

*Overview of the National Highway
Traffic Safety Administration's*

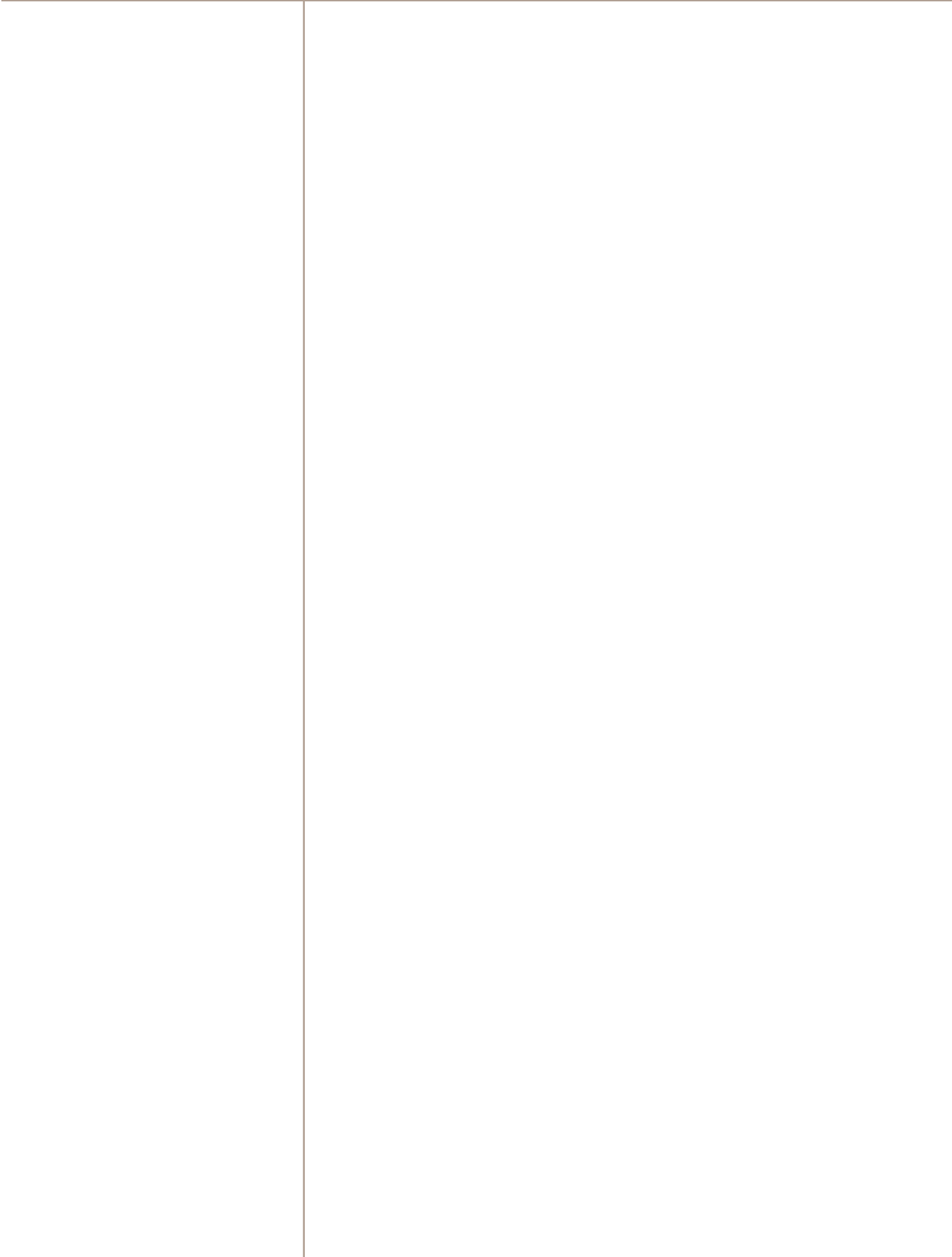
Driver Distraction Program



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Introduction

The National Highway Traffic Safety Administration's mission is to "save lives, prevent injuries, and reduce economic costs due to road traffic crashes." Driver distraction is a significant and difficult safety problem to address. This program lays out NHTSA's efforts to address it. Planned projects for 2010 and beyond are described, with some building on a significant number of research projects conducted in prior years.

This plan is intended to communicate NHTSA's priorities to the public with regard to driver distraction safety challenges, namely our long-term goal of eliminating crashes that are attributable to distraction. Among them are programs and projects involving improving our understanding of the problem, reducing workloads from driver interfaces, keeping distracted drivers safe, and recognizing the risks and consequences of distracted driving. NHTSA notes that this plan as well as individual projects are subject to change depending on evolving interaction and changes in agency workload, resources, and priorities. NHTSA also notes that while we communicate our research plans with other Department of Transportation agencies, this plan is not meant to represent the extensive efforts planned throughout the DOT.

Background

This overview is intended as a complement to a previous NHTSA report, "Driver Distraction: A Review of the Current State-of-Knowledge."¹ Refer to that document for additional detail and discussion. This report is available at the NHTSA Web site (www.nhtsa.gov).

Definition, Measurement of Distraction

Although the definition may seem obvious, the term *distracted driving* has been used to represent different driver conditions. Some reports or news articles use the terms *inattention* and *distraction* synonymously. While drowsiness and daydreaming can be categorized as inattention, the term *distraction* as used in this plan is a specific type of inattention that occurs when drivers divert their attention away from the driving task to focus on another activity instead. These distractions can be from electronic distractions, such as navigation systems and cell phones, or more conventional distractions such as interacting with passengers and eating. These distracting tasks can affect drivers in different ways, and can be categorized into the following types:

- Visual distraction: Tasks that require the driver to look away from the roadway to visually obtain information;

¹ Ranney, T. A. (2008). Driver Distraction: A Review of the Current State-of-Knowledge. DOT HS 810 704. Washington, DC: National Highway Traffic Safety Administration.

- Manual distraction: Tasks that require the driver to take a hand off the steering wheel and manipulate a device;
- Cognitive distraction: Tasks that are defined as the mental workload associated with a task that involves thinking about something other than the driving task.

The impact of distraction on driving is determined not just by the type of distraction, but also the frequency and duration of the task. That is to say, even if a task is less distracting, a driver who engages in it frequently or for long durations may increase the crash risk to a level comparable to that of much more difficult task performed less often. Because drivers often have a choice regarding when and how often to multitask when driving, their exposure to risk is typically within their control; however some research — discussed later in this report — has shown that drivers underestimate the overall risk of various tasks.

It should be noted that because of the complex nature of distraction, researchers have implemented various methodologies to better understand the problem. While each method provides insights into the problem, each also has its limitations. For a detailed discussion of these benefits and limitations, refer to the aforementioned summary report, *Driver Distraction: A Review of the Current State-of-Knowledge*.² Several methodologies and the subsequent results are discussed below.



NHTSA's 2007 Driver Cell Phone Use observational study estimated that about 6 percent of drivers are using hand-held phones at any given time.³ Furthermore, when asked about their willingness to multitask under high- and low-demand traffic situations, drivers in another NHTSA-sponsored study did not perceive common cell phone tasks to contain much risk.⁴ The study also showed that teenage drivers were the age group most willing to engage in various distracting activities and were confident in their ability to multitask without consequence. The limited skill of many young drivers and their poor judgment regarding when to attempt such tasks is of special concern, especially since the wireless devices they use are capable of providing even more complex features than phone operation, such as text messaging and accessing the Internet.



The safety impact of distraction is also dictated by the task itself and the workload it imposes on the driver. To measure workload, several types of studies have been conducted. The first type, controlled studies, have demonstrated how drivers' performances can be degraded when they multitask. In these studies, degradations were evidenced in such behaviors as reduced eye scanning behavior, slower reaction time, degraded

² Ranney, *ibid*.

³ NHTSA (2008). Driver Electronic Device Use in 2007. DOT HS 810 963. Washington, DC: National Highway Traffic Safety Administration.

⁴ Lerner, N., Singer, J., & Huey, R. (2008). Driver Strategies for Engaging in Distracting Tasks Using In-Vehicle Technologies. DOT HS 810 919. Washington, DC: National Highway Traffic Safety Administration.

vehicle control (i.e., increased weaving of the vehicle within the lane), and lower detection of critical objects in peripheral vision.⁵ NHTSA studies of several navigation system designs demonstrated the varying degree of impact that their interfaces can have on driving performance.⁶ More-distracting interface designs, or those that require more attention-related resources, diverted more attention from the driving task and, as a result, led to greater difficulty in lane keeping.

All of these effects can degrade driving safety, but due to the nature of controlled experiments, the crash consequences of such reduced driving performance are difficult to characterize. For example, people may operate devices differently when they know they are being studied than they do in the real world. They may increase the distance between themselves and the vehicle in front of them or they may slow down. What is known, however, is that some drivers don't compensate appropriately, sometimes resulting in crashes. One method to overcome some of these limitations of controlled experiments is the use of naturalistic data collection in which the behavior of drivers using their personal vehicles on real roads is recorded by an array of on-board instrumentation. When crashes and near-crashes occur, the information about the vehicle kinematics and driver behaviors leading to these events are saved for analysis.

NHTSA sponsored one such naturalistic study, conducted by Virginia Tech Transportation Institute, in which 100 cars in Northern Virginia were instrumented, commonly known as the 100-Car Study.⁷ Analyses of the recorded video data allowed researchers to determine whether the drivers were distracted in the moments leading up to the crashes or near-crashes. The researchers also analyzed video clips when the drivers were engaging in secondary tasks. By comparing distractions during normal driving to distractions during crashes and near-crashes, estimates were made of the relative risk of drivers when distracted. Due to the success of this method, the Transportation Research Board under its Strategic Highway Research Program 2 (SHRP2) has initiated a much larger naturalistic driving study with a wider sample of drivers, which is expected to be more representative of the general driving public. When it is completed (expected in 2012), it will provide more comprehensive data on the incidence of distracting activities among drivers generally and better information on the contribution of distracting activities to crash causation in passenger vehicles.

Naturalistic studies also have their limitations compared to controlled studies. Specifically, although controlled studies do not provide information about the frequency and circumstances in which drivers willingly engage



⁵ Ranney, *ibid.*

⁶ Tijerina, L., Johnston, S., Parmer, E., Winterbottom, M. D., & Goodman, M. (2000). *Driver Distraction with Wireless Communications and Route Guidance Systems*. DOT HS 809 069. Washington, DC: National Highway Traffic Safety Administration.

⁷ Klauer, S. G., Dingus, T. A., Neale, V. L., Sudweeks, J. D., Ramsey, D. J. (2006). *The Impact of Driver Inattention on Near-Crash/Crash Risk: An Analysis Using the 100-Car Naturalistic Driving Study Data*. DOT HS 810 594. Washington, DC: National Highway Traffic Safety Administration.

in distracting activities, naturalistic studies do not have controls or metrics to look at specific conditions. For example, drivers are free to use features or devices at their own discretion, which may or may not provide enough data to make comparisons. Thus, both methods are needed to fully understand the nature of distraction and its consequences.

Incidence and Safety Consequences of Distraction

Drivers have often experienced distractions due to other passengers, radio operation, and eating food, among other activities. Increasingly, drivers are distracted by new technologies and innovative features available in their vehicles or in portable devices that they bring into the vehicle. Prospective passenger vehicle buyers are faced with an ever increasing variety of In-Vehicle Information Systems (IVIS), each capable of tasks that are potentially distracting. Portable devices offer many of the same capabilities as original equipment manufacturers' products plus additional ones. Many of these technologies have the capabilities to receive, transmit, and display various types of information. They give drivers the opportunities to place calls, obtain directions, send text messages or e-mails, and choose from many multi-channel music and entertainment options. Through wireless communications, drivers may receive information about real-time traffic reports, parking information, and advertising for nearby businesses. Other information available to drivers includes advanced driver assistance systems that can alert and warn drivers about the condition of their vehicles, fuel economy, nearby objects, and likely crash situations.

Currently, NHTSA has three primary sources of data from which to assess the effects of distraction. The first two are police-accident-report-based systems. The Fatality Analysis Reporting System (FARS) is a census of fatal crash data assembled by NHTSA. In addition to fatality data, the National Automotive Sampling Systems (NASS) General Estimates System (GES) provides a sample of all police-reported crashes to estimate the number of injured people and to gather information about crashes of varying severity. These systems rely on the State data-based police accident report (PAR) as their primary data sources for the recoding of the distraction information into a uniform national data set. Estimating the role of distraction from these crash databases is difficult because the police-reported distraction and inattention data appear to have a wide degree of reporting and collection variability. Despite the limitations in this data collection, NHTSA's data shows that almost 5,870 people died and an approximately 500,000 people were injured in crashes that were reported to have involved distraction in 2008.⁸

The third primary source is an on-scene investigation-based crash data source that provides unique insights about distraction is the National Motor



⁸ Ascone, D., Lindsey, T., & Varghese, C.. (2009, September). An Examination of Driver Distraction as Recorded in NHTSA Databases. Traffic Safety Facts Research Note. DOT HS 811 216. Washington, DC: National Highway Traffic Safety Administration.

Vehicle Crash Causation Survey (NMVCCS).⁹ This nationally representative database consists of on-scene, in-depth multidisciplinary investigations of 6,949 crashes that occurred between 2005 and 2007. This in-depth, on-site approach provides more details than typical police reports about the driver, vehicle, and traffic characteristics associated with distraction-related crashes. This data indicate that distractions internal to the vehicle were a critical reason in about 11 percent of crashes studied. An analysis of the types of internal distractions found that about 0.2 percent of drivers were dialing or hanging up phones, about 0.9 percent were adjusting radios/CDs or other controls, and about 12 percent were conversing with passengers or on cell phones. Drivers 16 to 25 years old had the highest percentage of being engaged in at least one interior non-driving activity (6.6%).

The previously mentioned 100-Car study confirmed that distraction is a common occurrence while driving; many distractions increase the relative risk of crashes and near-crashes, and distractions that require drivers to take their eyes off the road are potentially more of a safety problem than purely cognitive distractions. The researchers in that study used the data to determine the odds ratio or increased risk of engaging in various secondary tasks over “just driving.” Table 1 shows some of the results (statistically significant results are in bold). A significant odds ratio indicates a reliable increase in risk associated with that activity.

Table 1. Odds ratio for secondary tasks in the 100-Car Study

Type of Secondary Task	Odds Ratio
Reaching for a moving object	8.82
Insect in vehicle	6.37
Looking at external object	3.70
Reading	3.38
Applying makeup	3.13
Dialing hand-held device	2.79
Inserting/retrieving CD	2.25
Eating	1.57
Reaching for non-moving object	1.38
Talking/looking to a hand-held device	1.29
Drinking from open container	1.03
Other personal hygiene	0.70
Adjusting the radio	0.50
Passenger in adjacent seat	0.50
Passenger in rear seat	0.39
Child in rear seat	0.33



⁹ NHTSA. (2008, July). National Motor Vehicle Crash Causation Study Report to Congress. DOT HS 811 059. Washington, DC: National Highway Traffic Safety Administration.



Based on these results, reaching for a moving object is the most risky behavior observed, increasing crash risk by more than eight times that of just driving.

A similar methodology to NMVCCS was used to collect data in recent heavy-truck research. The Large-Truck Crash Causation Study recorded information on nearly 1,000 heavy-truck fatal and injury crashes.¹⁰ An estimated 2 percent of these crashes were associated with a distraction inside the truck. Two additional naturalistic studies – the Drowsy Driver Warning System Field Operational Test and the Naturalistic Truck Driving Study – were combined with the Large-Truck Crash Causation Study and analyzed to further investigate distracted driving. While few crashes were observed, preliminary results indicate that text messaging on a cell phone while driving increased crash risk more than 23 times.¹¹

Epidemiological studies have also evaluated the crash risk associated with cell phones.¹² Some of the studies consistently found a four-fold increase in crash risk associated with the use of a cellular phone.^{13 14} The increased risk associated with cell phone use is not certain, however, because researchers may have relied on incorrect assumptions about driver behavior, for example whether the driver was on the phone when the crash occurred (versus right after the event to call for emergency services).

As summarized in the Research Note, Examination of Driver Distraction as Recorded in NHTSA Database:¹⁵

Measuring driver distraction in the field is difficult and potentially imprecise because of self-reporting and timing of data collection. Due to differences in methodology and definitions of distraction, each study or survey conducted may arrive at different results and conclusions with respect to the involvement of driver distraction during a crash. NHTSA's research paper *Driver Distraction: A Review of the Current State-of-Knowledge* discusses multiple means of measuring the effects of driver distraction including observational studies, crash-based studies, and experimental studies of driving performance.

These differences may explain discrepancies in the results based upon the different sources.

¹⁰ FMCSA. (2006). Report to Congress on the Large Truck Crash Causation Study. Washington, DC: Federal Motor Carrier Safety Administration.

¹¹ Olson, R., Hanowski, R., Hickman, J. S., & Bocanegra, J. (2009). Driver Distraction in Commercial Vehicle Operations. DOT FMCSA-RRR-09-042. Washington, DC: Federal Motor Carrier Safety Administration.

¹² McEvoy, S. P., Stevenson, M. R., McCartt, A. T., Woodward, M., Haworth, C., Palamara, P., and Cercarelli, R. (2005). Role of mobile phones in motor vehicle crashes resulting in hospital attendance: a case-crossover study. *British Medical Journal*, 331: 428.

¹³ Redelmeier, D. A., & Tibshirani, R. J. (1997). Association between cellular telephone calls and motor vehicle collisions. *The New England Journal of Medicine*, 336, 453-458.

¹⁴ McEvoy, *ibid.*

¹⁵ Ascone, *ibid.*

Technology-Based Distractions

Cell phone use while driving has received a considerable amount of research attention (for a summary of 125 studies see McCartt et al.¹⁶). Most research studies show that task complexity (i.e., the amount of resources required to complete the task) is a key to estimating distraction potential in that more-complex tasks are more detrimental to driving performance than lesser-demanding tasks. The issue as to whether operating a phone via a hands-free mode is safer or less safe than operating a phone in a hand-held manner has also received a lot of research attention over the years. While early work tended to show a decrement with both hand-held and hands-free, newer technologies and applications require additional research to determine if the any one of the interfaces provide an advantage.

In addition to cell phones, in-vehicle and other portable entertainment devices can have complex interfaces for drivers to operate. Examples include touch screen visual displays, joystick input methods, voice interfaces, and head-up displays. As a result of the increasing number of information sources and their complicated interface designs, drivers are facing more opportunities to become distracted by devices that may be more challenging to use than what drivers are accustomed to.

To provide an estimate of how future technology trends affect driver distraction, NHTSA conducted an inventory of in-vehicle technologies, primarily focused on navigation systems.¹⁷ This inventory highlighted aspects of equipment design that could affect driver distraction. This effort was followed by another inventory that included adaptive cruise control, park aid systems, night vision systems, and navigation/route guidance systems, and was an impetus for a larger study of early adopters of these technologies.¹⁸ These inventories gave NHTSA snapshots of the sources of potential driver distractions.

Countermeasures for Distracted Driving

As a result of the growing concern over the increasing use of wireless communications devices and other “electronic distractions,” NHTSA held a public meeting in 2000 to bring the issue to national attention and to seek the engagement of the automotive and related industries.¹⁹ One result

¹⁶ McCartt, A. T., Hellinga, L. A., & Braitman, K. A. (2006). Cell phones and driving: Review of research. *Traffic Injury Prevention, 7*, 89-106.

¹⁷ Llaneras R. E., & Singer, J. (2002). Inventory of In-Vehicle Technology Human Factors Design Characteristics, DOT HS 809 457. Washington, DC: National Highway Traffic Safety Administration.

¹⁸ Llaneras, R. E. (2006, January). Exploratory Study of Early Adopters, Safety-Related Driving With Advanced Technologies. Final Task 2 Report: In-Vehicle Systems Inventory, Recruitment Methods & Approaches, and Owner Interview Results. DOT HS 809 972. Washington, DC: National Highway Traffic Safety Administration.

¹⁹ Llaneras, R. E.. (2000, November 15). Driver Distraction Internet Forum: Summary and Proceedings. Washington, DC: National Highway Traffic Safety Administration. Available at: <http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/Driver%20Distraction/FinalInternetForumReport.pdf>



of the meeting was the decision of the Alliance of Automobile Manufacturers (AAM) to form a working group to develop a set of guidelines for device design to minimize driver distraction. The current AAM guidelines address only those functions that require drivers to look at and manually operate controls and displays. In a letter to the NHTSA administrator dated April 22, 2002, the AAM committed its intent to have its products conform to AAM guidelines.

Many efforts have been made to develop guidelines for in-vehicle devices. NHTSA sponsored a cooperative agreement with the CAMP (Crash Avoidance Metrics Partnership) industry consortium to develop workload metrics (measures of driver performance).²⁰ In addition, several European countries have conducted metrics development efforts under the HASTE (Human Machine Interface And the Safety of Traffic in Europe) program. Also, several manufacturers developed metrics under the ADAM (Advanced Driver Attention Metrics) program. Transport Canada proposed a Memorandum of Understanding with automotive manufacturers in regard to adherence to industry-developed performance guidelines relating to telematics device design and development. These guideline efforts have gone on to support many ongoing research programs today.



The NHTSA-sponsored SAVE-IT program (SAfety VEhicle Using Adaptive Interface Technology) explored the feasibility of a workload management tool, which is a system designed to minimize the workload (i.e., mental effort required) from in-vehicle interfaces at unsafe times, such as when drivers need to focus on critical driving situations.²¹ These systems use sensors and algorithms to make real-time calculations of the difficulty of the driving situation and, based on those calculations, determine when to suppress the display of additional potentially distracting information or to prioritize their presentation to limit the amount of information displayed at one time. For example, if a driver is in heavy traffic, in the rain, or on a curvy road, an incoming phone call (an added demand) could be automatically routed to voice mail, instead of ringing as normal. To design a workload manager, it is necessary to know which driving tasks are riskier than others, and the distraction potential of attending to another information source. The SAVE-IT program demonstrated the feasibility of such a system.

In addition to distraction-specific technologies, several driver assistance technologies (e.g., lane departure warning, crash-imminent braking, forward collision warning) have the potential to reduce the negative impact of distracted driving. Many past and ongoing NHTSA research programs have examined these technologies (e.g., Integrated Vehicle-Based Safety Systems

²⁰ Angell, L., et al. (2006, November). Driver Workload Metrics Project: Task 2 Final report. DOT HS 810 635. Washington, DC: National Highway Traffic Safety Administration. Available at: <http://www.nhtsa.dot.gov/staticfiles/DO/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/Driver%20Distraction/Driver%20Workload%20Metrics%20Final%20Report.pdf>

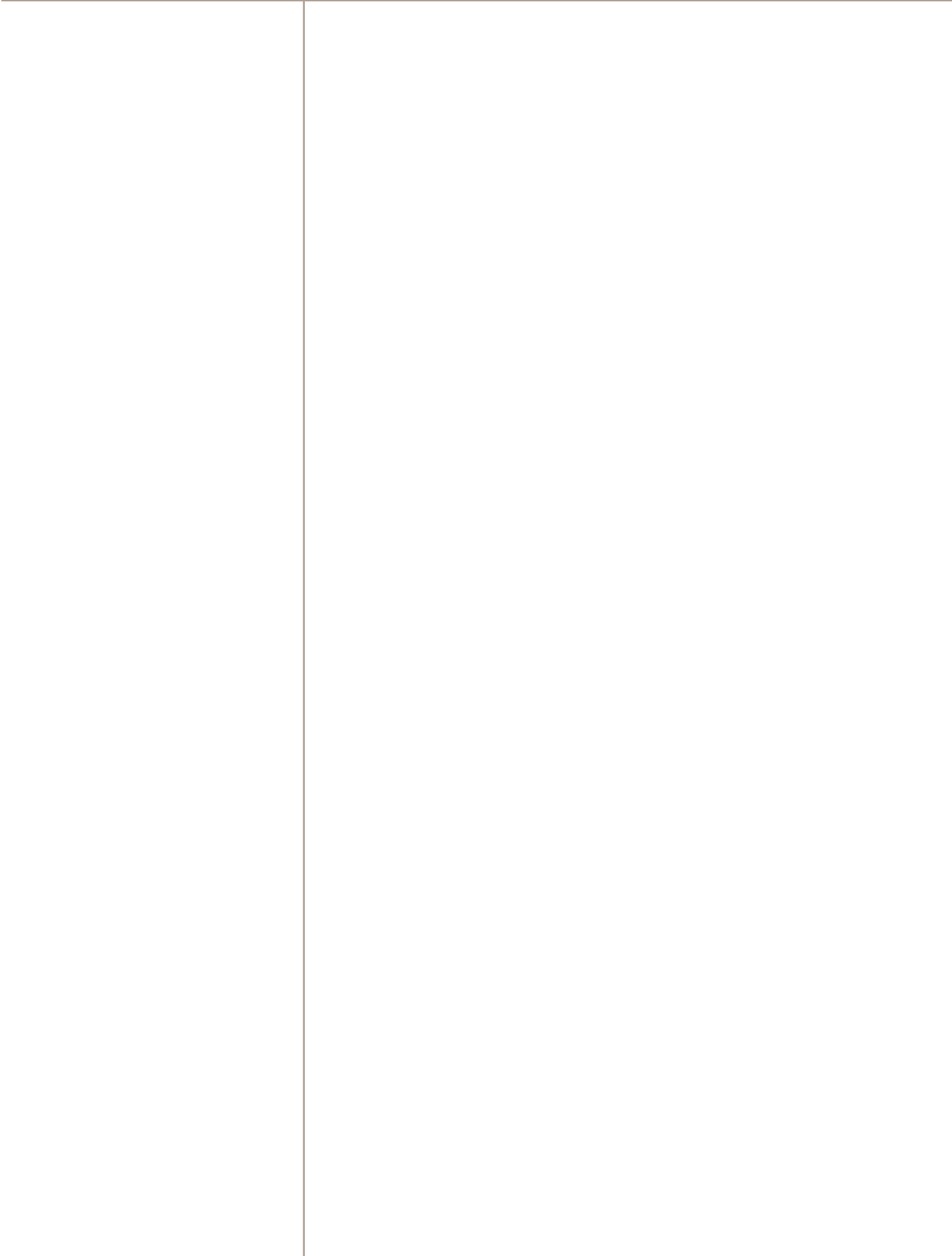
²¹ Information on the SAVE-IT program can be found at: <http://www.volpe.dot.gov/hf/roadway/saveit/index.html>

[IVBSS], Advanced Collision Avoidance Technologies [ACAT], and Vehicle to Vehicle/Vehicle to Infrastructure Communications under the Intellidrive program²²). NHTSA will continue to investigate these technologies to evaluate their crash-reduction potential and determine ways to reduce the distraction potential the systems themselves may present.

Summary

Researchers use epidemiological studies, experimental studies, and analyses of crash data to assess the safety problem of driver distraction. The findings widely indicate that distraction is a safety problem that can increase crash risk; many studies have shown how this increased risk can occur due to the degradation in driving performance during multitasking, including slower reaction time and narrowed visual scanning. Future research will help to provide better risk estimates and insights regarding the role of distraction in crash causation.

²² Information on the Intellidrive program can be found at: <http://www.intellidriveusa.org/>



Distraction Program Goals

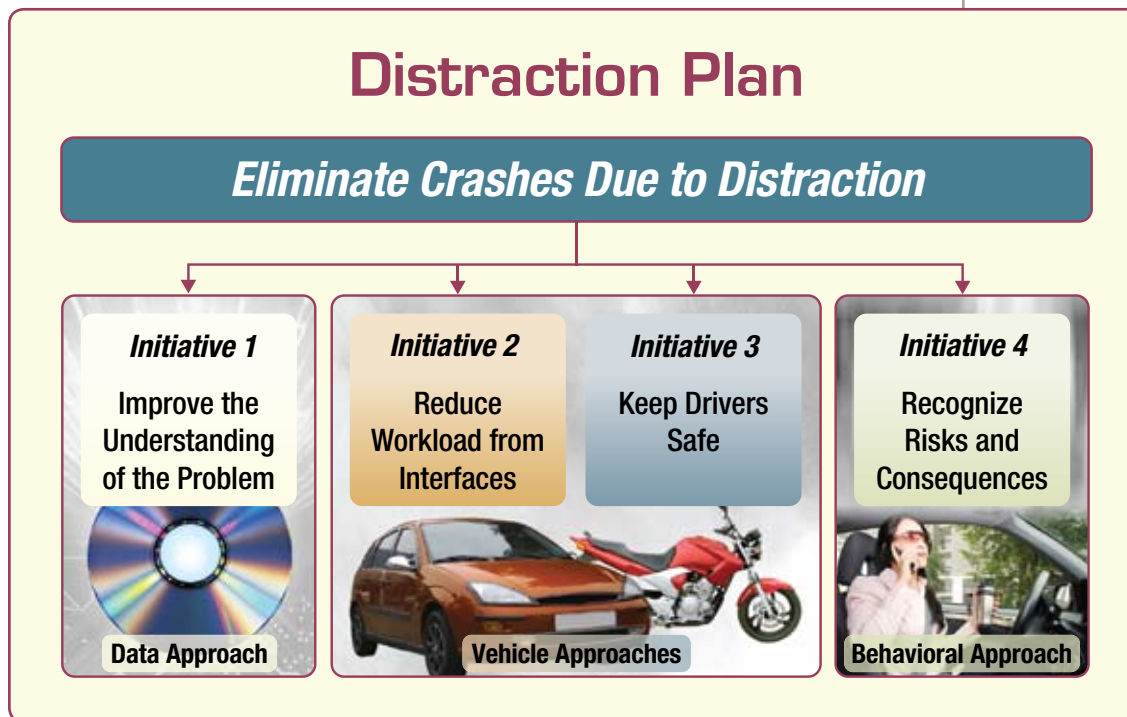


Figure 1. Distraction Plan

As part of NHTSA's overarching goal of reducing fatalities and injuries due to traffic crashes, the agency has been interested in an array of safety problems, including distraction. The agency developed this distraction plan to help in its long-term goal of eliminating a specific category of crashes – those attributable to driver distraction. The program involves four initiatives (Figure 1). The first initiative is to improve the understanding of the extent and nature of the distraction problem by enhancing the data quality and analysis methods. These efforts will continue to improve the understanding of the extent and nature of the distraction problem. The two vehicular initiatives include determining how to design interfaces to minimize workload, and developing and evaluating crash avoidance technologies that will keep distracted drivers and their passengers safe (i.e., use crash warnings and distraction monitoring systems to detect risks, and warn drivers). The fourth initiative, a behavioral approach, seeks to educate drivers on the risks and consequences of distracted driving. The comprehensive program presented below is intended to limit the workload experienced by drivers using devices in vehicles and keep distracted drivers safe regardless of the distraction source.

Built into the program are considerations to identify and control for risks that, left unchecked, would limit the program's success, such as driver acceptance and/or low adoption rate of technologies. Technology-based solutions may be difficult to implement due to high costs, marketplace resistance, and unproven effectiveness. Effectiveness may be reduced by driver efforts to circumvent unpopular countermeasures. In addition, benefits may be compromised if drivers overestimate the protection afforded by technologies and adopt unsafe behaviors, such as increased phone use, that are counterproductive to safety. Behavioral approaches, such as laws restricting cell phone use or educational programs, must overcome the resistance of drivers who may not fully appreciate the risks associated with common and "electronic" distractions.

Initiatives

Initiative 1: Improve Understanding of the Problem

Background

The changing nature of distracting tasks and the limitations of available data require a continuous effort to better understand the issues surrounding driver distraction. As discussed previously, our understanding of exposure to distractions is limited by the availability of real-world data. In addition to this real-world data, the relative risk of a task compared to other factors, such as what devices and tasks cause drivers to become distracted, the circumstances under which crashes occur, the drivers' characteristics that increase the propensity to lose focus, and the effects of potential interface improvements on crash risk.

The rapid advances in technology entering the marketplace also add complexity to the distraction problem – it requires a focused effort on monitoring current trends to identify distractions early in the deployment. To better assess the distraction potential of new technologies, this plan outlines the agency's efforts to gain a more in-depth understanding of the interfaces currently on the market, specifically for distraction potential and use rates.

Programs to Support Initiative 1

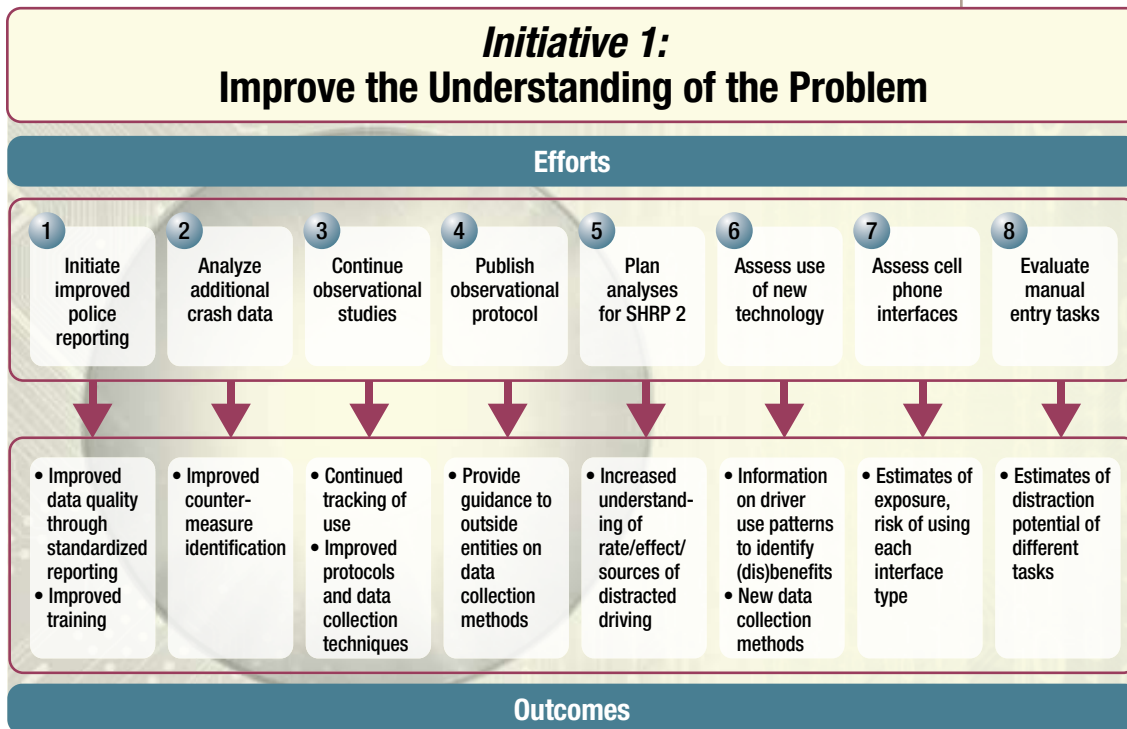


Figure 2: Tasks and Outcomes for Initiative 1



1. *Initiate improved police reporting.* Distraction incidence is not consistently recorded across the United States, as there is variation in both the data collected on police accident reports and the quality of police reporting. Currently 49 of the 50 States have some mention of distraction or inattention on their police accident forms. However, the level of detail has a wide range of disparity. The quality of police reporting has a wide degree of variation based on the level of training and reporting requirements. In many jurisdictions the police officer must specifically witness or be able to provide evidence of the circumstances reported in order to mention as a contributing factor or report as an infraction, further reducing the likelihood that an officer will document any information relating to distraction. In addition, the self-reporting of distraction may be biased due to poor recall, avoiding self-incrimination or admission of fault. Many countries are also assessing their distracted driving problem. Sharing best practices in data collection methods and improving police reporting will be assessed.

Expected Outcomes: Improved training and standards for coding distraction on PARs would help NHTSA and the States better estimate distracted driving-related events and monitor any new trends and effects of countermeasures.

Status: This is an ongoing project. The first step, communicating the variables that are available in all States, is complete. The second step, improving those variables, will be completed by Q4 2012. Assessment of international best practices will be completed by Q1 2011.



2. *Analyze additional crash data.* The NMVCCS database is derived from in-depth crash investigations that can provide many more details about crash circumstances than standard police crash reports. NHTSA plans to conduct detailed analyses of this database to identify characteristics of distraction-related crashes in terms of such factors as the types of distractions, crash scenarios, driver characteristics, and other related contributing factors. The report is scheduled to be published in 2010. In addition, NHTSA will mine the agency's additional databases for distraction-related data.

Expected Outcomes: NHTSA expects to use the results of this analysis to define research that will identify countermeasures for the most prevalent distraction-related problems. The agency expects to use the results to provide the public with a better understanding of the types of distractions that contribute to crashes.

Status: This is an ongoing project. A report detailing the results of NMVCCS to assess distraction-related crashes will be completed in Q3 2010. A second report investigating the rate of intersection crashes will be completed in Q4 2010.

3. *Continue observational studies.* Currently, NHTSA administers the National Occupant Protection Use Study (NOPUS), which provides the only nationwide probability-based observational data on driver electronic device use in the United States. The NOPUS is conducted by the National Center for Statistics and Analysis (NCSA) of NHTSA. NHTSA will continue to collect this data. Furthermore, NHTSA will seek out additional data collection protocols and techniques to better expand our capabilities and further enhance the data.

Expected Outcome: This survey allows the agency to track annually cell phone use while driving. The data allows NHTSA to monitor any changes in use patterns and gauge the interface type and level of use across the vehicle fleet. The identification of new data collection protocols and techniques will allow for enhanced data collection, which will further provide insight into the driver distraction issue.

Status: This is an ongoing project, and is expected to continue throughout the duration of the execution of this Plan.

4. *Publish protocol for the NOPUS cell phone study.* To allow other organizations to collect similar data, NHTSA will publish the protocol currently used for the NOPUS cell phone study. This outlines in detail the procedures and tools used to conduct the NOPUS.

Expected Outcome: Publishing these protocols will allow outside organizations to conduct similar studies.

Status: This is an ongoing project, with an expected publication date of the NOPUS protocols for Q3 2010.

5. *Plan analyses for SHRP2.* The Transportation Research Board's SHRP 2 initiative is a naturalistic driving behavior study which will deploy about 1,950 vehicles that are instrumented with video data recorders and other sensors to record behaviors, including driver distractions, both in routine driving and in the seconds leading up to crashes. The non-crash data on driver behaviors will serve as a baseline to provide estimates of exposure that can be used to calculate relative risk of different distracting tasks. NHTSA expects that the resulting data set, which will be available in 2012, will be the most comprehensive source of information that shows the types of activities that drivers engage in while driving.

NHTSA has participated in planning the SHRP program, and plans to conduct analyses that specify the frequency of various distracting activities and their safety implications. The agency also intends to use the data set to further the understanding of the role and crash risk of distractions, and potential countermeasures.



Expected Outcomes: Ultimately, the results of the data analyses will be used to support policy decisions. In addition, the results will be used to identify countermeasures, such as standards to lockout distracting device operation, and laws restricting driver use of distracting devices.

Status: This is an ongoing project, and is expected to continue as data are collected and reduced. Data collection is scheduled to end in 2013.

6. *Assess use of new technology.* NHTSA will continue to monitor the new technologies, either those associated with in-vehicle devices or, to a lesser extent, portable devices (especially those applications that would reasonably be used while driving). Specifically, this review will focus on vehicles equipped with advanced information/entertainment systems and features and evaluate their interfaces for (relative) distraction potential. In addition, this effort will look at technologies that can assist in data collection, specifically for the rate at which drivers use cell phones, and improve law enforcement capabilities.

Expected Outcomes: The information from this assessment will provide a preliminary indication of potential technology benefits and problems that can be used to define needed research. The information on driver use patterns will help track trends that can be used to identify and forecast potential safety issues.

Status: This is an ongoing project, and is expected to continue throughout the duration of the execution of this Plan. The first step, researching new technologies to help with roadside data collection, has been initiated.



7. *Assess integrated, hands-free, and hand-held interfaces.* The distraction potential of different types of interfaces has been of interest to researchers. Cell phone interfaces can be sorted into three general categories: hand-held (i.e., dialing is manual and the phone is held to the ear when conversing), hands-free (i.e., dialing is performed manually or vocally, and talking is conducting using a headset or speakerphone), and integrated (i.e., dialing and talking interactions with the phone take place through a vehicle-based, OEM interface). With the rapidly changing state of technology, the subsequent impact of these interfaces is not known. NHTSA will conduct an evaluation of current users of different cell phone interfaces to determine the relative exposure of the different types of interfaces and the relative risk of each when used while driving. By recruiting current users of the different technologies, novice user effects will be eliminated.

Expected Outcomes: The information from this assessment will provide an estimate of exposure for each interface type and the distraction potential associated with use of each interface type. With

this information, NHTSA expects to increase the overall understanding of driver interaction with technology, better understand the needs of the driving population, and identify improvements for current vehicle systems.

Status: NHTSA is in the planning stages of this project. The final report is expected to be published in Q1 2012.

8. *Evaluate distraction from manual entry tasks.* Consensus from driver distraction literature is that manual phone dialing, text messaging, and navigation route entry take the driver's eyes off the road for longer periods of time, which is detrimental to driving. These tasks share a main component, manual number and/or text entry, which is consistently found to interfere with driving performance. Some research found that teen drivers spent up to 400% more time with their eyes off the road when text messaging than when not text messaging, were less able to maintain their lateral position, or respond to traffic signs.²³ This project will examine portable and in-vehicle technologies to test the similarities and differences in driver performance when drivers engage in these secondary tasks. In turn, this evaluation will permit estimation of the risk associated with consecutive number and text entry while driving.

Expected Outcomes: Results of this assessment will provide an estimate of the distraction potential of different manual secondary tasks. This information will be useful for future policy decisions.

Status: NHTSA is in the planning stages of this project. The final report is expected to be published in Q1 2011.

Initiative 2: Reduce Workload Demands on Drivers When Using In-Vehicle Technologies

Background

The degree to which drivers' attention is diverted away from the primary driving task while using in-vehicle or portable devices is determined, in part, by the design and operation of the equipment. The device's interface can affect the degree to which drivers are able to perform primary driving tasks, such as event or object detection and maintaining vehicle control. In addition, some interfaces require many button presses to operate them. Consequently, one way to minimize the risk is to establish device-related distraction assessment metrics (e.g., total eyes off road time, maximum glance duration) that can provide information to help identify which design features are the least intrusive on the driving task. Design guidelines may also be used to reduce driver workload; this Plan includes developing and evaluating such guidelines.



²³ Hosking, S. G., Young, K. L., & Regan, M. A. (2009). "The Effects of Text Messaging on Young Drivers." *Human Factors*, Vol. 51, No. 4, 582-592.

Programs to Support Initiative 2

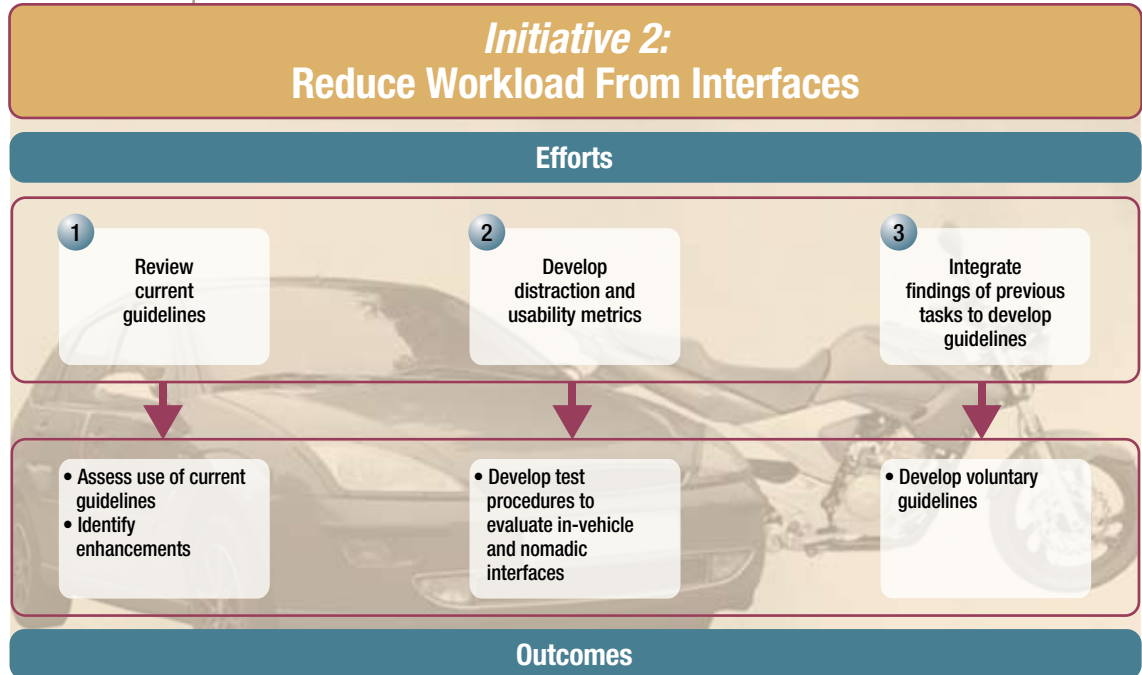


Figure 3: Tasks and Outcomes for Initiative 2

1. *Review current guidelines.* The Alliance of Automobile Manufacturers has published human factors guidelines for driver interactions with advanced in-vehicle information and communication systems and informed NHTSA of its intent to design products to meet these guidelines. However, we currently have little information on the extent to which these manufacturers and others are following human factors guidelines and testing their products to confirm that distracted driving is sufficiently limited. NHTSA supports the efforts of manufacturers to limit the distraction potential of the products they sell. To gain a fuller understanding of the state of implementation of human factors guidelines, NHTSA plans to review the extent to which manufacturers are following basic human factors guidelines as well as the current guidelines put forth by the Alliance of Automobile Manufacturers.

Expected Outcomes: This information will provide NHTSA a status report on the extent to which existing human factors guidelines are used, and an understanding of potential gaps in existing guidelines.

Status: NHTSA is in the planning stages of this project. The final report is expected to be published in Q4 2010.

Statement of Principles, Criteria and Verification Procedures for Driver Intentions with Advanced In-Vehicle Information and Communication Systems

Including Updated Sections

Driver Focus-Telematics Working Group

June 26, 2006

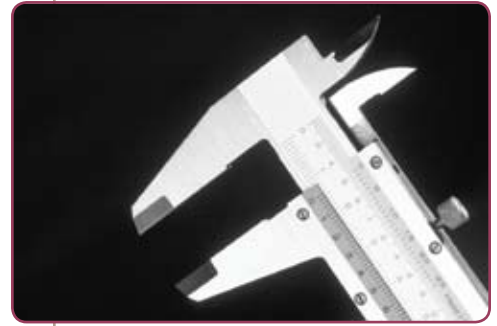
2. *Develop distraction and usability metrics.* This ongoing program is designed to foster less distracting interface designs:

- Building on the work of Collision Avoidance Metric Program (CAMP), Human-Machine Interface And Traffic Safety in Europe (HASTE), and completed NHTSA work, the first approach involves developing procedures to test interfaces for original equipment and portable devices using driving performance and distraction assessment metrics to establish a link to safety. Data obtained in a dual-task driving simulation will be used to assess the relative distraction potential of information and entertainment devices in production vehicles. New metrics will be explored, including newer variants of the peripheral detection task (PDT). Newer variants of the PDT have shown increased sensitivity for detecting cognitive distraction effects, relative to the original version. NHTSA is studying these metrics since they represent low-cost approaches with increased sensitivity for evaluating the potential distracting effects of operating wireless communications devices and other in-vehicle systems used for entertainment, information, and communication.
- The second, complementary approach involves development of a protocol for measuring and comparing the ease of use of similar features on different devices. Specifically, NHTSA expects that this work will involve an adaptation of the traditional human factors techniques, such as task analysis. This undertaking all the relative ranking of secondary task distraction potential, which will allow the identification and categorization of the types of secondary tasks that drivers perform using in-vehicle devices.

Expected Outcomes: The primary outcome will be objective and safety-relevant test procedures to evaluate production vehicles and portable technologies to assess distraction potential and usability. In addition, the findings can provide decision criteria for acceptable and unacceptable performance levels, in turn providing information to policy makers (including NHTSA) faced with decisions about developing regulations.

Status: The first phase of the project is near completion, with a final report to be published in Q1 2010. NHTSA is in the planning stages of a follow-on study; the report from this is expected in Q1 2011.

3. *Integrate findings of previous tasks to develop guidelines.* Following the conclusion of the previous tasks, this task will synthesize those results and develop voluntary guidelines for minimizing the distraction potential of in-vehicle and portable devices. These guidelines will include reliable, repeatable metrics, and are expected to represent the minimal interface requirements for technologies.



The guidelines will be developed in three phases. The first phase will explore visual-manual interfaces. The second phase will include portable devices. The third phase will expand the guidelines to include voice interfaces.

Expected Outcomes: This project will result in a documented set of voluntary guidelines for designing in-vehicle system/device interfaces to minimize driver distraction. NHTSA expects these guidelines to be used to establish the minimum requirements for interfaces.

Status: The first phase of the project has been initiated, and is expected to be completed in Q3 2011. The second phase is expected to be completed Q3 2013. The third phase is expected to be completed in Q1 2014.

Technologies

Initiative 3: Keep Drivers Safe

Background

As outlined previously, much research has already been undertaken to determine requirements for crash warning systems that can alert inattentive drivers of the need to take avoidance actions under crash likely scenarios. Safety systems such as forward crash avoidance and lane keeping assist appear to have potential for reducing crashes. Work has been undertaken in two directions: sensor and warning algorithm development to detect when driver action is needed and human factors research to guide the selection of appropriate warning timing and interface requirements for how to alert an inattentive driver. The technology challenge has been to develop sensors and algorithms that can minimize false and nuisance warnings and detect critical events 100 percent of the time. The human factors challenge has been to determine interface requirements that provide warnings to distracted drivers that are acceptable, detectable, understandable, and that lead to an appropriate crash avoidance response. In addition, the systems need to ensure that drivers do not become complacent and drive even less attentively if they assume that the systems will always protect them.

Sensors that monitor the state of the driver are a newer development. The most common type is fatigue monitoring systems that use machine vision to compute the driver's direction of gaze in real time. The emergence of real-time distraction monitoring capability offers the potential to support the driver in several ways. In contrast to reducing workload, these technologies may alter the collision mitigation countermeasures to provide more effective warnings and reduce nuisance warnings to distracted drivers by adjusting the warning timing and degree of intrusiveness. Such a device might help drivers realize when they are looking away from the road too much and may help to redirect their attention to the driving task. Several vehicle manufacturers have started to deploy the first generation of many of these systems, including real-time driver state monitoring. Some manufacturers have been researching the potential of distraction feedback systems.

Programs to Support Initiative 3

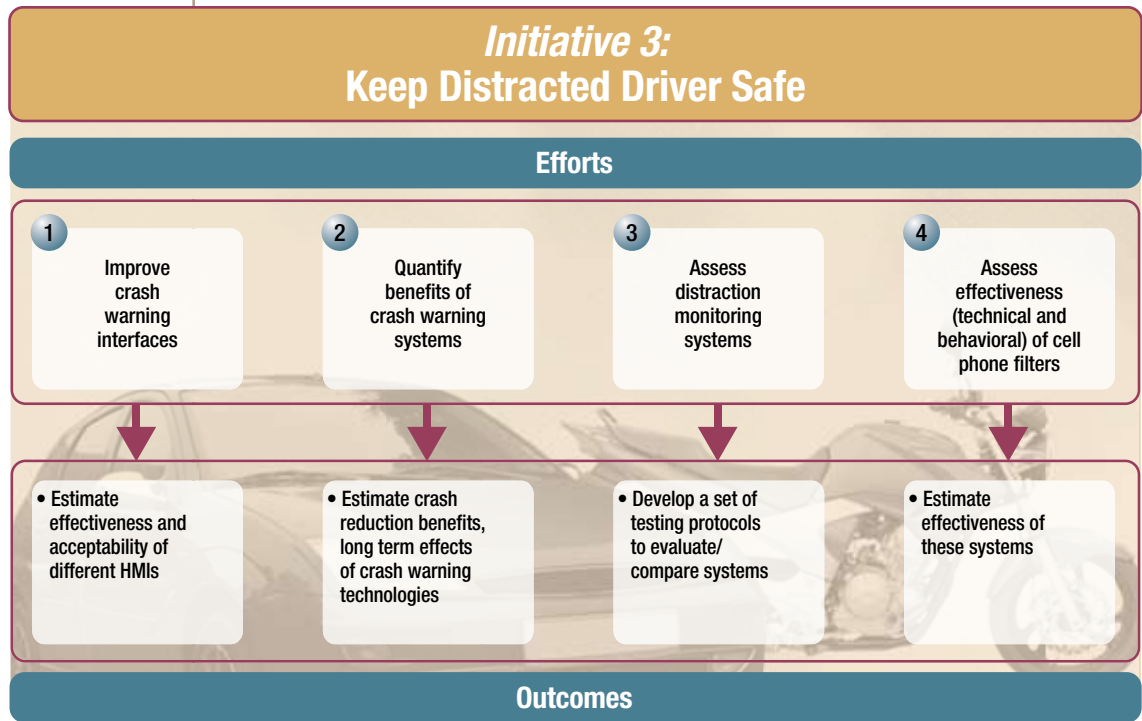


Figure 4: Tasks and Outcomes for Initiative 3



1. *Improve crash warning interfaces.* Advanced crash warning systems (ACWS) have the potential to help distracted drivers reduce the frequency and severity of common crash situations. The driver-vehicle interface (DVI) is a critical component of ACWS that aims to support effective crash avoidance by drivers without creating adverse effects, such as driver confusion, inappropriate responses, distraction, and automation complacency. The warning interface should be tailored to the capabilities of the crash prevention system as well as to the capabilities and limitations of the driving population. To help ensure that the crash warning systems provide distracted drivers an overall benefit, NHTSA is pursuing the Crash Warning Interface Metrics (CWIM) project, which will develop a set of test protocols to compare how they affect the drivers' crash avoidance responses.

Expected Outcomes: This project will evaluate the performance of different ACWS interfaces in terms of driver crash avoidance response and acceptability. These results could then be used in future human factors recommendations, guidelines, and/or support for regulatory programs.

Status: This is an ongoing project, with a final report expected to be published in Q1 2011.

2. *Quantify benefits of crash warning systems.* While various crash avoidance warning systems have been developed and are starting to be deployed, their effectiveness and long-term influence on driver behavior are unknown and can only be estimated. For example, drivers using these technologies may overly rely on the technologies, and engage in other (high-risk) behaviors, assuming the technology will compensate. Previous efforts to assess effectiveness have used computer modeling, test track studies, and field operational tests to estimate safety benefits. However, none of these techniques fully and accurately account for the effects of real-world driver behavior in responding to warning interfaces in a broad range of traffic scenarios over an extended period of time. More accurate estimates of the crash reduction benefits of crash warning technologies and the long-term effects on driver behavior, including among those drivers that are distracted, are needed.

Expected Outcomes: This effort will provide an estimate of the safety benefits of crash avoidance technologies. In addition, this project will determine any long-term driver behavior changes, including unintended consequences (e.g., increased rate of multitasking). NHTSA intends to use these results to promote technology deployment, gauge driver acceptance, improve the prediction of crash benefits, identify factors that could increase benefits and minimize any possible adverse effects, and provide support for potential rulemaking and performance standards.

Status: NHTSA is in the planning stages of this project. The final report is expected to be published in Q4 2013.

3. *Assess distraction monitoring systems.* Systems that monitor drivers and provide feedback have been shown to have the potential to increase traffic safety, especially in vehicle fleets.²⁴ In regard to distraction monitoring, such a system may help drivers reduce the frequency and duration of multitasking while driving. NHTSA expects to identify real-time distraction detection methods and investigate different interfaces and methods for providing feedback to the driver. The value of this feedback will be assessed by whether appropriately designed displays can help drivers improve their focus on the driving task. This research involves developing a set of metrics that will allow the comparison of distraction monitoring/mitigation systems.

Expected Outcomes: The research will provide NHTSA with a set of testing protocols to evaluate/compare distraction monitoring/mitigation systems. These protocols will then be available for use in estimating the benefits of each system.



²⁴ Misener, J. A., et al. (2007, December). Onboard monitoring and reporting for commercial motor vehicle safety, FMCSA-RRT-07-030. Washington, DC: Federal Motor Carrier Safety Administration.



Status: This is an ongoing project, with a final report expected to be published in Q2 2011.

4. *Assess effectiveness (technical and behavioral) of software cell phone filters.* Cell phone filters are an emerging technical option in managing distraction. The software, which can be downloaded to a cell phone, has thresholds past which calls are not sent through to the driver but instead sent to voicemail; text messages are also blocked. NHTSA is planning a research program that would not only verify whether the programs work as designed but investigate the behavioral aspects, specifically whether people will voluntarily use these programs.

Expected Outcomes: The research will provide NHTSA with an estimate of the effectiveness of these filters. Specifically, NHTSA will better understand the technical capabilities and limitations of these technologies, and how willing people are to use the cell phone filter software. This information can then be used to assess the overall feasibility of these as a countermeasure for distracted driving.

Status: NHTSA is in the planning stages of this project. The final report is expected to be published in Q4 2011.

Initiative 4: Recognize Risks and Consequences

Background

Multitasking is a natural aspect of human behavior. Understanding the nature and extent of risk involved in newer forms of multitasking while driving is critical to modifying driver behavior to reduce these new forms of risk. Drivers clearly do not understand the ways in which use of new technologies increase crash risk, or of how their behaviors contribute to risky driving. A detailed understanding of driver risk taking behaviors, the factors that determine a driver's willingness to engage in distracting behaviors, and what knowledge, incentives, or legal restrictions are most effective in improving driver safety will inform the development of effective and acceptable programs to change unsafe driver behaviors. This research may also investigate how drivers can learn to better recognize their impairment due to distraction. This research listed below can be tailored to the safety problems of specific driving populations, such as teen drivers and commercial fleet drivers. The findings could support guidance to legislators, driver educators, safety professionals, and drivers.

Programs to Support Initiative 4

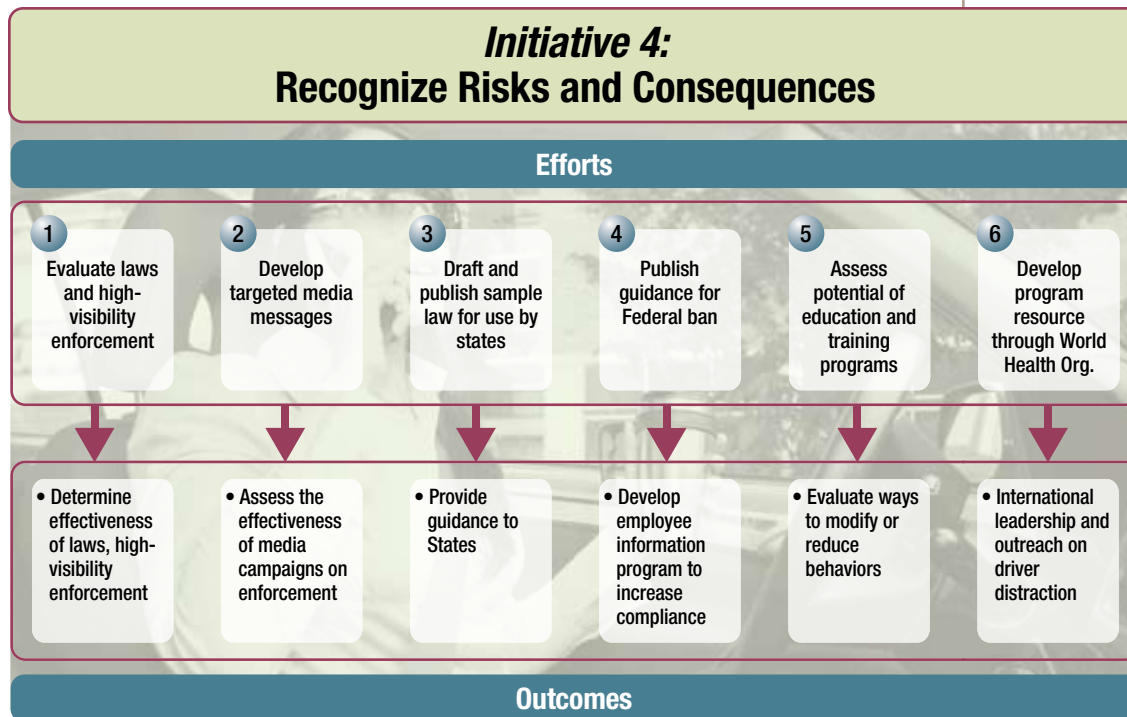


Figure 5: Tasks and Outcomes for Initiative 4



1. *Evaluate laws and high-visibility enforcement.* High-visibility enforcement campaigns such as NHTSA's annual *Click It or Ticket* seat belt mobilizations are proven countermeasures to change drivers' behaviors.^{25 26} They are effective because they increase a driver's perception of the likelihood of being ticketed for violating a particular traffic safety law. High-visibility enforcement programs combine active law enforcement with paid media advertising that emphasizes the heightened enforcement. In *Click It or Ticket*, the message is "wear your seat belt or you will get a ticket." NHTSA is planning to test the high-visibility enforcement model by applying it in a distracted driving demonstration project in two cities (Syracuse, NY, and Hartford, CT) that have laws banning handheld cell phone use while driving.

Expected Outcomes: The results will provide a preliminary indication of the effectiveness of laws and high visibility enforcement to raise public awareness about the risks of distracted driving and to alter driver behavior to reduce the incidence of distracted driving.

Status: This is an ongoing project, with a final report expected to be published in Q3 2011.

2. *Develop targeted media messages.* Driving while distracted increases the likelihood of a crash,²⁷ and recent well publicized events have brought this unsafe driving behavior to the forefront of the public eye. Cell phone subscriptions have grown exponentially from 1988 through 2009. About 89 percent, or 276.6 million of all Americans, have a cell phone, according to CTIA – The Wireless Association.²⁸ For many, it is the only kind of telephone they possess. In a recent NHTSA survey, most people (77%) reported that they talk on the phone while driving at least some of the time.²⁹ NHTSA will develop and test new targeted media messages to support high visibility enforcement demonstration programs. The goals of the messages are to educate the driving public about the increased risks when using electronic devices while driving and the reasons for increased enforcement of State laws that ban cell phone use or text messaging while driving. To promote these themes, paid media messages are being developed for television, cable, Internet, and radio broadcast.

²⁵ Solomon, M. G., Ulmer, R. G., & Preusser, D. F. (2002). Evaluation of *Click It or Ticket* Model Programs. DOT HS 809 498. Washington, DC: National Highway Traffic Safety Administration.

²⁶ NHTSA. (2009). Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices, Fourth Edition. DOT HS 811 081. Washington, DC: National Highway Traffic Safety Administration.

²⁷ Ascone, *ibid.*

²⁸ CITA 2009 report available at www.ctia.org

²⁹ NHTSA. (2008). 2007 Motor Vehicle Occupant Safety Survey, Volume 4: Crash Injury and Emergency Medical Services Report. DOT HS 810 977. Washington, DC: National Highway Traffic Safety Administration

Expected Outcomes: NHTSA's new distracted driving media messages will support two high-visibility enforcement demonstration campaigns beginning in early 2010. Once shown effective, NHTSA plans to make available these distracted driving paid advertisements for use by other States that want to address these problems.

Status: This is an ongoing project, with a final report expected to be published in Q3 2011.

3. *Draft and publish a sample texting law for use by States.* As of March 2010, 21 States have enacted bans against text messaging while driving for all drivers and 9 States have partial bans that cover only some, such as novice drivers. Six States have laws that ban the use of hand-held cell phones while driving. The provisions of these laws vary widely with some so specific that they would make it extremely difficult to enforce or successfully prosecute in a court of law or the penalties so mild that there is little fear of enforcement. Developing a sample law to ban text messaging while driving based on the consensus of traffic safety experts will help State legislators to enact more effective distracted driving laws and will create more uniform legal policies and procedures across the country.

Expected Outcomes: NHTSA will provide guidance to States by publishing a sample law to ban text messaging in conjunction with other traffic safety organizations. This law can then be implemented by the States in an effort to reduce text messaging-related crashes.

Status: This is an ongoing project, with a sample law expected to be published in Q2 2010.

4. *Publish guidance for Federal ban.* On October 1, 2009, President Barack Obama issued an Executive Order directing all Federal employees not to engage in text messaging when driving a government-owned vehicle, or when driving a personally owned vehicle while on official Government business. Furthermore, the Executive Order prohibits Federal employees from using electronic equipment supplied by the Government while they are driving. NHTSA will develop an employee information program geared toward educating Federal employees about the text messaging ban. Initially, the program will be administered within the DOT, but will be made available to the entire Federal workforce.

Expected Outcomes: NHTSA plans to develop a model employee information program to increase compliance with the new ban against text messaging by Federal employees while on official business.

Status: This is an ongoing project, with a final guidance document expected to be published in Q3 2010.





5. *Assess potential of education and training programs.* Young drivers are much more likely than experienced drivers to divert their gaze away from the forward roadway for longer than 2 seconds while they are engaged in secondary tasks as shown in simulator,³⁰ controlled road,³¹ and naturalistic studies.³² Recent research demonstrates that training programs using simulated driving can teach young, novice drivers to maintain their forward gaze while multitasking.³³ NHTSA intends to direct future research toward the assessment of how well these training programs transfer to real-world driving situations; whether the behavior change observed during training transfers to real-world driving and can reduce crash risk. Another avenue of research is assessing how well training programs help novice drivers anticipate hazards before they become a source of potential conflict. Training appears to alter simulated driving behavior, and planned research will determine whether this generalizes to actual driving behavior.

Expected Outcomes: Greater understanding of the ways in which multitasking elevates crash risk and ways to modify or reduce inappropriate multitasking behavior may alter driver attitudes toward and willingness to engage in distracting tasks while driving. Information gathered for this initiative will enhance development of more effective education and training programs that reduce distracted driving.

Status: This is an ongoing project, with a final report expected to be published in Q3 2011.



6. *Develop Driver Distraction Program Resource through World Health Organization.* The proliferation of wireless personal communications combined with rapidly expanded use of personal motor vehicles in developing nations raises transportation safety concerns world-wide. The DOT is working with the U.S. State Department to provide global leadership and technical assistance regarding driver distraction.

Expected Outcomes: Adoption of effective policies and programs worldwide to reduce driver distraction and consequent crashes, injuries, and deaths.

Status: This is an ongoing project, with a final report expected to be published in Q3 2011.

³⁰ Chan, E., Pradhan, A. K., Knodeler, M. A. Pollatsek, A., & Fisher, D. L. (2008). Empirical Evaluation on a Driving Simulator of the Effect of Distractions Inside and Outside the Vehicle on Drivers' Eye Behaviors. *Proceedings of the 87th Transportation Research Board Annual Meeting*. CD-ROM. Washington, DC: National Research Council.

³¹ Wikman, A., Nieminen, T., & Summala, H. (1998). Driving experience and time-sharing during in-car tasks on roads of different width. *Ergonomics*, 43(3), 358-372.

³² Klauer, *ibid.*

³³ Fisher, D. (2008). Evaluation of PC-Based Novice Driver Risk Awareness. DOT HS 810 926. Washington, DC: National Highway Traffic Safety Administration.

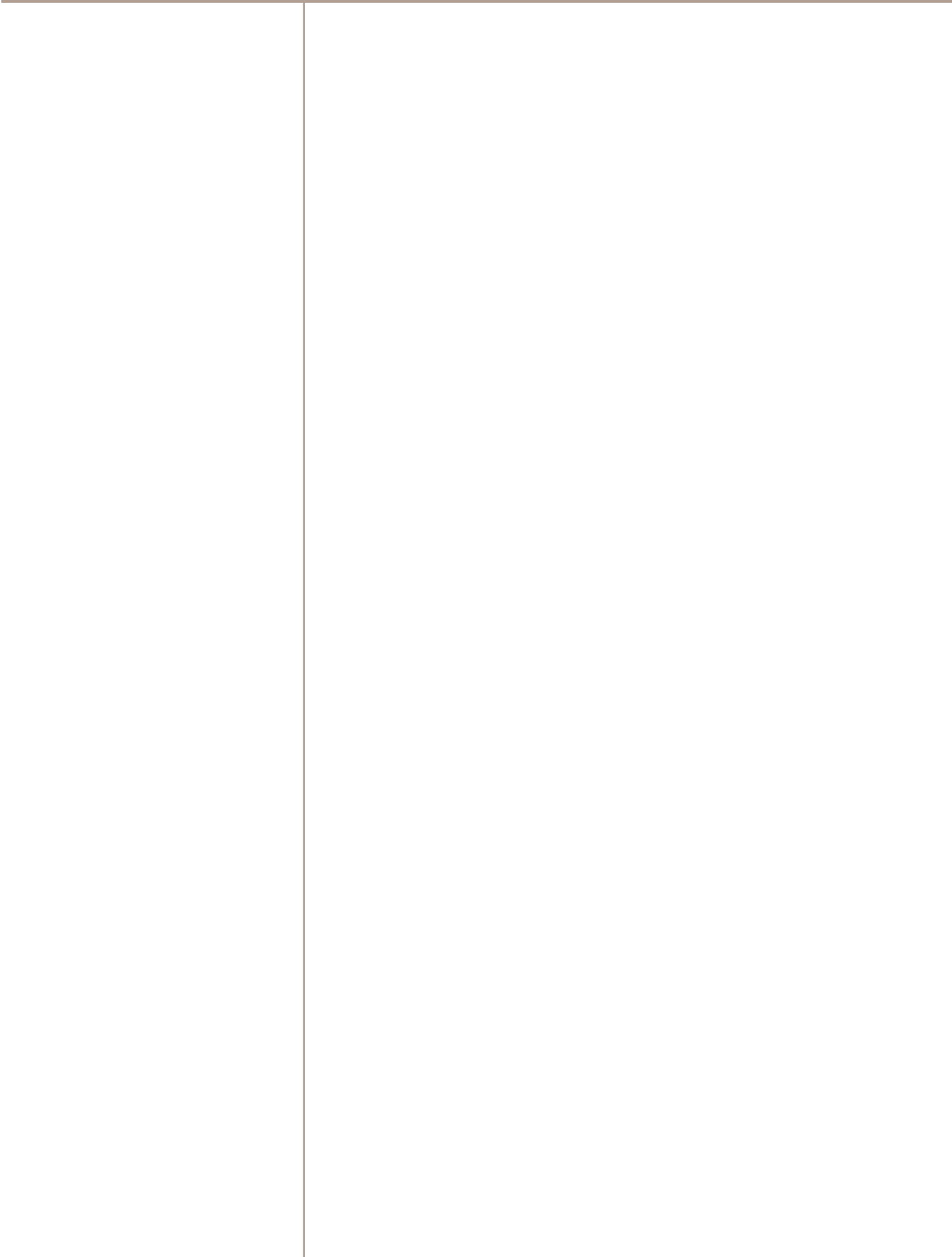
Summary

This document outlines NHTSA's plans for distraction research. To tackle this complex problem, four initiatives have been outlined in this document:

1. Improving the understanding of the problem,
2. Reducing driver workload from in-vehicle systems (interfaces),
3. Keeping distracted drivers safe, and
4. Increasing public awareness to recognize the risks and consequences of distracted driving.

This Plan reflects both ongoing and planned research. At the conclusion of each project the results will be made available on the NHTSA Web site. Some of the projects will also provide additional public benefit, such as media messages to warn of the dangers of distracted driving.

NHTSA is confident that this comprehensive approach, in addition to the contributions from other stakeholders, will move us toward our ultimate goal: eliminating distraction-related crashes.



DOT HS 811 299
April 2010



U.S. Department of Transportation
**National Highway Traffic Safety
Administration**

