

APPENDIX D

APPENDIX D1

ALCOHOL RESEARCH FOR A DISTANT FUTURE

James Hedlund, Ph.D.

Carl E. Nash, Ph.D.

This meeting was called to develop a research agenda for the 1990's on alcohol and other drugs in transportation. To do this we must pass beyond what we'd like to know today. The research conceptualized here may be funded by the mid-1990s, but won't be completed until later in the decade and will have little impact until the 21st century. So we must project into the future: what will the problems of impaired driving and other transportation impairment look like after the year 2000 and what will we need to know to address them?

Lest we think the issues we will face in 10 years are the same as today's, it's useful to recall the major changes that have occurred in the past 10 years. Here are some examples:

- Alcohol-involved traffic fatalities have dropped from 25,170 in 1982 to 19,900 in 1991. The proportion of all traffic fatalities involving alcohol has dropped from 57 percent to 48 percent.
- All states and the District of Columbia now have a minimum drinking age of 21, compared to only 26 states in 1982.
- 47 states and the District of Columbia now have illegal per se laws for alcohol, 43 with a blood-alcohol content (BAC) level of .10 and 5 with .08. In 1982, only 26 states had illegal per se laws: 25 at .10 and one at .13.
- 31 states and the District of Columbia have administrative license revocation laws for drivers who exceed the legal BAC limit. In 1982, only 6 states had these laws.
- 23 states and the District of Columbia have implemented the Drug Evaluation and Classification program, which trains police officers to recognize signs of impairment caused by drugs. In 1982, these techniques were just being developed in Los Angeles.
- Ten years ago, the "drug-free workplace" was only a concept, without widespread acceptance. Today, workplace drug testing is standard and alcohol testing will soon be included.

What is the Problem?

Alcohol and drugs are antithetical to the safe operation of transportation equipment and systems. They impair a person's attention, reaction capability, judgment, and problem-solving capabilities, all of which are critical to the safe operation of a vehicle or control system. The problem involves three components coming together: (1) a *person*, who (2) takes in some *impairing substance*, and who then (3) participates in *transportation* in some manner that has the potential to produce property damage or injury (as a transportation industry employee or as a private citizen operating a motor vehicle or even walking).

Our tools to address safety issues of impairment also fall into three general categories: (1) *laws and their enforcement*, including publicity to encourage compliance with the law, (2) *education* to make people aware of the hazards posed by impairment, and (3) *technology* that can intervene to detect impairment, prevent an impaired person from operating transportation equipment, and compensate for errors made by impaired operators.

Problems with impairment and transportation can occur in both private life (driving automobiles, flying airplanes, or sailing boats) and in the workplace (driving trucks and buses, operating light and heavy rail equipment, piloting airliners, controlling air traffic, navigating ships, and more). Impairment also increases the possibility that pedestrians and passengers will be injured and killed in and around transportation vehicles.

Detection and control of impairment in the transportation industry is far easier than it is for private vehicle drivers. The basic principle of an alcohol- and drug-free workplace already has been established in public opinion, law, and business practice. The principle is enforced through workplace drug and alcohol testing, with failures punished by job-related sanctions. The primary workplace research area is thus quite specific: to develop effective and low-cost methods for drug and alcohol detection and testing. However, since impaired driving—mostly involving alcohol—produces over 90 percent of all transportation casualties involving impairment, that is the focus of these remarks. We also believe that is where the bulk of our research should be concentrated.

Predictable Changes

Let's look at each of the six areas—three problem components and three solution types—in turn.

People

We can estimate the demographic make-up of the population quite accurately for at least the next 20 years. There will be two important changes over this time: our population will be older and it will be more culturally diverse.

The peak of the baby boom generation—now in their early 30's—will be middle aged in 2010. Today's teenagers, who are the trough that followed, will be in their mid-30's by then. Senior citizens will continue to increase in numbers and will drive more miles.

Fatal crashes per capita disproportionately involve males from 15 to 30 years of age and over 70. Women have a similar pattern, but their involvement rates are nearly 60 percent lower than those of men in the critical 15- to 30-year old age range. The good news on alcohol is that the number of younger people will not increase much over the next 20 years, and that drunk driving is much less common among older drivers. On the other hand, older drivers are more likely to use, and perhaps be impaired by, prescription or non-prescription medications. This suggests an increased research focus on medications.

Minority populations will increase faster and be younger than the majority. In the 1990 census, minorities plus people of Hispanic origin were about a quarter of the U.S. population. This proportion is expected to grow by one to two percentage points per decade. Federal household survey statistics indicate that whites have generally higher rates of alcohol and drug use than blacks or Hispanics, but the differences are not substantial. Black males over 30 have moderately higher per capita crash fatality rates than white males, although their crash alcohol involvement is lower.

Measures to address alcohol and drug use in transportation must recognize this increasing diversity. Education, publicity, and even laws and sanctions must be relevant to different population groups. Some implications are obvious: messages in English are irrelevant for people who do not understand English. Others are more subtle: reward and punishment methods may have very different effects on people from different cultures.

Impairing substances

Alcohol consumption per capita has decreased about 10 percent over the past decade. The mix of beverages has also changed: beer and wine make up a larger, and spirits a smaller, portion of the total. Use of other recreational drugs is much more volatile. Different drugs can spring into popularity quickly. A drug can be common in one area of the country and almost unknown in another. Prescription and non-prescription medication use patterns also can change quickly.

It is unlikely (but not unthinkable) that some or all drugs will be legalized in the next two decades or that there will be dramatic changes in the drinking habits of the general population. The most likely prediction is that recreational and medical use of legal and illegal impairing substances will continue at substantial levels. The traffic safety system must be prepared to cope with new impairing substances.

Transportation

We can estimate what the motor vehicle fleet will be like ten years hence. Many new cars to be built in the year 2000 will be on platforms that are now on the drawing board or currently in production. Other changes, such as virtually complete adoption of air bags and anti-lock brakes, are all but certain. Dramatic changes in roadways are unlikely. More traffic on a slowly expanding road network will increase congestion.

Considering only changes in demographics, the number of licensed drivers, and fleet size projections, highway fatalities will increase by the turn of the next century¹. Such projections are not based on increases in vehicle miles travelled (VMT) or fatality rates (per VMT). Historically, increases in VMT have tended to be offset by the fatality rate reduction.

If we consider the implementation of new standards and programs, such as the automatic frontal crash protection and side impact standards, reduced impaired driving, increased restraint use, and highway safety improvements, fatalities are likely to remain at or below their present level of just over 40,000. Of course, this number could fluctuate significantly because of economic or other external factors.

As we go into the 21st century, we anticipate that crash avoidance measures being developed in the Intelligent Vehicle/Highway System (IVHS) program will begin to demonstrate their promise. One might easily imagine that two or three decades from now

¹ Last year, NHTSA completed a study for the Office of Management and Budget that projected annual highway fatalities would be between 47,000 and 49,000 by the year 2000. A more recent extrapolation based on complete 1991 accident data projected year 2000 fatalities would be around 46,000.

new, state-of-the-art car could have sensors to determine its global position, its position within the travel lane, its proximity to other vehicles, and the condition of the driver (alert, impaired, drowsy,...). It could process this information with computer power that exceeds that of the best current personal computer. This car's ability to sense potential hazards and to develop crash avoidance strategies may rival that of its driver. In concert, the car and its driver might improve their crash avoidance capability dramatically, even when the driver is somewhat impaired. Can one imagine that the car itself might help to be the designated driver?

Nevertheless, the fundamental problem of impaired driving will remain unchanged. Vehicles will continue to require a driver to be in active control. Thus the goal is to prevent a person who is impaired by alcohol or other drugs from driving a motor vehicle, or otherwise participating in the transportation industry.

Laws, Enforcement, and Sanctions

Our society believes that we can control behavior through laws, with associated publicity, enforcement, and sanction. We certainly try to do so in transportation, where a wide variety of laws attempts to regulate private citizen and transportation employee behavior. Of course, these laws are balanced against the fundamental individual rights guaranteed in the Constitution, such as due process.

In the past decade the American public and the states have shown themselves willing to regulate more closely in the interest of public safety. Examples include the impaired driving laws cited earlier (BAC limits, administrative license revocation, minimum drinking age) as well as child seat, adult seatbelt, and motorcycle helmet use laws. The courts have upheld these laws. The Supreme Court has ruled that sobriety checkpoints are not an unreasonable violation of individual rights. Thus, there is strong support for laws directed at impaired driving.

Enforcement of these laws, however, is another matter. Police are faced with increasing demands on their services to address what many believe to be more serious societal ills than impaired driving. At the same time, overall police resources are shrinking as state and municipal budgets are squeezed. Court dockets are crowded; jails are full; many prosecutors, judges, and police officers treat impaired driving as a minor but burdensome annoyance instead of a major societal problem. The situation begs for research to identify how police and courts can use their resources more productively. The same issues apply to enforcement of substance-free workplaces: what is the most cost-effective method of drug and alcohol screening to

deter use by workers?

Research also should investigate technological advances that can assist enforcement. Some methods now exist but need to be evaluated, such as NHTSA's Drug Evaluation and Classification program to assist police in detecting impairment due to drugs. Other methods have not been developed such as a fast, cheap, non-intrusive method to detect drug presence in the workplace or at the roadside. Finally, we should explore the public acceptability of various automated enforcement methods. Photo radar and photo red light enforcement are used in other countries but have only limited use in America. Standardized driver's licenses with 'smart card' technology to carry driver identification and records would assist police and courts greatly but may meet opposition from those who fear it would become a national identity card.

Education

Formal and informal public education concerning traffic safety suffer from the same problems as enforcement: other demands are increasing at the same time that funds are decreasing. As an example, many high schools are dropping driver education courses or are charging substantial fees for them. Public information and education must compete with \$800 million per year of very compelling commercial advertising for alcohol and with peer pressures and life style demands, particularly for the attention of young people.

Employers may provide a new avenue for education. Employers are extremely conscious of increased health care costs and seek to reduce these costs. They understand that substance abuse contributes substantially to these costs as well as to workplace inefficiency. Some employers have begun to realize that traffic crashes and injuries, both on and off the job, are also very costly. Through a combination of alcohol and drug awareness activities and employee assistance programs, employers have many avenues to affect their employees.

Technology

New technology is difficult to predict. But some recent developments deserve noting in considering a research agenda. Examples include

- Vehicle interlocks that prevent a car from starting unless the driver's alcohol level falls below a pre-set limit;
- performance tests, now being developed for fitness-for-duty testing in many industries;
- biological markers that can measure whether a person has used alcohol recently.

Unpredictable Changes

What will change in unpredictable ways are things that depend strongly on the beliefs, attitudes and behaviors of large segments of the population, on technological developments, and perhaps on international relations. You need only think about the last ten or twenty years to see how this is so. Personal computers have become extremely powerful, cheap, and ubiquitous at home and at work. More than half the population is wearing safety belts. People are not getting all of their entertainment at home: movie theaters are doing very well despite television, video, and predictions of their demise. Japanese companies are making about a quarter of our new cars, including some of the most interesting. After we wiped out small pox, conquered polio, and got control over bacterial infection, many people thought we were well on the way toward conquering all disease, but AIDS has become a major and uncontrolled threat to public health, and cancer and heart disease remain the major threats to the health of middle-aged and older people.

Strategic planning is a powerful technique for thinking about the future. It's a way of analyzing near-term actions based on their long-range implications; it's *not* a blueprint for actions for the next 10 or 20 years. It would make little sense, for example, to develop better drug recognition techniques if inexpensive, accurate, unobtrusive drug test equipment was soon to become widely available for most common drugs. Strategic planning ideas and tools can be useful in thinking about the future and in avoiding the trap of assuming that the future will look like the present.

Strategic planning addresses the uncertainties of the future by using scenarios: plausible stories about the future that capture the issues keeping us awake at night. If we are looking at the abuse of alcohol and drugs and its consequences, such as impaired driving, we might construct scenarios that will capture future possibilities that are not strictly predictable as extensions of what we know today.

For example, the division of society in which major segments of the population become even more concerned about health and safety might be accentuated. Religion or other belief systems may support this change. These people will drink less and may support more severe sanctions against anti-social acts fueled by impairment. On the job drug and alcohol testing may have a profound impact on demand for both. At the same time, other segments of the population could get more involved in drugs and alcohol and become an increasing threat on the highway.

Advances in the technology of drug making may result in a further expansion of the varieties of drugs

available and a reduction in their cost. Drugs that can be manufactured from more common domestic materials might kill the market for imported cocaine and heroin; but they would bring new problems, such as how to detect driver impairment from them. A drinkable drug alternative to alcohol is not unthinkable.

The distribution and retail marketing of drugs could also evolve, making them more available, less dangerous to buy, and cheaper. This might lead to some degree of actual or *de facto* legalization, or at least to broader drug use.

The kind of research that would make sense in the 90's might be much different depending on which of these scenarios more closely resembles the future. One would like to be able to do the research that would make sense in any reasonably likely scenario.

Scenario Construction

There are a number of approaches to developing scenarios. The simplest is to identify the key issues that will face us and to look at the forces that will drive decisions concerning them. We should be acutely interested in those issues that are very important to us and that have highly unpredictable outcomes. Scenarios are built by considering the effect of different external forces that drive decisions on the issues.

There are more complex ways of developing scenarios that involve analytic techniques for identifying issues, driving forces, and potential developments. It takes hard work, insight, and the involvement of decision leaders to do a good job of scenario building.

To properly use scenarios, we should look for policies or decisions that work well in a variety of the most plausible scenarios. The value of good scenarios is that they give us future conditions against which to test our plans. They also give us indicators of trends as time passes. These trends may point toward one of our scenarios. If so, we can gain further insight from this scenario and adjust our plans to take advantage of it.

To show how this works, here are some ideas about issues that may be critical to impaired driving policies:

- Public attitudes toward alcohol, drugs, and their control may shift further as they have with auto safety and tobacco. Concerns over health, safety, and fitness are likely to continue and to carry over to alcohol and drug use. Changes in values and behavior concerning alcohol and drugs should carry over to impaired driving. It is uncertain, however, whether the message will get through to young males who remain the greatest threat to traffic safety. As we suggested earlier, however, the split within society of views on these issues may strengthen.

- There could be support for more government regulation of alcohol product offerings, advertising, sales outlets, prices. Nevertheless, if the government does make a serious attempt to reduce inappropriate or excessive alcohol consumption, demand and use could increasingly shift to illicit drugs.

- Technological developments may overwhelm attempts to control drugs or may enhance our ability to do so. The technologies of monitoring impairment and of performance testing will give us new tools for licensing, job-related tests, and non-punitive sentencing of drug and alcohol offenders. But technologies can be used to thwart attempts to control impairment in transportation just as radar detectors are used to foil speed enforcement technologies.

- Technological developments may obviate our current impaired driving situation. We could have an antidote (an amethystic agent) that would prepare one to drive home safely after drinking. The technology of the future automobile might significantly facilitate the ability of an impaired driver to drive safely.

- Government control of the growth, import, sale, and use of illicit drugs has been only moderately successful up to the present. The societal and economic costs of drugs and of government programs to control them has been very high. Currently we have a multibillion dollar, unregulated production, importation, and sale of illicit drugs; corruption of police and public officials; extensive drug use by minors; prenatal damage to significant numbers of babies from drugs, not to mention mistreatment of children by parents using alcohol and drugs. A few public leaders such as Baltimore's Mayor Kurt Schmoke have suggested a much wider ranging public debate on our national drug policies. Unfortunately, alcohol and drug policies may be driven by prejudice, politics, and economic interests, rather than by realistic analyses of societal needs.

- Traffic enforcement might continue to be a victim of shrinking police resources and competing demands for them. Safety education for young and novice drivers may be a similar casualty.

- Citizen activist groups such as Mothers Against Drunk Driving (MADD) and Reduce Impaired Driving (RID) may or may not continue effective advocacy of reduced impaired driving and public education on alcohol and traffic safety. Public consciousness of impaired driving may be crowded out by competing health issues such as AIDS, hand guns, and ozone depletion.

Certain forces are likely to continue to drive alcohol and drug issues as they have in the past:

- Economic forces from the very profitable alcohol business will continue to be an important factor in alcohol consumption.

- There are a number of citizens, religious groups, and secular organizations, some of which would like to reduce the availability and use of both alcohol and drugs, and some of which want to have and enforce stronger impaired driving statutes.

- Alcohol supports other industries such as sports, advertising, and broadcasting. The economic well-being of these industries often makes them allies of the alcohol industry in debates on the subject.

- Relations between the U.S. and countries that are major drug growers and producers will affect the supply and price of imported drugs.

Alcohol and Drugs in the 21st Century

There almost certainly will be more choices of mind altering substances in the future. This will present us with a variety of new problems in traffic safety. Detection and control of impaired driving is more difficult with drugs than with alcohol. Thus, it would make sense to study the fundamentals of use and addiction patterns in the general population and look for policies to reduce demand. Our research today needs to take account of the possibility of major growth in the variety of drugs available and their use, and to look for strategies to reduce demand and deal with the consequences of drug use.

Alcohol products, their marketing, and markets will almost certainly evolve further. We already have wine coolers, prepackaged mixed drinks, and more. New types of social activities, such as the rave, will increase the possibilities for impaired driving. If these products and activities are profitable and expand markets rather than simply switching consumers from one product or social situation to another, they increase the potential for drunk driving. Yet there seems to be little public support for additional regulation of either alcohol products or marketing. Despite recent increases in alcohol taxes as a revenue source, there seems little support for further increases in alcohol taxes as a means to discourage consumption or to cover the social cost of harm from drinking.

Before the more scientific approach to auto safety of the last 25 years, most crashes were either considered acts of God or blamed on the "nut behind the wheel." There is a current tendency to define impaired driving and other types of alcohol and drug abuse the same way by blaming the "nut behind the bottle," not the marketing and social conditions that permit and

engender the behavior. Personal responsibility must be a part of any safety program, but we need to understand the environmental and other factors that encourage such behavior. We may not be able to change these forces, but research can illuminate the driving forces for alcohol and drug abuse, and may give us insight for other approaches to their control.

A cross cultural look, both within the U.S. and in comparison with other societies, might give some further insights into what we will need to know about alcohol and its abuse. Certain attitudes or behaviors involving use of drugs and alcohol that are found in small groups in society may become more widespread in the future, as often happens with popular culture. We may get insights into the nature and limits of alcohol abuse and impaired driving by looking at cultures that view alcohol use differently than we do.

Exploring these kinds of issues, forces, and scenarios can provide useful pictures of the future. This meeting easily can identify other issues and plausible scenarios, and can provide insights into their relative importance. A strategic planning process, including scenario development, would be an important early project for this decade's research agenda. Simply advocating that we now do the research that was left undone in the 1980's would be short-sighted at best. The 21st Century will demand more forward thinking, more creativity, and a more daring and thoughtful research agenda.

**APPENDIX D2
DETECTION AND DETERRENCE OF DRUG AND
ALCOHOL ABUSE IN THE TRANSPORTATION
WORKPLACE**

George M. Ellis, Jr.

INTRODUCTION

Although trends have concerned scientists and industry professionals for at least the past decade, only in the past few years has the extent of drug and alcohol abuse in the transportation industry caught the attention of both the federal government and the American public. Drug and alcohol abuse in transportation has triggered concerns about public safety, environmental protection, and economic impact. Use of these substances is no longer seen as an issue of personal choice or morality. But in spite of warnings, it has taken a few highly visible and catastrophic events to focus public and political attention on the problem.

Three Northwest Airline Pilots were convicted in

1990 for being under the influence of alcohol while flying a commercial airliner during an early morning flight. Ninety-one passengers were on board. The pilots were arrested after landing the flight safely. Tests showed blood alcohol concentrations ranging from 0.06 percent to 0.13 percent (the captain). All three pilots admitted drinking heavily the night before.¹

In 1988, a Trans-Colorado Airlines Commuter operating as Continental Express crashed at Durango, Colorado, killing the two crew members and seven of the fifteen passengers on board. The National Transportation Safety Board (NTSB) found that the captain's use of "a bag" of cocaine the night before resulted in a degradation of performance which contributed to the cause of the accident.²

In 1987, a Conrail freight train improperly passed a stop signal at Chase, Maryland, and entered a main line where it was hit by an Amtrak passenger train at 120 miles per hour. The Amtrak engineer was one of the sixteen people killed. Over 170 people were injured. Both the Conrail engineer and brakeman were judged by the NTSB to be impaired at the time of the crash by their very recent use of marijuana.³

In 1989, a Exxon oil tanker ran aground in the Prince William Sound, Alaska. Over 250,000 barrels of oil were spilled causing extensive environmental damage. The ship's captain, who had a known alcohol problem, was judged by the NTSB to be impaired by alcohol at the time of the accident. He had left control of the ship to a junior officer at a critical time in the movement of the vessel.⁴

These catastrophic accidents, however dramatic, should merely draw attention to the very real problem employers face each day in deciding how to detect the impaired operator performing safety-sensitive functions and how to best create a workplace free from the effects of drug and alcohol abuse.⁵ In this paper, these topics will be examined from the perspective of looking at research needs for the next decade based on an assessment of the current state of knowledge. Topics to be covered include both chemical and non-chemical based methods of detection and deterrence. In addition, the paper will examine other complementary research needs which may contribute directly or indirectly to these goals.

STATEMENT OF THE PROBLEM

Transportation workers provide their services in complex environments which may change instantaneously from highly tedious and monotonous to extremely stressful and dangerous. They may do so under conditions of