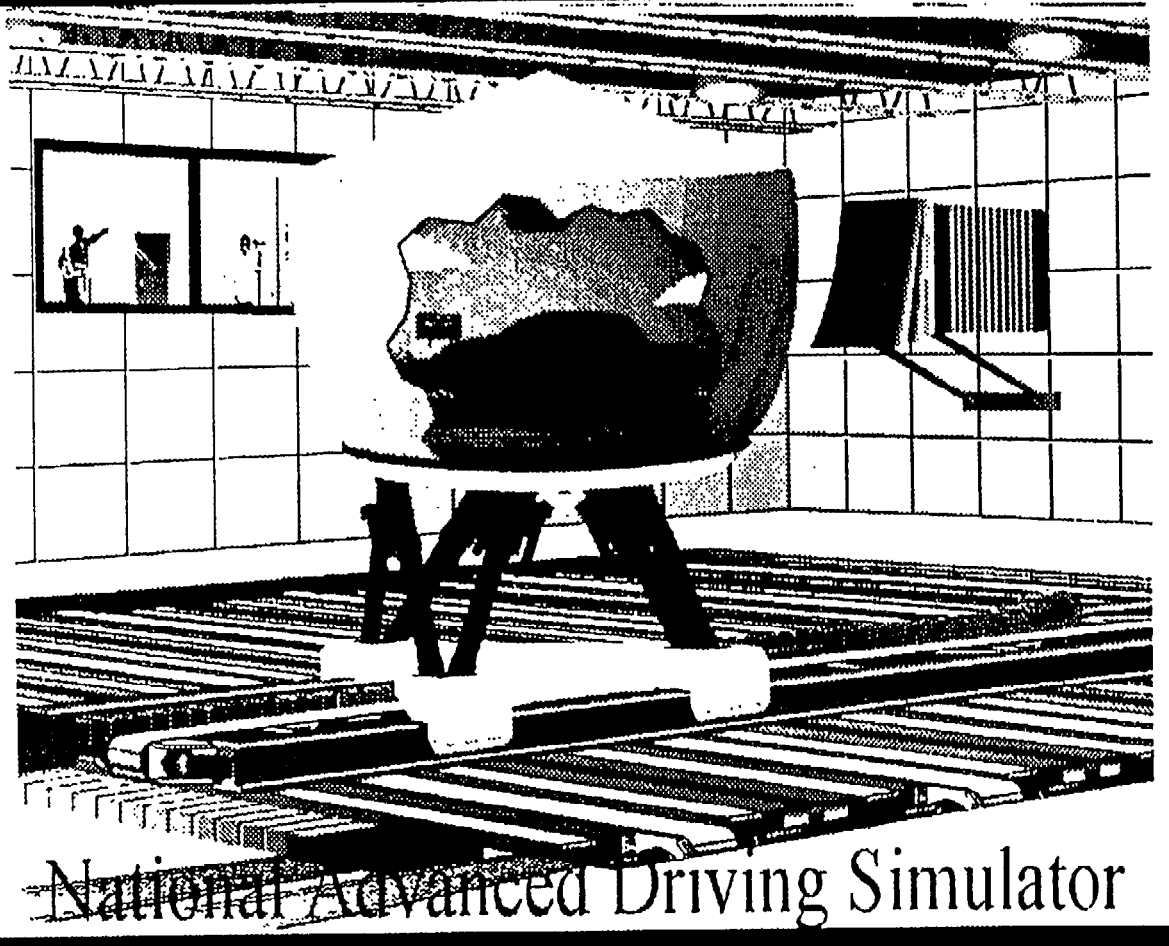
- System Capability
  - Sensor
  - Computational
  - Driver Interface
- User Acceptance
  - Measure of Performance
    - False positives
    - False negatives
    - Nuisance warnings
    - Perceived warnings
    - Workload
    - Cost
- Benefits
  - Number of collisions
  - Number and severity of injuries
  - Number of fatalities
  - Amount of secondary congestion

Variable Dynamics Testbed Vehicle

Office of Crash Avoidance Resea



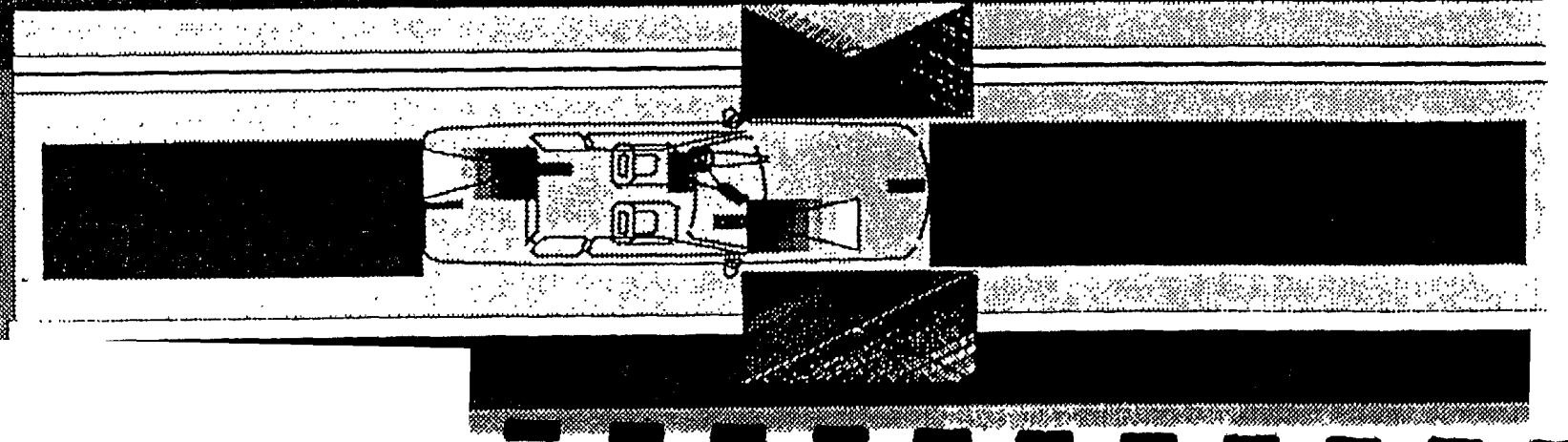
National Advanced Driving Simulator (NADS)



VME OP RATI N N P

DASCAR Sensor Suite

Video Imaging: Forward, Rear,
Lane Tracking: · Driver
Headway/Tailway: · Lateral Positioning
·



LAW OFFICES
NOSSAMAN, GUTHNER, KNOX & ELLIOTT, LLP

WALTER L. NOSSAMAN
(1886-1964)

THIRTY-FOURTH FLOOR
50 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111-4712
TELEPHONE (415) 398-3600
FACSIMILE (415) 396-2436

JOHN T. KNOX
WARREN G. ELLIOTT
OF COUNSEL

LOS ANGELES
THIRTY-FIRST FLOOR
445 SOUTH FIGUEROA STREET
LOS ANGELES, CA 90071-1602
(213) 612-7800

IRVINE
SUITE 1600
18101 "ON KARMAN AVENUE
IRVINE. CA 62715-1007
(714) 833-7800

WASHINGTON, D.C.
SUITE 600
1227 25TH STREET, N.W.
WASHINGTON, D.C. 20037-1156
(202) 223-9100

SACRAMENTO
SUITE 1000
915 L STREET
SACRAMENTO. CA 95614.3701
(916) 442-8888

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Prepared For Joint Workshop On Liability Issues In Advanced Vehicle Control And Automated Highway Systems

February 5-6, 1997

Stephen N. Roberts

Liability Lessons Learned from ITS

The following details in outline form many of the issues raised in articles about and discussion of ITS liability for the last few years, with a focus on AVCS and AHS issues. It organizes the issues various ways. Rather than an exhaustive list of every issue, it is meant as a spur to discussion of some of the liability questions which arise in the AHS and AVCS context. The outline is annotated with comments on some of the points and with a brief explanation for non-lawyers of some of the legal concepts.

I. LIABILITY ACCORDING TO TYPE OF LEGAL THEORY

AHS/AVCS designers and providers will face liability under varying legal theories in state and federal court. The following describes the chief legal theories which might be used by consumers or other parties to contracts in asserting liability against providers of AHS/AVCS.

A. Negligence

Most analyses will begin with the most obvious theory, negligence, the failure to exercise due care. Manufacturers of components used in systems may face claims they were negligent in design or manufacture. Engineers who design the specific project in which the equipment is used face claims of design negligence, as do the builders. Both the operators and those who maintain the systems face liability under this theory. Negligence by someone else may be used as a defense, either to allocate liability to others or as a defense to a claim by a user who was negligent.

B. Strict Liability

This is of concern largely to those, like auto manufacturers, who provide products, rather than services. Defects in some types of products may, depending on the local jurisdiction, impose strict liability on the products' manufacturers or suppliers: i.e., liability regardless of negligence.

C. Breach of Contract in General

Contracts allocate liability among the parties to the contracts. Because by definition AHS/AVCS involves new types of technology, forms of contracts used by parties in more traditional circumstances may not provide adequate protection or appropriate allocation. Further, because these technologies may be delivered in unusual ways, such as through public/ private partnering, the traditional allocation of liability in contracts may need rethinking. Since much of the technology is new, procurement contracts may be more subject to litigation than in more familiar circumstances.

D. Breach of Warranties in Consumer Contracts

1. Express

Manufacturers traditionally take care in preparing express warranties for consumers; that is even more important with these newer technologies. This should be a joint project between the lawyers and the designers.

2. Implied

The law may imply warranties. In the end, implied warranty theories are largely variants on negligence liability and strict liability; they define the circumstances under which someone may legally be held liable.

E. Fraud and Misrepresentation Theories

These are issues familiar to manufacturers and service providers in other contexts, and not much will be different here other than the nature of the product about which representations are being made.

1. Fraudulent Misrepresentation or Fraud

With an element of fraud, these legal theories normally involve knowing misrepresentations about a product, although gross negligence in making misrepresentations might also provide a basis for a claim.

2. Negligent Misrepresentation

Not all laws will require a misrepresentation to be knowingly made for liability to be found. If due care is not taken in its preparation, there may be liability.

3. Fake Advertising

This is a variant of misrepresentation, usually in the consumer context. Depending on the laws of various jurisdictions, there may be a requirement that the advertiser know the advertisement was false.

4. Punitive Damages

Where fraud is involved, there may be a right to substantial punitive damages. Depending on the jurisdiction, such damages may also be available for strict liability and gross negligence.

F. Invasion of Privacy

Informational ITS technologies have raised a number of privacy issues. This appears to be a less significant problem in the AHS/AVCS context. However, AHS system operators will gather information about the location of vehicles, a major privacy issue.

G. Antitrust and Trade Practice

In view of the fact there are so many partnerships, consortia and teams developing ITS, antitrust issues are a concern. That is especially the case with AHS. The possible need to agree among companies on standards and specifications may also lead to antitrust problems. The role of government in these projects may minimize antitrust concerns, however.

H. Intellectual Property

In that this technology involves new products, normal problems of protection of intellectual property are raised. This may be complicated by the role of government in the projects, since a governmental entity may not claim intellectual property rights; that could affect those who are sharing technology with the government.

I. Environmental

It is possible that some ITS products might have environmental issues such as EMF emissions, but they would seem minor compared to other liability issues. Largely environmental work pertaining to ITS will be clearances prior to a project, not liability afterwards.

II. FORUM ISSUES OF CONCERN TO ITS

Tort liability is primarily an issue of state law, and the law varies from state to state. The same problems will exist with international transactions, adding one more layer to the complication of trying to assess the risk. (This outline largely assumes the technology is being used in the United States.) In theory, a possible solution to fears that tort liability is a barrier to AVCS or AHS development is a larger role for the federal government. However, this may be counter to other trends, such as the structure of ISTEA.

A. State

1. Sovereign Immunity

Under common law, states were often immune from suit--the sovereign cannot be sued. The states have by constitution or statute cut back on that restriction, but the laws of the 50 states vary on how much. Distinctions are drawn on the basis of whether the design is deficient (usually the state is immune from suit), whether the maintenance is faulty (usually not immune), amount at issue, etc. Local jurisdictions and some state highway departments may not be immune. Private suppliers to government usually will not be able to take advantage of state sovereign immunity, although the clever contract drafter might find some help for a private party.

2. Differing Laws in Different States

The tort laws vary from state to state, so that the provider of a product which will be sold nationally will not necessarily know until suit is filed in a particular state how a legal test will be applied to some claim of liability against its product. A provider of services or an engineer designing roads may have more information about this since its project is often state specific; that provider or designer can therefore protect itself more easily.

3. Contracts Specifying What State's Law Will Govern

In many cases it will be unclear what law will apply to a given tort situation. A provider of services may be able to protect itself somewhat by limiting the distribution of its products. It can also protect itself by choice of law provisions in its contracts, although choice of law provisions would normally govern only contract liability, and not tort liability in the consumer context.

B. Federal

1. *Sovereign Immunity of Federal Government*

The federal government has its own rules relating to immunity for torts. These will vary further when the military is involved. However, federal law may be able to extend some of the governmental immunity to private parties under the federal contractor doctrine.

2. Preemption of State Law

The federal government's involvement in ITS is extensive and, for AHS development, may be greater than in other transportation products or services. To the extent the government passes extensive laws on particular ITS services, those laws may preempt the laws of the various states. This may make it clearer for the AHS/AVCS provider as to what liability it will face. Urging the federal government to pass preemptive laws may be a way to remove barriers to ITS development. Further, to the extent the federal government is funding projects at the state or local level, the conditions of that funding might provide leverage in getting the recipient state to minimize potential liability.

C. Unofficial Forums

1. Arbitration Clauses

American courts generally favor the use of arbitration clauses in the general contract arena, but will be more hesitant when a non-negotiated consumer relationship is involved. If a dispute is to be resolved in arbitration, it can hopefully reduce the transactional expense of defending against liability claims. Also, many feel an arbitration award is not subject to being as irrationally high as a jury verdict.

2. Other Dispute Resolution Mechanisms

Large transportation construction projects have led the way in pioneering unusual and successful mechanisms for resolving disputes short of litigation. Many of these can be adapted successfully where AHS/AVCS is involved. Again, this method of resolving disputes may be more useful outside the consumer context.

D. Class Actions/ Multi-Forum Litigation/ Mass Tort Actions

A vehicle under the control of someone other than the driver, a highway accident involving hundreds of vehicles--these provide the elements both for a bad movie and a large lawsuit. Complicated rules for class action and litigation across state lines may be applied in some AHS/AVCS situations.

E. Types of Rules

1. Statute and Constitutional Provisions

State statutes normally establish the basic guidelines for tort litigation. Also, to the extent state entities are involved, the statutes (or sometimes state constitutional provisions) largely determine the level of sovereign immunity enjoyed by the state. Because the federal government is a leader in ITS development, Federal statutory law may have a more important role with respect to AHS/AVCS than with respect to traditional highway matters. Also, federal tort claims law sets the boundaries on the ability to sue the Federal government for torts.

2. Regulations

Government, federal or state. might also promulgate regulations which more precisely set out what the statutes say. In theory, the regulations would not expand or contradict what is permitted by statute. Procurement rules especially might be set forth in regulations.

3. Local Law, Codes or Specifications

Especially when it comes to highway matters, local ordinances or specifications might have application. However, local authorities will often defer to standard state specifications.

III. EVIDENCE IN LIABILITY LITIGATION

Especially when the test is negligence, the trier of fact will need a basis to judge whether the supplier of ITS products or services or the operator of a system, has acted properly. A trier of fact will compare what the litigant did to evidence of what others do, and will determine if the product or design meets certain standard and accepted specifications.

A. Industry Groups Establishing Specifications

One defense a provider of a product or design services might utilize is that its work was done according to industry specifications. Since AHS/AVCS is new technology, such specifications largely do not exist as they would in more traditional areas of engineering. As a result, efforts to promote standard specifications may be a critical exercise for providers of AHS/AVCS services. Impediments to'that are antitrust concerns along with the natural hesitance of competitors to share information. Organizations such as ITS America and government entities can play a leading role in these efforts; where government entities are involved, their presence may provide an insulation to charges of violating antitrust laws. Because AVCS products often can be produced alone by a manufacturer, whereas AHS by definition requires cooperative effort, joint work may be more common with respect to the latter.

B. Other Published Criteria (e.g. Standard Specifications of Highway Departments)

Highway departments have standard forms of specification, which in turn might be utilized by local agencies. Providers of ITS services will be expected to work with the states in establishing specifications. In view of the rapidly developing technology, this might be done just prior to the procurement stage.

C. Specifications From Government Procurements

Specifications set forth in procurement packages might be a source of guidance for anyone fighting a negligence suit. However, in view of the changing technologies, some RFP's are asking the proposers to offer creative design solutions and other ideas, so the parameters of a project may not be fully spelled out.

D. Federal Specifications

A contractor for the federal government which follows federal specifications might have available to it a defense referred to as the federal contractor defense. Federal specifications may also be relevant at the state level where federal money is involved.

E. Prior Experience

The initial development of and experience with a technology should be monitored carefully. A person making a liability claim will undoubtedly wish to examine such evidence in determining whether someone was negligent.

F. Opinions of Experts

Most lawsuits of any magnitude have the ubiquitous "expert." This will be an individual from the relevant field who will testify about whether a technology was designed,

built or administered with due care. There is elaborate debate in the courts about how advanced and well-settled theories of science and engineering must be before an expert may testify before a trier of fact. Experts can normally be found about anything, and those who are taking the more aggressive positions based upon arguably minimal science are often referred to by their opponents as engaging in "junk science." Since these technologies will be relatively new, the issues of experts engaging in junk science theorizing will be especially acute.

G. Files of Manufacturer

Plaintiffs in these cases will try to prove their cases from the files of manufacturers, which raises difficult issues about what is committed to writing and what files are destroyed.

Iv. ALLOCATION OF RISK

One way in which developers of AHS/AVCS may overcome barriers is by carefully allocating the risk. There are various parties between and among whom the risk might be allocated.

A. Between and Among Governments

1. Between Federal and State Governments

Because in most circumstances transportation facilities may be built by state entities rather than the federal government, even if federal funding is involved, one might expect that the primary liability risk will be with state government rather than with the federal government.

2. Between State and Local Governments

Of course transportation projects might be local in nature, rather than statewide, although projects of the scale to utilize AHS/AVCS technologies in the near future are likely to be at the state level. Sovereign immunity may not attach to local governments.

B. Between and Among Private Parties Who Are Developing AHS/AVCS

1. Allocation of Risk By Contract

The first line of liability protection for any developer of AHS/AVCS Technology is its contracts with others involved in the development, Consequently, indemnity and other allocation of risk issues should receive careful and detailed attention in the contracts.

2. Choice of Law In Contracts

To the extent state government entities are involved, choice of law issues are probably a moot point. Nevertheless, in limited circumstances, developers of AHS/AVCS might be able to limit liability by carefully examining the particular jurisdiction's law and having the contract choose the best jurisdiction. Since AHS may involve highways in a single state, the choice of law may be clear and therefore the rules that would apply to any liability dispute more certain.

3. Alternative Methods of Resolving Contractual Disputes

Providing for alternative means of resolving disputes is in part a method for reducing the transaction costs of litigation. With respect to AHS/AVCS, it may also be a matter of making the process of determining liability more rational. The parties to these contracts may feel that a more just result is likely to be reached either through a negotiation process such as mediation or through an arbitration where the trier of fact is going to be an experienced judge or someone with a special expertise in a technical field, rather than a jury.

4. Express and Implied Indemnity

Regardless of whether the parties choose to deal with indemnity issues in their contracts, state statute or common law may impose indemnity obligations. Consequently, it is often beneficial to deal with those issues carefully and precisely in the contracts to replace unfavorable or unclear state law, where that state law can be waived. This will result in express indemnity clauses in the contract, rather than the implied indemnity that would come about solely from the nature of the relationships as dictated by state law. The insurance carriers for the parties to the contract should be consulted to make certain that liability from such indemnity is covered by insurance.

C. Between and Among Governments and Private Parties

Since a large number of possible AHS/AVCS projects will involve government, the procurement contracts will be important. ITS is and will be the subject of many unusual or even unique public/private partnering relationships, not seen in traditional road building or transportation projects. Consequently, the contractual documents for these should be followed through from beginning to end; the parties should not simply fall back on traditional forms of agreement. With respect to liability, the parties are on an unequal footing since the government entity will normally enjoy some sovereign immunity whereas the private parties will not.

D. Between The Providers and Operators of ITS Products and Systems

A primary liability issue is whether a failure of the product or system resulted from a design error or an operational or maintenance problem. Since the operators of many AHS

systems are by definition going to be someone other than the ultimate motorist consumer, the maintenance versus design issue should be carefully thought out in contractual relationships.

E. Insurance

1. Do Standard Comprehensive General Liability Policies Cover AHS/AVCS Risk?

The courts are full of cases between insurance groups and industry groups who have different opinions regarding what standard comprehensive general liability (CGL) policies cover. Examples are asbestos and environmental coverage disputes. Ten years from now insurance carries and AHS/AVCS providers may differ as to whether a CGL policy in 1997 covered a particular type of risk. For example, a typical clause precluding coverage if an injury was "expected or intended" might be the subject of dispute. Consequently, AHS/AVCS developers should not automatically assume they are going to be covered for these ventures by their normal CGL coverage, but should press their risk departments to examine insurance relationships closely in light of specific projects. Another problem is that the law varies state by state respecting whether punitive damages may be insured under some circumstances.

2. Does the ITS Provider Have Long Tail Coverage?

Insurance might be "occurrence" based (covering a claim which occurred during the period of the policy) or "claims made" (only covering claims which were presented to the insurance carrier during the term of the policy). Design professionals often have claims made policies. Therefore, unless they renew their insurance each year, they will not continue to have insurance for design decisions made in prior years. Problems with AHS/AVCS programs may not surface for several years after the program starts.

3. Are There Special Insurance Products Available?

As the industry evolves, so too can the available insurance coverage. Larger carriers continually create new forms of coverage to meet specific industry needs. AHS/AVCS developers should have a risk manager who becomes familiar with these possibilities, or at least a broker who has access to such policies. It is even possible with a willing insurance carrier to write a policy to a specific need. Some corporations might pool with others for insurance.

4. What Parties to a Transaction Are Responsible for Insurance?

The allocation of risk between the parties in a contractual relationship may mean nothing if the one party does not have the financial viability to withstand a large judgment. In such a circumstance, the parties which are stronger financially may end up bearing the entire liability even though the weaker party was partially or wholly responsible for the loss. As a

result, contractual relationships may wisely require each party to obtain insurance and to provide proof continually of that insurance.

F. Toll Rates

One way to spread the risk is to build the cost of potential liability into tolls. No matter what system of risk spreading is used, in fact the cost will normally be born as a group by the consumers, who use the AVCS technologies or AHS road, or instead by the taxpayers as a group.

G. Allocation Between Providers and Users (see next section)

The final comparison is between the consumer and everyone else. The topic is covered in the next section.

V. LIABILITY ISSUES PERTAINING TO CONSUMERS

The bulk of tort law in the transportation field is constituted by automobile liability cases, with one motorist suing someone else over an accident. One estimate, for example, has attributed 90% of accidents to motorist negligence. Elaborate laws and fine distinctions have developed state by state. AVCS, and especially AHS, technology may materially change the nature of this field since many of the rules in the area are premised upon the fact that the consumer has a large degree of control over the vehicle. To the extent that that is no longer true, the consumer will drop out of the equation, and instead the liability may rest greatly or totally upon the providers of the products or services. This raises the liability risk for manufacturers, designers and operators.

A. Testing Phases of Products

One way to limit liability is a more elaborate testing period for products. Such testing. especially if it involves consumers, will need to have the relationships spelled out more specifically by a contract than traditional relationships are.

B. Sophistication of User - Training

To the extent a consumer is going to be involved in operation of the AHS/AVCS system, rather than some third-party operator, training on these systems may be a more important issue than it has been traditionally. Automobile manufacturers do not currently require specific training on cars before allowing them to be sold to a consumer. Yet requiring some specific training on complicated devices may cut down on misuse and may also be a defense available **to** a manufacturer that it did not act negligently by allowing an uninformed consumer to use it.

C. Expectations of Consumers

Many tort cases turn on what the consumer expected with respect to a particular product or technology. In more traditional transportation technologies, consumers are more likely to have realistic expectations. They know how a vehicle behaves in response to certain commands, they know what to expect fiom normal road conditions, etc. As AHS/AVCS technologies take some of these operational abilities out of the hands of consumers, the expectations are likely to become more unrealistic. The more complicated the technology becomes, the less likely it is that a consumer will have realistic expectations. For example, many consumers expect air bag deployment to be equivalent to a fluffy pillow being thrust in their faces whereas the actual event is quite forceful. Manufacturers therefore need to find a way to deal with unrealistic expectations. Unless and until these technologies take control of the vehicle totally out of the hands of consumers, the consumers who use any of these technologies will need to have sensible expectations as to what they do. Also, since consumer expectation may be an element of a tort case, realistic expectations will cut down on the potential liability of the ITS product provider.

D. Provision of Warnings

One of the ways in which the producers of these products might defend themselves against unrealistic consumer expectations is by clear and precise warnings.

1. Language of Warnings

The preparation of a written warning should be a joint enterprise between the engineers who design a particular system, lawyers, and someone skilled in writing plain English (not necessarily one of the two professional groups). Clear warnings about a product are perhaps more important with respect to sophisticated AHS/AVCS technologies than they may be with older technologies where consumers already know what they do.

2. Method of Delivery

Modem technology can be used to improve the warning as well as the underlying systems. For example, specific warnings on an electronic screen or voice warnings might be used prior to allowing a consumer to operate a system. The consumer might be required to answer “yes” to questions about knowledge about the system.

E. Screening of Users

To the degree the users of a system are limited to those who are skilled in its operation, the incidence of failure will be cut back. In addition, the provider of the service may be held negligent fewer times, since it did not permit an unskilled person to use the system. While limiting the number of users of a product may run counter to the wishes of the marketing

department, it might be advisable in some circumstances, although such an approach may be criticized as being "naive" or impractical in that it does not reflect how business is done or what consumers might tolerate.

1. *Obtaining of Consents/Waivers*

One way in which users might be screened is by having them execute well-informed consents or waivers prior to using a product. The consent or waiver should make clear that the user understands what the risks are. This would be especially important in the testing stage of a product.

2. Investigation of Users' Background Prior to Use

Some limited screening is already practiced. For example, rental companies screen out drivers who do not have a driver's license. In the right circumstance a provider of a service might limit its availability to only those who have received proper training in its use, or who do not have a record of abusing the product.

3. Getting Signed Representations of Users Prior to Use

A variation on the prior two sections is asking the user to set out facts about his **or** her level of experience and abilities and then relying upon those representations. This would be similar to the securities industry requirement of having an investor make representations about income and investing experience prior to opening an account.

F. Screening of Vehicles

Potentially an automobile could be tested prior to being admitted to an AHS highway. This could add protection against liability but might create some problems with the consumers whose vehicles are excluded.

G. The System as It Relates to Other Aspects of Vehicle Operation

One liability issue which should be given consideration is the "cellular telephone issue." To the extent consumers of these products will still have some responsibilities, the AVCS systems may distract them from otherwise good driving, just as use of car phones purportedly distracts drivers. In the end, the primary answer to this will be good design of the products.

H. Continued Consumer Responsibility in AHS

Although AHS would ultimately take over all aspects of a vehicle's operation, consumers would be left with the obligation of maintenance, possibly a weak point in the system.

I. Security Issues

In a fully automated AHS system, the operators will face security issues similar to airlines. If they act negligently in protecting their system, there would be large liability because of the number of people who would be in an accident.

J. Special Issues of Convoying

Some proposals pertaining to convoying shift responsibility of the convoy not to mechanical means totally; rather the lead convoy driver may have some control. Depending on what that driver controls, there may be difficult liability issues.

Analogs & Trends In Other Industries

Joint Workshop on Liability Issues
NAHSC - ITS-America - ASHTO
John W. Bagby - Penn State Univ.

Legal Issues
AHS & AVCS

ITS Deployment Challenges

- Technical Factors are Resolving
- Institutional Factors Still Predominate
- Is Liability a Barrier to ITS Innovation?
- Other Barriers:
  - Procurement
  - Inseparable sub-systems

Legal Issues
AHS & AVCS

Tort & Product Liability Litigation Crisis

- Casualty Insurance Availability
  - 1980s Destructive Price Competition
  - Collusion Alleged
  - Highly Effective Publicity Campaign
- Refine the Proof of Scientific Facts
  - Litigation *US v Daubert* (reasonable basis In scientific evidence required)
  - Regulation: regulatory reforms
  - Legislation only political controls

Legal Issues
AHS & AVCS

Targeted Methods to Reduce Liability Risks

- Safety & Environmental Regulations
- Contractual & Negotiated Disclaimers
  - Automobile & system purchase
  - Subscription to services
  - Suppliers & subcontractors
- Federal Preemption
- Specific Liability Waivers, Exceptions, Exemptions & Limitations

Legal Issues AHS & AVCS

Specific Liability Waivers, Exceptions, Exemptions Indemnifications or Limitations

- Swine Flu Act
  - * Federal liability substituted for drug mfg
- Statutes of Repose
  - * General products liability - 10 to 15 yr.
  - * Gen Aviation Revitalization Act '94 - 18 yr.
- Warsaw Conv (aircrash liability limit)
- Price-Anderson (nuclear pwr limit)
- Jones Act (expands maritime remedy)

Airbag Regulations

Manual Passenger Airbag Cutoff Switch

* 60 FR 27233 (6/22/95. insufficient rear seat)

Less Aggressive Inflation

* 49 CFR Part 571

NHTSA's 3d Report to Congress-12/96

Nat'l Automotive Occupant Protection Campaign

- Smart Airbag Workshop

Legal Issues AHS & AVCS

ITS Legal Issues

Airbag Liability Exemption

- Cutoffs, Depowering, Postponement
  - * NHTSA regs protect manufacturers?
- Airbag Deactivation
  - * Do regs protect vehicle repairers & mfgs?
- Effective Liability Exemptions?
  - * Strict construction: statute or reg not broadened beyond regulatory liability exemption
  - • Logically implies liability exemption

Legal Issues AHS & AVCS

Mandatory Risk Pooling/ Spreading Techniques

- Workers Compensation
- Unemployment Compensation
- Federal Flood Insurance
  - * Subsidized premiums
  - * Non-market solutions
- Assigned Risk Pools

Legal Issues AHS & AVCS

General Methods to Reduce Liability Risk

- Tort Reforms
  - * Damage caps, joint & several. structured settlements. collateral source. sanctions
  - * Health care industry success
- Product Liability Reforms
  - * Tort reforms, freeze theory development, repose. state-of-the-art. federal uniformity.
- Premises Liability vs. Product Liability
- Setbacks to Reform

Legal Issues AHS & AVCS

Traditional Civil Engineering Conservatism

- Redundancy of Safety & Failsafes
- Exhaustive Testing
- Certification for Permanent Deployment
- Demonstration Projects
- Affords Time to Assess Sources & Costs of Risks
- The "Onion" Layers of Liability

Balancing Innovation Incentive with Optimal Responsibility

- States Rights
  - 50 separate laboratories-experimentatron
  - Public policy attuned to local needs
- Justifications for Federal Preemption
  - Interstate commerce
  - Uniform standards necessary
  - Uniform interoperability critical
  - Simultaneous multi-state deployment envisioned

Lessons from Other Industries

- Crisis Preceeds Major Reforms
  - Can ITS community convince public & policy makers that needs are crisis-level
- Lessons from Federalism
  - Will inconsistency be perceived between deployment by regional experimentation & an "Imperative' for national uniformity
- Demand Pull vs. Cost Push

Nominal Group Technique

The five steps in the Nominal Group Technique are undertaken sequentially by the group in order to extract ideas from group members and organize them to represent a group consensus response to focus questions.

Step 1: Silent generation of ideas in writing

Group members reflected on the focus questions silently and independently, writing each response that came to mind on Post-It notes. The color of the notepad indicated the interest group represented by that participant (Red = NAHSC; Blue = Departments of Transportation: Green = Insurance and Attorneys; Brown = Product Manufacturers; Light Brown = Other). The benefits of this step are:

- adequate time for thinking and reflecting on the issues/questions posed
- social facilitation (e.g., constructive tension created by observing other group members working hard)
- avoidance of
    - interruptions
    - competition, status, and conformity pressures
    - pressure to choose ideas prematurely
- sufficient time for search and recall

Step 2: Round robin recording of ideas

Working around the table, each member of the group selected his/her best response to the focus question(s) from the collection of responses. These were placed in order on a flip chart that was visible to the entire group. Participants were free to discard any of their own responses that they felt were redundant with a response already given, or to present it with a different perspective. The process continue around the table as many times as needed to elicit all possible responses to focus question(s) under consideration. There is general agreement among scholars that the sharing of all ideas and equalization of participation increases group creativity. The rather mechanical format of going to each member in turn to elicit ideas establishes an imponant behavior pattern. The benefits from round-robin recording include:

- equal participation in the presenration of ideas
- separation of ideas from personalities
- increase in the ability to deal with a larger number of ideas
- tolerance of conflicting ideas
- encouragement of hitchhiking, or the stimulation of one idea from another that has been presented

Step 3: Serial discussion for clarification

In this step each idea on the flip chart was offered to the group for a short explanation or clarification. The central objective of this step was to clarify, not to win arguments. No responses were taken out of consideration during this step. Instead, the brief words or phrases on the flip chart were discussed for meaning and understanding in preparation for the next step. The benefits of this step include:

- avoidance of focusing unduly on any particular idea or subset of ideas
- opportunity for clarification and reduction of misunderstandings
- recording of differences of opinion without argumentation

Step 4: Serial discussion for evaluation

During this step, the group leader facilitated a sequential group discussion of each response, focusing on the articulation of advantages and disadvantages of each response. The discussion included observations, statements of agreement or disagreement, and any other relevant analysis of the identified response, but is not an opportunity to win arguments. At this stage of the process, the group had the oppormnity to:

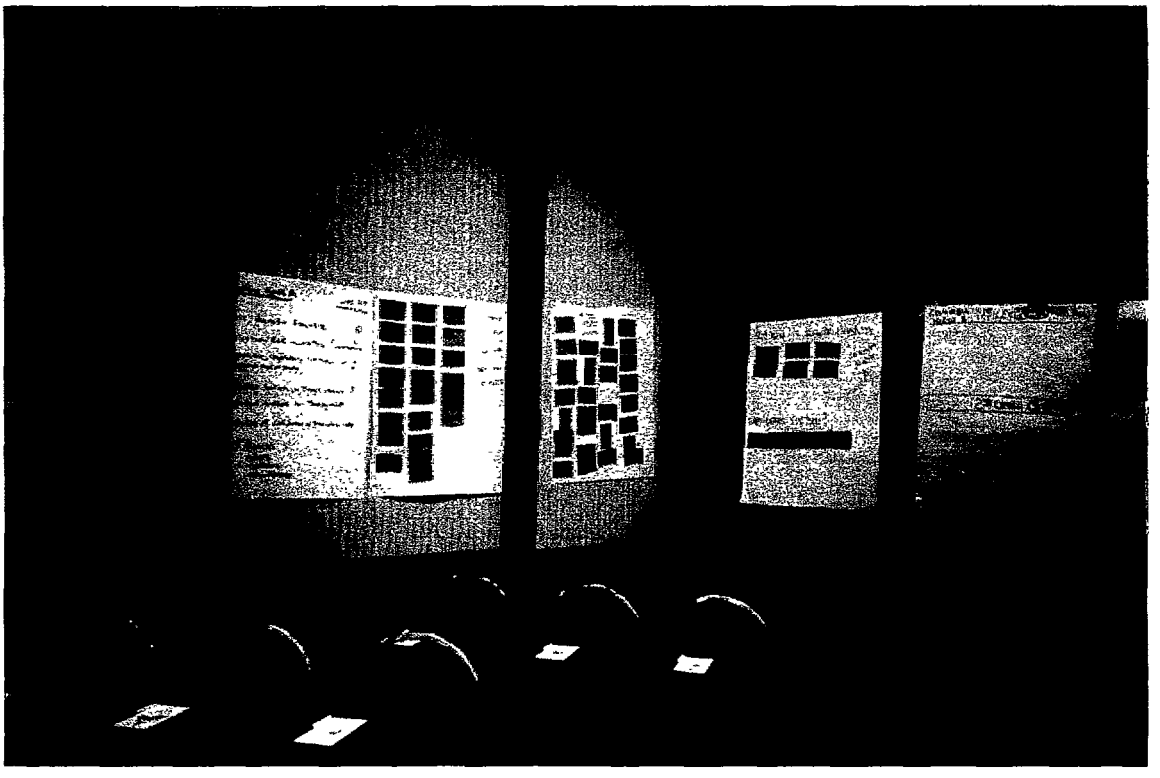
- discuss the logic behind the ideas
- discuss the pros and cons of a particular idea
- air disagreements and differences of opinion
- discuss the feasibility of each idea

Step 5: Preliminary vote on relative item importance

Most nominal-group-technique based meetings will generate many ideas during their idea-generation phase. Through serial discussion, group members come to understand the meaning of each idea, the logic behind it. and arguments both for and against the particular idea. By voting, the groupsaggregated the judgments of individual members in order to determine the relative importance of individual items.

This workshop used NGT in three breakout sessions in which participants were asked to identify and prioritize the key issues, perspectives, conflicts. and recommendations for a particular set of focus questions. Groups in the first breakout session contained participants with similar interests and perspectives. For the second and third breakout sessions. participants were re-organized so that possibly diverse and conflicting mterestsiperspectives were represented in each group. Participants' remarks were identified by interest group via color coded notepads.

Detailed Breakout Group Notes



Session 1: Interest Group Issues Clarification

EDUCATION

Historical Perspective. (I.E. Air Bags) of Advanced Technology Liability

How to deal with the consumer misunderstanding (airbag is supplement, belt necessary) (using ABS, stopping distance increases) [PR Campaign/Dealer]

Demo Showcase Aug 97

Having a report dealing with these issues available to the public.

Education & Certification
- of drivers who use AHS
- vehicles and systems to reduce liability

TECHNOLOGICAL

Human Technology Interface

Maintenance

Warning: (Timing - when
{Methods - how - (beep, lamp)

how extent: (Standardization
{Customization

Want to think about intervene or overtake the system by driver. Driver tend to avoid critical situation.

How will quality control be assured for vehicle conversions (non-OEM) to AHS Technology? What liability questions are raised?

LEGAL RESPONSIBILITY

Liability for product manufacture/design despite compliance with any established standards

Public/Jurors perception of Responsibility and Liability
- Driver of vehicle
- Vehicle manufacturer

What new liability issues are raised in terms of plaintiff demonstration of defect and defense of products, e.g. was system functioning properly at time of crash?

Do liability concerns counsel against private “ownership” of AHS lanes?

What new requirements will or should be added for:
- System warranty and life of warranty
- System maintenance requirements....owner obligations
- System diagnostics and failure warnings?

MANUFACTURERS, Wednesday a.m. Session

May not have most qualified people designing system, but plaintiffs experts will have no problem explaining defect.

Accident occurs because of less attention of driver. Who has the responsibility? Driver or manufacturer?

What new liability issues are added when considering the responsibilities of vehicle systems and manufacturers to consider all conceivable uses of products, e.g. avoiding things falling off trucks, large animals, etc.?

Torts/Damages
Disincentive for Corporate Participation

Will the car manufacturer be ultimately liable for the malfunction of a product in their car or will that fall on the product manufacturers shoulders?

How do you address the cost of liability in the price of the product?

If chain reaction of vehicle-to-vehicle communication causes crashes, who is responsible?

Availability/Adequacy of insurance

Unrealistic consumer expectations will make product liability defense very difficult (impossible)

Financial liability from Fed/State/Local Government standpoint in regard to level of funding and ultimate responsibility

Joint & several liability; Liability over; Indemnification by Contract (Suppliers & OEM's)

The use of consent forms or damage waivers to use AHSIAVCS-equipped roads & vehicles

Junk Science used by Plaintiffs Bar/Experts

How do you address liability costing without increasing the problem?

When new technologies are considered failure to employ something can be used against defendants.

(Among Manufacturers)
Liability for infringement of intellectual property rights

How do you address 50+ different (any changing) legal and state road specifications?

PRE-EMPTION

Is it possible to enact potential protections for vehicle manufacturers including detailed government mandated design requirements plus clear preemption and national evidence exclusion rules prohibiting introduction of evidence of design improvements and preempting State evidence rules. Nothing can overcome juror's changing perceptions of responsibility.

Is heavy federal standardization of AHS a good idea? (e.g. design specs.)
Rapid and extreme safety design advances in vehicles will generate more law suits and liability findings regarding vehicles without those advances. All non-automated and non-state-of-the-art vehicles will be alleged to be detective.

Liability limiting by legislation or regulation, federal occupation of field.

Federal standards min/safe harbor

Federal requirement to record crash data

(Fear of liability):

- Potential manufacturers will see potential liability costs as Bar to entering business

(AHS development process):

- Are there stages pre-AHS that pose unacceptable liability risks (e.g. partial automation, ambiguous driver roles)

(Liability by AHS characteristics):

- What is difference in liability exposure based on distribution of intelligence (autonomous, cooperative, infrastructure-based, etc.).
  - Does deployment in dedicated lane or mixed traffic present greater liability risks to participants?

(Stages of liability by sector):

- How to transition from personal to systematic liability
- Proportion of liability among parties

STANDARDS - VERIFICATION/TESTING

How can auto industry assure that vehicles will not have to be built differently for different liability rules across the country?

How to check-in and certify vehicles?
- health and condition
- things strapped on

Different vehicle manufacturers will develop proprietary hardware and software, which will evolve over time. Who will be responsible (liable) for verifying downwards/sideways compatibility?

What effect will performance standards have on auto manufacturer liability?

and highly stressing situations that can't be predicted. What is the limit of software designers liability?

capabilities must be done for any change made to the functionality of either. This explodes given the number of manufacturers, (and subcontractors) and years/ makes/models on the roadway. Who is responsible (and liable) for this verification?

CONSEQUENCES

Many crashes of a few vehicles (pre AHS) could be replaced by many fewer crashes of a larger number of vehicles/crash (post AHS) -what does this do to liability costs even if total harm is much less?

THREATS

What responsibility (liability) do the system designers and operators bear for sabotage or "hacking" by third parties?

DESIGN LIABILITY (DIFFERENT FROM PRODUCT LIABILITY)

Are designers of AHS strictly liable for any loss resulting from operation of AHS?

HOW TO MITIGATE (FEARS AND) LIABILITY (BY SECTORS)

What level of national benefit needs to be shown for AHS in order to get special legal status (like nuclear, aviation, prescription drugs)? and how do we get it?

Will roadway operators be shielded from suit under sovereign immunity doctrine?

How to bound "provider" liability?

Tort claims limits vary by public entity inviting "joint venture" or "joint enterprise" actions.

Is mixed traffic scenario insurable?

If insurable for drivers, how will insurance be paid for-tolls, fees when buying AHS equipment for autos or separate riders to personal policies or pools?

Are there some essential roles for US government in addressing AHS liability on a national scale?

What is the role - Can AHS specs be developed as Federal Spec subject to doctrine of immunity as are military specifications?

Changing of the rules - How can the auto industry be sure that liability guidelines will be stable for a reasonable time?

Will suppliers of component parts participate in AHS without full indeminification?

Public entity cannot indemnify third party for negligence of that party - nor use public funds for purchase of insurance to benefit third parties.

AHS DEVELOPMENT PROCESS

Are there some intermediate stages toward AHS that pose unacceptable liability risks? (partial automation, ambiguous driver roles). How do we determine that?

How can liability issues for AHS be addressed substantively before the AHS is designed, prototyped and tested? (to be proactive rather than reactive on this issue)

To what level (by what stages) can/should NAHSC address the liability issue so as to keep the AHS development/deployment process on track?

Ability to gain needed operating experience in evolutionary manner
- gain knowledge and experience prior to next development step
- capabilities that work on all roads

LIABILITY VARIATION BY AHS CHARACTERISTICS

What is the difference in liability exposure based on distribution of intelligence? (autonomous, cooperative, infrastructure involved)

Does deployment in dedicated lanes vs mixed-traffic present greater liability risk to participants?

How do different approaches to AHS obstacle management affect liability exposure?

Who is liable in intra-platoon collisions
- caused by equipment failure
- caused by technical implementations by differences between manufacturers' model year
- caused by human intervention

What is the effect of different degrees of driver responsibility on AHS liability exposure?

Limit liability for operation on non-designated lanes?

NAHSC LIABILITY

What will be liability of NAHSC core members in a developed AHS?

In addition to this session what else can NAHSC do to allay fears/concerns and address liability hurdles during the next five years?

STAGES OF LIABILITY BY SECTOFUSTAKEHOLDER

Can the NAHSC/DOTS.... be held liable for limiting deployment to a few select locations?

Concern Re:
Ability to develop full-proof systems - with adequate safeguards for all (not just anticipated) operating and failure conditions

Does check-in imply vehicle safety, (will not drop loads, mufflers, etc.)

Will liability remain the same for rear-end collisions in mixed traffic?
(If lead automated vehicles can avoid by sending 'break' warnings or shifting lanes, does this become a new requirement for due care?)

Auto manufacturer responsibility limits - - can we determine the extent of our exposure given a system design?

How to transition from personal to systemic liability

Proportion of liability among parties

FEAR OF LIABILITY BY SECTOR

Potential manufacturers of AHS equipment and vehicles will see potential liability costs as a bar to a viable business case - and not enter the business.

Limited ability of public entities to acquire/install "state of the art" infrastructure as it becomes available, i.e. funding, procurement.

Will liability concerns be AHS show stopper?

Fear that State and local DOT/s will not be willing or able to accept the maintenance and operations liability risk - and therefore not deploy AHS.

Fear of perceived liability costs sufficient to halt research funding.

Fear that government will regulate so firmly that business cannot predict profitability

Fear:
- early picture
- benefit proven
- problem re: safety (major happening)

Fear that international differences (re: liability) will fragment a global success story in ITS.

Will privacy issues create additional liability?

OWNERSHIPS

Liability for
- Personal injury
- property damage

due to failure of technology

System ownership and maintenance

Try to follow existing State laws with some modification

Potential liability crashes resulting from conflict of different traffic control messages describing the same highway conditions. (example) (in-vehicle vs changeable messages.).

Providing qualified system support (infracstructure)

Liability shifts

Will states have liability for non-infrastructure applications of AVCS?
Example: ICC

What are liability issues for advanced traffic control devices (in-vehicle vs out on the roadway).

Does the state have a responsibility to increase driver training?

Training
- users
- managers

Equipment modification
- Criminal
- Hot rod

System mod-hacker

Intervention
- third party
  - negligent
  - intentional
- "Acts of God"
  - weather
  - animals, wild & domestic, etc.

Control Issues
- Federal - participation
- State - local

Can existing body of law satisfy concerns with regard to liability? "policy"

Obligation to provide the technology - as a safety item and a reasonable system

CONTROL/OPERATIONS

Partial implementation due to finance short falls

Identification of system capabilities and benefits (Do these systems work as advertised in the real world?)

Privatize AHS until states feel that they can handle the system.

Impaired driver impact
- medical
  - sudden
  - long-term
- alcohol
- drugs

Potential liability to highway agencies from secondary or expanded traffic control (warning; regulatory or guide) messages over and above the standard traffic control device message allowed by new technology.

Development of Regulations/standards for AHS/AVCS technologies

Then it may be an issue of speed vs quality of system

How can one quantify the liability from a particular project?

Dealing with losses - committee approach

Lack of communication between states of the experience re liability -- increased communication would allow states to benefit from other states experiences.

Determine exposure and set up mechanics to investigate incidents -what, why how to avoid repeat exposure

Excessively litigious culture will encourage lawsuits against ITS products.

Privacy of personal information

Information
- distribution authority -who?

OWNERSHIP - DESIGN/STANDARDS - IMPLEMENTATION - CONTROL OPERATIONS

Total privatization
Staged/partial implementation

Authority/control?
Training/education

TCD integration (old-new)

Development of standards

Define or limit owner responsibility arising out of AHS/AVCS Implementation and failure/adequacy of existing law

Runners-up:
- Impaired driver; outside factors; tampering
- Experience sharing
- Privacy vs public
- State liability for AVCS (in-vehicle)

INSURANCE

Standards - Products

Standards - Legal

Tort Reform Strategies

Risk Allocation

Insurance and Risk Management

Other

INSURANCE AND RISK MANAGEMENT

What strategy is recommended for assessing insurance needs?
- For demo
- For long-term

What mitigation strategies are applicable to risks being identified?

What additional insurance will companies have to implement? What will current policies cover?

Quantify how much insurance coverage and what type of insurance are required for demo.

STANDARDS (PRODUCTS)

Lack of standards because of newness

Who will set the standards for implementation of the technology?

State of the art - how handled by industry, by government?

NHTSA Regulation - How technology drives" performance regulations"
- later leading to unacceptable risks, i.e. airbags

STANDARDS - LIABILITY.

Increased immunities

Any Federal pronouncements, regulation or directives indicating degree to which companies should be held liable? If not, what regulations could we expect and from which agency?

Malfunction theory or need for technological recording systems if accident occurs.

Existing State Law Overlay
- how does ITS impact current evidentiary bars, i.e. DOT/belt use/etc.
- sovereign immunity

Is there a model of a similar liability problem in the history of law?
Yes, workplace injury solution - workers comp law and no-fault insurance

Warnings/Advertising
- should there be a standard
- should drivers have to accept risk each time they opt into system?

Risk/Benefit
- If state or federal government accepts the risk of injury/death, what does that mean to manufacturers and insureds?

Buggy whip Improvements?

- The problems of ITS are no different than the entire problem of law in America. It is the system of law which must be modified.

No uniformity in liability standards and subject to state law and statute of 50 individual states.

Private/Public participation on technology rollout and various defense that can be enjoyed by government partner but not by private partner.

Unlimited statute of liability outlasting products intended use.

After market alteration might cause liability to OEM

Doctrine of joint and severally liability where one party might be required for all compensation to injured party.

Loss of safety performance standards and does this help or hinder defense

Usefulness and feasibility of promulgation of standards by NHTSA that would limit liability for manufacturers or operators of vehicle control technology (requires act of Congress)

- At this point, is the private sector the main source of this technology? Can we expect the federal government to develop their own systems? If so, how much burden (legally) will they take?

TORT REFORM STRATEGIES

Usefulness and feasibility of caps to liability for vehicle control technology

Usefulness and feasibility of a compensation pool for injuries (similar to workers comp)

Is the current legal framework sufficient to balance compensation to injured parties with the need to deploy?

Problem of making changes in liability law without having to take on all of the vested interests in the existing tort industry.

What can a small private firm place in a contract to free itself? Belt as much as possible from liability?

- Contractors/subcontractors

RISK ALLOCATION

Liability of Consortium vs. Individual Corporation and Associates (demo specific but AHS in general)

- Introduction into mainstream prior to sufficient testing

What is the best system of financing the liability? ITS, toll system/mile. (The best way to finance liability is to spread it over the consumers by a per mile charge on a toll road or using intelligent transportation technology.)

- Manufacturer/supplier risk/indemnity agreements
- Shift in liability?

Will there be absolute liability for manufacturers who resist or delay implementation of technology? (increased cost of auto)

Will there be liability for municipalities who resist implementation of the technology because of cost concerns? (What is the indemnity?)

OTHER

Where will the experts come from?

Are there currently any states or municipalities that have plans to implement an ITS system?

Lack of mandated alternative dispute resolution putting one defendant against another

Summary:

- Cost/Benefit Analysis
- Voluntary Risk allocation (contractual)
- Legislative, regulatory limitation of respective risk of party
- Potential conflicts in design standards
- Potential conflicts in deployment
- Protection of confidential or proprietary info
- AHS access
  - Users
  - Operators
  - Maintenance

IDENTIFY CONFLICTS

DOTs	Shared or mixed liability when unable to isolate operative cause of loss – mobile/fixed systems – hardware/software – software/software - comm failure between (incomplete in original note)
DOTs	Shared resource allocation post loss
DOTs	Deployment Schedule (rush to get technology deployed vs.potential liability issues)
Insurance	Manufacturing vs Insurance – mistakes strict liability for manufacturers vs negligence issues for insurers and "people" mistakes
Manufacturers	Is federal standardization a disadvantage for any group?
Manufacturers	Every interest group wants the other parties to have or solve the liability issues of AHS
Manufacturers	To the extent that sovereign immunity can diminish liability, can and should it be extended to all aspects of the system?
DOTs	Potential conflict: Standards between manufacturers and DOT's
NAHSC	Insurance concerns for lack of existing legal standards will not help manufacturers concern that potential liability costs will deter/bar participation in AHS
DOTs	Patent Issues
Insurance	DOT vs Manufacturer – should be no conflicts if automation on both sides of equation – unless too much passed to manufacturer who is, therefore, reluctant to produce
DOTs	PUBLIC/FEDERAL/STATE Government's vs. Public's responsibility for training/being trained users
DOTs	PRIVATE VS. PUBLIC OWNERSHIP

DOTs	Philosophical Approach to Technology – Safety vs. Convenience Devices (implications for user expectations and liability when problems result)
NAHSC	Need for (quick) legislative response to questions about liability/risk shifting among/between participants and expanding immunity
Manufacturers	Minimization of liability/limit liability No interest group wants to bear the cost of establishing AHS technologies
DOTs	Who will be responsible for developing standards?
DOTs	Standards – who sets them – how are they set – how extensive should they be
NAHSC	Risk allocation in “gray areas” of operation, e.g. during check-in inspection
DOTs	Prioritization: – NAHSC: Priority to see program through – Insurance: Priority = Risk Management – Government: Costs, Funding & Public Good/Safety
DOTs	Funding is a big issue. Public agencies do not have money unless Congress appropriates it.
DOTs	Conflict: – Potential costs from liability will bar SHS implementation – Federal Government is mandated to implement AHS

CONFLICTS

Insurance	The connection between government regulation and insurance rates, schedules
Insurance	Conflict #1 - each individual vs. group
DOTs	Manufacturing companies may be both developers and - through operational tests - evaluators of these systems.
DOTs	Research agencies conducting operational tests of AVCS systems may not fully disclose elements of test to other operational test participants, due to their incentive to publish results, be first with results.
NAHSC	National goal of increased safety and efficiency of highways without requisite tort reform may be a conflict
Manufacturers	Forcing the driver to accept some risk
Insurance	Industry/Agency desire for avoidance of liability cost vs. the injured need for compensation.
Insurance	People vs. Government
NAHSC	AHS benefit of greater safety may reduce insurance rates for individuals due to fewer accidents.
Manufacturers	Agreeing upon acceptable risks - Who performs the risk analysis for providing system safety? NHTSA, FHWA, safety groups, manufacturers, etc.
Insurance	Industry need for profitability and affordability of products vs. safety interest groups demand for guarantees against all loss and to punish for any mishap
Manufacturers	Driver cannot accept the function of system. Bad “Human/Technology Interface
Insurance	Safety/Security vs. Cost
NAHSC	Constructors and designers of infrastructure may be at greater risk because of lack of standards (AASHTO) due to newness
Manufacturers	System Financing & Ownership – Who pays? – Who operates? – Who maintains?
Insurance	Concern for liability risk of new technology vs. liability for not installing new safety features.
NAHSC	Developers of technology, manufacturers vs ultimate owners/operators/maintainers of system.
Manufacturers	Drivers cannot understand the limitation of the new system.

NAHSC	Mixed flow vs dedicated lane - should you crawl before you walk?
Manufacturers	Equal treatment of all system users.... Only the rich have AHS vehicles?
Insurance	Engineers' use of volunteer standards as a guide to good design vs. lawyers use as a floor for practice
NAHSC	Getting the system designed vs. issues of future liability may be conflict
Insurance	Benefit to society of elimination of accident types vs. injury to individuals caused by technology.
Insurance	Public's perverse ability to use a product in a way not intended it its design.
Insurance	Desire in selling to extoll benefits and ease of use vs lawyers' need to warn
Insurance	ITS Industry (reform) vs. Tort Industry (status quo)
Insurance	Industry need for predictability in costs vs. plaintiffs bar creativity re new doctrines for recovery.
Insurance	Public agency desire for private contractor covering risk vs private sector seeking sovereign immunity shield.
NAHSC	Wanting benefits but wanting others to take the risk
DOTs	Driver wants to use the system but also wants to be protected in use of the system

SOCIAL BENEFITS VS HIGHER LIABILITY

NAHSC	Greatest concern: How suppliers of AVCS and AHS can quantify the degree of additional exposure. Automated systems and vehicles may drastically increase total liability due to elimination of tort defense of contributory/comparative fault and due to increased number of suits related to non state of the art roadways and vehicles.
NAHSC	Overall social benefits might be highest where liability problems are highest - how do we get past the liability "hurdle" to gain those benefits?
Insurance	Will limiting liability on manufacturers reduce incentives to design and manufacture a safe vehicle (i.e. 100 injuries/l 00,000 vs. 10 injuries/l OO,OOO)?
NAHSC	Greatest Liability Benefit from AHS: The opportunity to form alliances to mitigate, but especially spread the risk.
Insurance	Will limiting liability increase competition by encouraging more firms to enter the marketplace? Do major corporations have an interest in not reducing liability to that level?

WHO LEADS SYSTEM DEVELOPMENT

DOTs	Is no participation by State DOT a show stopper?
DOTs	Who is responsible to develop the system?
DOTs	Sharing technologies - do private developers share with competition for the sake of public good?
DOTs	‘Government” wants industry to develop, Industry wants to avoid or limit risk/liability to do so.

WHO PAYS?

NAHSC	Infrastructure and vehicle groups each want to avoid more liability and shift it to each other. How do we find "optimal" balance?
DOTs	Assuming that the state/government entity needs to officially install and provide infrastructure then who will be responsible when it fails.
Manufacturers	Poor road maintenance causes system damage in vehicle sensors. Result = crash! Who defines level of maintenance and strength of sensor?
Manufacturers	How can product be identified so there is equitable distribution of liability? – Vehicle? – Roadway? – Intelligence?
Manufacturers	Government must give manufacturer preempton to induce development of systems and vehicle.
Insurance	Conflict between ultimate user and manufacturer. Consumer wants right to sue even though minimum standard met by manufacturer. Manufacturer wants immunity once it reaches minimum standard

SHIFTING LEGAL STATUS

Manufacturers	Selling the AHS vs. Real Work Vehicle crash caused by AHS system failure (out of position occupant) - crash worthiness.
NAHSC	The need to show progress early and often to secure Federal research funds make intermediate stages almost inevitable. Where does liability lie in the intermediate stop?
NAHSC	There is a savings in liability due to reduced human error. How can operators use this savings to cover new liability? Same for manufacturers.
Manufacturers	Agencies view of "liability" vs other parties' view

STANDARDIZATION

DOTs	Common definition of AHS
Manufacturers	Need training and education for system operators and users, but lack standards and also back user acceptance of more government regulation.
NAHSC	Compliance with standards, especially performance standards, is difficult, expensive, and time consuming. Making it federal does not make the standard infallible or complete.
NAHSC	How do we find appropriate level of specificity in standardization -to provide protection but not stifle innovation and progress?

NAHSC	How do we optimize overall system, rather than individual elements of concern to one group or another.

EQUITY

Insurance	If standards are promulgated, will the public be adequately represented in the existing instiiutional framework?
Insurance	Regional costs for implementing maintenance may create liability for those underfunded/financially strapped municipalities and safer roads for the more affluent roadways
Insurance	Given the level of investment, what percentage of the public can effectively take advantage of AHS? or directly benefit from AHS?

Summary:
- Consumer;
  - *Needs protection*
- Provider: (engineers, manufacturers, sub-contractors, operators)
  - *Manufacturers don't want responsibilities*
- Regulator:
  - *Caught in the middle - responsibility to both and short of funds*

Are those receiving benefits those assuming risks?

Chicken/egg:

Can't allocate liability w/o system definition

Consumer	Provider
• *Needs protection*	• *Doesn't want responsibility*

Regulator
- *Caught in the middle*

BENEFITS

Increased information/data makes liability assignment more clear (info is good) (accident causation)

Can Use Evidence

Collaboration between entries for sharing risk. (Contractual = clear definition) Risk mitigated more easily because more easily defined

Incrementalism --> digestion. (avoids indigestion)

More uniform transportation system inherently contains less potential liability
- reduced accidents
- less trauma
- less environmental impact
- Increased productivity Increased benefits mitigates effects of increased liability.

Evidence Data

DOTs In terms of legal liability, the aspect of AHS which will be a benefit will be a permanent record of the highway traffic operations

Insurance Easier to identify responsibility for accidents - traffic management vs product manufacturer - Human error = traffic management company

DOTs	The cooperative nature of AHS allows for greater review of systems and sharing of valuable information
	Defined Risk Allocation
DOTs	A well defined AHS architecture may help define risk allocation
Insurance	Opportunity to manage risk allocation
DOTs	The simplified nature of AHS, i.e. not having consumers as involved, ought to make the calculation of risk easier
	Efficiency
Insurance	Liability protection could be structured to reduce redundancy
NAHSC	Why tilt at windmills? Benefit = incremental evolution of responsibilities for transportation service burdens - as technology is introduced = deal with it! Business as usual!
	Non-Liability
Manufacturers	(Long drive on AHS) - Private compartment - no need to wait at airports or stations NAHSC Benefit = sustainable transportation (through control of transportation resources)
Manufacturers	Convenience - Release from Burden vs. inattention.
	Reduction of Accidents
Manufacturers	Will AHS reduce some areas of driver discretion, and therefore room for error?
DOTs	For AHS - Control leaves hands of consumer - accidents can be avoided - total liability for the system is lower
NAHSC	Reduced number of accidents makes those cases which do go to court more substantive
Manufacturers	Uniform driving condition will be achieved by AHS: easily regulated
Insurance	Benefit: outreach program reducing those 75% of accidents now caused by driver error

STANDARDS

Manufacturers	How to optimize warning level for each individual?
DOTs	Will federal regulations insulate from liability - standards/regulations
Insurance	Conflicting standards and preemption issues - state vs. federal
Manufacturers	Retreat from federalism - national uniform standards

ALLOCATION OF RESOURCES

NAHSC	MDOs/DOTs may be equally liable for not implementing as they may be for implementing AHS/ITS features
DOTs	Does state have liability for accidents on non-AHS roads because people can't afford to drive an AHS car?
NAHSC	New Institutions/Authorities - political football - local/state/federal

RISK ALLOCATION

(Who Pays?)

Manufacturers	Minimize manufacturer exposure: a) Standard compliance as defense b) Federal preemption c) Joint and several liability limitation - plural defendants d) Junk science control.
Manufacturers	Where possible, apportioning responsibility between OEM and product supplier based on design specs and manufacturing of the product.
Manufacturers	Driver/Public Education/Qualification - Driver periodic re-qualification
DOTs	Insurance companies do not like to pay claims. How can we insure that there will be real protection for DOT's and manufacturers down the road?
NAHSC	No system is foolproof. Engineers/designers moving into new domain of personal liability and are being asked to do the impossible.
Insurance	Various liability protection available to government entities not available to private industry
Manufacturers	Liability based upon an unreasonable expectation of the products' function/use/safety by the driver
Insurance	Legal doctrine of joint and severally liability
Insurance	Risk tolerance levels: Particular types of entities unwillingness to accept any risk allocation (wants complete risk transfer)
Manufacturers	Manufacturer's responsibility for drivers' wrong usage - what is "wrong" usage and what's "correct"?
Manufacturers	Responsibility sharing among drivers/owners, vehicle manufactures and system operator
NAHSC	The system designers have an unfair advantage in assigning risk to 'others', (may leave only veto power or refusal to implement) as only option.

ARCHITECTURE/IMPLEMENTATION

DOTs	For specific system, will the intelligence be lodged in the vehicle vs the highway -(Example: Grade security warning system or lane guidance system.)
Manufactures	ACC vs. AHS - Early deployment Sometime system will take over - Driver reserves primary responsibility /shift of responsibility
NAHSC	End state confusing next steps
DOTs	Who has responsibility for the (in-vehicle vs. roadway) uniformity of the traffic control message -the governmental agencies or individual in-vehicle device manufacturer or manufacturers.
Insurance	Who's on 1st? Premature deployment A. Competitors vs. uniformity B. Standards C. Federal
Insurance	Evaluation/certification would be an ongoing process, never quite in full compliance
Insurance	So many people in chain - Indemnification
NAHSC	Why tilt at windmills?
DOTs	How can states politically give greater tort protection to manufacturers in view of the political appeal of protecting consumers?
DOTs	Integration conflict between system suppliers

RISK VS. REWARD

insurance	Risk/Reward (compensation for taking risk). Ratio: reward needs to be sufficient enough to accept risk. Compensation plan.

Consumer - • *Needs protection*	**Provider -** (Engineers, Manufacturers, Subcontractors, Operators) • *Don't want responsibilities*
Regulator - • *Caught in the middle - responsibility to both & short of funds*	

Insurance	Multi-party relationship: developers, manufacturers, designers operators, regulators - all inherit adversity from prior dealings.
NAHSC	Every stateholder group wants/needs to minimize their expose to liability yet system cannot be implemented without one or more groups assuming much of the burden.

STANDARDS

Can't write standards for a new technology, but need to expedite implementation
Premature standards retain innovation

Uniform standards promote technology, but uniformity cannot be obtained w/o retreat from federalism

Staged deployment assists in technical development/market acceptance but creates passive negligence liability

POTENTIAL BUCKET TOPICS

	Players
Manufacturers	Certain user groups (CVO) may not be willing to participate in the "evolutionary" development planning of AVCSS and AHS until their participation early on does not guarantee concept assurity.
Manufacturers	Local cities/jurisdictions that could contain possible AHS/ITS projects may not be willing to "reserve" potential right of way or "restrict" access onto future facilities without assurance from their State DOT or Attorney General that their liability is removed just for planning AHS/ITS.
	Design Attributes
Insurance	Create better result because of fear of liability. More emphasis on quality of technology not just implementation.
Manufacturers	Design system which requires continual driver interaction. Don'tallow driver to become a passenger.
NAHSC	Would liability considerations preclude any otherwise - desirableAHS configurations or deployment steps?
Manufacturers	Apportionment of technology between infrastructure and vehicle may be helpful in distributing and/or minimizing liability.
NAHSC	Do liability considerations significantly favor one or another of the AHS design alternatives?
	Design Process
NAHSC	Is the total liability "burden" directly tied to the expected deaths/injuries/damages associated with use of the AHS? (i.e. should we simply design it to be as safe as we can, by whatever means?)
NAHSC	Civil engineering paradigm - Use the Bechtel/PB model for systems design rather than the aerospace model.
NAHSC	Case Studies. Use current AVCS designs as examples to predict liability exposure. Expand AHS case studies to include enough detail to allow prediction.
NAHSC	**What kind** and level of design analysis and testing do we need to do as part of the AHS development process to enable the lawyers to help us determine the liability burden?
NAHSC	If we need to compare designs that trade off frequency versus severity of crashes, how do we access the relative liability implications?
Manufacturers	Without some prototype models, is it possible to do the necessary risk analysis to define significant liability concerns?
	Speed of Implementation
Manufacturers	Unless liability concerns are reduced, developers may not proceed at fast pace until there is a public demand or crisis situation.

NAHSC — Concern about liability will lead developers to consult with lawyers, delaying product release encouraging warning rather than control devices and delaying by decades full automation.

Insurance — Implementation in foreign market may be first test arena due to domestic paranoia ("America #2").

Manufacturers — How long will DOT/Toll Road Authorities hold up any "spec"/ "design standards" creation until their own liability definition is "guaranteed" by State Attorney General's offices.

Vehicle/component manufactures won't go forward without an assurance states are working toward this.

Aggregate Liability Burden

Manufacturers — Insurers base their premium on experience or history. This is "new" technology with little experience or history to draw from. Insurers will not rush to cover from unknown risk/exposure, What experience they have from air bags, ABS may detract from their participation.

Manufacturers — If liability is a flexible concept, should the design of AHS dictate an acceptable system of liability?

NAHSC — Government Certified Desinns - Immunity to design-related liabilities.

Breadth of implementation

NAHSC — Less risk averse, smaller companies will take the lead, implying smaller deployments are likely rather than national, and less infrastructure intensity at the initial stages.

Manufacturers — Should we first implement two or three statewide systems, work out the bugs and then proceed to implement a national system?

Media Exposure

Insurance — Creates atmosphere of fear/distrust of technology.

Political Support

Manufacturers — Operators may not rush to incorporate AHS without some liability protection.

NAHSC — Liability concern will lead to government installation of infrastructure elements, leading to consideration of equity and more broadly applicable, less capable systems.

Economics

Manufacturers — What are the economic incentives for implementation and deployment? Why would the majority of Americans who rarely drive long distances need AHS?

Manufacturers — What is the impact of AHS on the economy? What is the Costs/benefits analysis?

Insurance	Conference Conclusion: We have no evidence that liability will be a barrier to AUCSIAHS deployment.
Insurance	AVCS/AHS are expected to improve safety, saving lives and reducing injury and property damage. It is therefore a net positive. That is the point that should be made about ITS Control Technology and Liability.
Insurance	Fear of Liability may become a constraint, not because it is a real problem, but because so many people think it could be. We neglect to tone down that rhetoric. (Liability paranoia - a double edged sword)
Insurance	Design the system to yield major safety benefits to the public but as the systems are deployed, assure that arrangements are in place to fairly compensate those that are injured due to malfunction of the technology.
Insurance	Immunity and pre-emption is not warranted until demonstrative costs to society are shown.
Insurance	There is nothing wrong with equitable avoidance of litigation but any attempt to negate litigation is wrong and disastrous. Litigation avoidance is secured by creating and using products in a thoughtful and safe manner. Thoughtful includes considering that people will get injured, and an injured estate must be fairly recompensed. Litigation negation includes such technology as “immunity”, leaving a plaintiffs estate short. THIS IS GENERAL GOOD ADVICE.
NAHSC	There appears to be greater liability risks with mixed traffic than dedicated lanes.
NAHSC	Liability issues differ significantly between infrastructure technologyand vehicle technology. Risk is greater for manufacturer/designer of vehicle systems and owner/operator of vehicle. Risk is less for design/manufacturer of infrastructure improvements and more for owner/operator of highway who is protected by sovereign immunity and/or limited tort liability.
NAHSC	AHS Design include reviews by legal counsel in design reviews as appropriate.
Insurance	Continue outreach efforts to the insurance and safety communities.
NAHSC	Research need: Expand study of state by state tort law to include: - Status and extent of Sovereign Immunity- Tort Claims limits for various public entities Benefit: To aid in evaluation of risk of widespread versus limited deployment.
NAHSC	Protective device records include recording devices in AHS equipped vehicles similar to airlines to insure additional knowledge of the accident.
Insurance	AVCS/AHS should be designed with liability claims in mind; provide a record of what happened with the technology in the event of incidents.
Manufacturers	Government support to install black box for AHS, e.g. reduce tax, reduce insurance rate.

Testing
Drivers and riders contractually bound – no third parties.
Public demos. - obtain rider waivers.

Owners/Operators
May need to form joint venture/enterprises to provide adequate liability protection for prospective plaintiffs and to avoid duplicative defense costs.

Reality versus Perception in Marketing/Public Relations
Think through all safety statements, advertising, etc.

LITIGATION STRATEGIES

Insurance	Get AHS technology to be considered a good or service, and not a product, whereby falling up the legal decline of negligence not strict liability.
Insurance	Mandate arbitration provision in each/every ITS contract.
Insurance	Design must include developing 'expert" groups as triers of fact for litigation defense.
DOTs	Liability problems require the lawyers to sit in on engineering decisions. • Legal trends • Unfavorable ruling • Case study

METHODOLOGY FOR DEPLOYMENT

Manufacturers	Evolutionary Design Liability issues will be gradually resolved as other AVCS technologies are introduced and public acceptance grows.
Insurance	Take a longer time to develop and put into market
Insurance	Design of AHS needs to incorporate campaign for Federal Preemption Crisis of · congestion · no more highway expansion · consequential costs, etc.
Insurance	Design of AHS must include an outreach campaign to insurance industry
NAHSC	Design a system which will provide status of all the subsystems.
NAHSC	Outreach campaign to the ultimate consumer is needed.

BARRIERS TO DEPLOYMENT

DOTs	Liability problems in ITS make negotiation of Indemnity Provisions in contracts more difficult than in other contracts, and a major financial issue for some suppliers of ITS.
DOTs	Liability problems may keep a product with marginal safety issues from the market.
NAHSC	We might not design the ultimate feature of an AHS, ITS and AVCS.
NAHSC	Any AHS design that places more liability on a particular entity than that entity can handle will not succeed.

NAHSC	x>y>z If y depends on x for deployment and x cannot be deployed on its own merits, the entire deployment leg (x,y,z) 'dies'.
Manufacturers	Regulatory design restrictions would limit manufacturer exposure but also limit innovation.
NAHSC	Any AHS design that places too much liability on one entity at the exclusion of other entities, will not succeed. (e.g., we can't force DOTs to take all burden,....)
NAHSC	Any designer/manufacturer/implementer that sells AVCS/AHS products/services must either • make gobs of money to be self-insured • be insurable
DOTs	It will foster a tension between manufacturers of products and operators of the system. The distribution of intelligence is an issue more because of liability than an engineering or cost issue.
Manufacturers	No design freedom discourages manufacturers' motivation.

REQUIREMENTS FOR DEPLOYMENT

DOTs	Influence the design of AHS It will ensure fail safe mechanisms, documentation of operation, adherence to maintenance guidelines

Summary

- Black Box Technology as Event Recorder to Limit Liability Speculation & defense costs while moreaccurately assess fault
- Access Management to limit vehicle and driver AHS conflicts

Insurance	Eliminate speculation/ Eliminate defense costs and Accurate assess fault
DOTs	Development of event/accident recording capability for analysis(deterrnine who did what, when, why, etc.)

ROLE OF DRIVER

Summary

- Less of role (liability based)
- But maintain minimum role to enhance safety
- Certification, training, education, license

Manufacturers	Need to decide at what point driver can "take over" if car/infrastructure malfunctions or vice versa.
DOTs	Minimum role enhances system safety but query transition or emergency responses of inattentive person, perception of potential higher risk at those points.
NAHSC	Minimum participation of driver is preferred for safety concerns. Some participation may be required for emergency situations and perhaps to exit/enter the system.
Insurance	Less of a role > less risk > need to monitor/record Record actions/system status > record both and record any driver overrides.
Insurance	Vehicle separation issue > keyed to driver role > do you want system liable (i.e. low reaction time) or driver liable > what is technical feasibility.
DOTs	There should be a choice by the driver about how much of the AHS they want to use per each trip (100% > 0%).
NAHSC	Use ways to actively affirm driver decision to relinquish control (i.e. affirm knowledge of how system works, willingness to turn over control and warnings) at: • purchase • entry to AHS • (potentially) licensing
Manufacturers	Before triggering AHS or AVCS systems, driver should certify knowledge to systems (which may include waivers and directions, and before entering AHS lanes, system should certify worthiness of vehicle).

Manufacturers	Driver AHS certification.
DOTs	Users of the facility must have training and license test.
Manufacturers	Driver must be aware of technology's abilities and inabilities.

DEPLOYMENT SEQUENCE

Summary

- Physical: urban > suburn > rural
- Legislative: State programs
- But diversity among states is barrier to manufacturers
- Consumer based (education based) incremental
- Engineering based certification

Demonstration/operational test

Share results

Standards)

Insurance	State/Local > more influenced by state law > different technological solutions therefore impediment to manufacturers participation.
DOTs	Urban - suburban - rural sequencing most probable given traffic demands. Issues will be occasional rural driver in urban system - Access limits to restrict liability by licensing or fee permits to fund costs and losses.
DOTs	A lot of operational tests need to be conducted in various parts of the country. • share the results • develop standards • take incremental approach for deployment
NAHSC	Build in: • Certification • Demo Projects • Operational tests in different States • Share results • Develop standards incrementally
NAHSC	Assume no federal exemption from liability.
DOTs	Deployment should be coordinated closely with education and training. Slow and easy best approach.

DISTRIBUTION OF INTELLIGENCE

Summarv:
- Network/spread intelligence
- **Place emphasis on infrastructure**

DOTs	The more networking, the wider the scope of potential defendants but the opportunity exists to also spread defense and judgment or insurance costs.
Manufacturers	Independently increase driver involvement, Increase automatic hazard recognition and control.
NAHSC	Preferred model for communication vehicle to vehicle, with each vehicle in communication with control center. Vehicles also in communication with infrastructure.
Insurance	Laptop > Network Car System Need storage of " deviations" from normal systems function i.e., hard data on crash
DOTs	Loading up the highway system with the intelligence would lessen the liability concerns of the manufacturers.
Manufacturers	To minimize liability, intelligence should be passed through infrastructure systems.
NAHSC	Infrastructure-based reduces product liability therefore places legal responsibility in entity (State) • getting public benefit, and · most capable of responding to State-based cost-push tort reform

DEDICATED LANES

Insurance	Federal/State > dedicated only no questions after the fact.
DOTs	Initially use dedicated lanes, i.e., HOV lanes, HOV ramp meters. Focus on the arterial impacts during the design stage.
Manufacturers	If communications depend on widespread development of roadwide. infrastructure (as liability concerns counsel) deployment should occur in dedicated lanes.
DOTs.	Dedicated lanes for starters. Technology should define when mixing of traffic is appropriate.
DOTs	There is enhanced safety in dedicated lane system in both start up and evolving AHS systems (deployment sequency).

VEHICLE SEPARATION

Summarv:
- Separation by appropriate sensor and control system
- Dedicated lanes by vehicle classification
- Rehab crash absorbing systems

DOTs — Limit Access to AHS
Examples:
- Vehicles with exposed/loose-cargo not allowed (obstacle
- Drivers of necessary skills (a licensing procedure may be needed).

DOTs — Allowing vehicles to operate as separate as is feasible provides that sense of freedom most drivers want. May reduce liability risk to AHS.

Manufacturers — Sensor systems for automated separation crash absorbing buffer systems.

DOTs — Commercial med/light duty (time)
- Heavy-long haul (lane &time)
- AHS dedicated lanes (time)

All issues affect liability distribution of risk and amount of risk.

DOTs — Manual override of AHS is good, however, information must be communicated to the following drivers (i.e., drivers behind the vehicle with manual override).

DOTs — Try the concept using cars only, then extend it to other types of vehicles.

OBSTACLE MANAGEMENT

Summary:
- Automatic detection system responsible to type of obstacle and weather conditions
- Disfunction between role of driver and system operator.
- Removal of Disabled Vehicle
  - Intrusion from person going from stalled vehicle in manual lane
  - Weather-responsive (fog, ice). Algorithm to control speed for entire highway

NAHSC — Sophisticated detection system responsive to type of obstacles and weather conditions.

DOTs — Providing automated avoidance is a safety benefit that outweighs cost of the feature. Worth the liability risk.

DOTs — Sophistication of obstacle detection system (smoke, dust, fog, moving humans or animal target or wind blown debris vs size of fixed obstacle) will determine confidence levels of risk by parties.

DOTs - Product manufacturers responsible for algorithm performance
- Operating agency is responsible for maintaining obstacle-free facility.

DOTs Don't rely on driver to monitor environment while on AHS.

DOTs Clear distinction between what the driver does and what the automation does.

- Define and communicate driver roles.

OTHER

AHS is coming incrementally with mixed and initial unfixed liability

DOTs **AHS**
Slow & easy is the best approach. Partial deployment over time.

DOTs Distribution of Intelligence - Role of Driver
Concentrate on developing an education - information - publicity program to assure that users will be prepared.

Manufacturers Role of Driver
People are wary of air bags and ABS due to recent problems. Will probably be even more wary of more advanced technologies. Consumer acceptance survey?

DOTs Liability must be shared by both public and private

NAHSC AHS:Proceed
Liability is unavoidable but not a show-stopper. Are there things we can do (e.g. conservative engineering) to reduce risk; rest will fall into place over time as with all new technology.

Consistent National System/Vehicle Design Standards.

NAHSC Dedicated Lane
Active rejection of non-AHS vehicles.

DOTs Ensure consistency of display (control functions/location) cross vehicles so no negative transfer results when drivers change from one vehicle to another (such as when they rent a car).

DOTs System Design
Balance role of driver, control, and system control.

NAHSC Design Issues - Other
Multiple redundancy.

NAHSC National Role

- Standard FHWA (federal)
- AASHTO
- ITS Architecture
- NTCIP

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List of Acronyms

AAMVA	American Association of Motor Vehicle Administrators
AASHTO	American Association of State Highway and Transportation Officials
ABS	Anti-Lock Braking System
AHS	Automated Highway Sys tern
AVCS	Automated Vehicle Control Systems
Caltrans	State of California Department of Transportation
CFR	(United States) Code of Federal Regulations
DOT	(United States) Department of Transportation
FHWA	(US DOT) Federal Highway Administration
GPS	Global Positioning System
HOV	High Occupancy Vehicle (Highway Lane)
ISTEA	Intermodal Surface Transportation Efficiency Act of 1992 (major source of ITS funding)
ITS	Intelligent Transportation Systems
IVHS	Intelligent Vehicle Highway System (precursor to ITS)
NAHSC	National Automated Highway System Consortium
NGT	Nominal Group Technique
NHTSA	National Highway Traffic Safety Administration
PATH	Partners for Advanced Transit and Highways
RFP	Request for Proposal
TexDOT	State of Texas Department of Transportation