

Information Collection Request Supporting Statement: Section A In-Vehicle Drowsiness Detection and Alerting

The National Highway Traffic Safety Administration (NHTSA) proposes to collect information from licensed drivers to determine (1) their eligibility to participate in a study evaluating procedures designed to detect and mitigate drowsy driving, (2) their driving performance during a simulated driving task to measure lane departure warning and drowsiness mitigation system effectiveness, and (3) their opinions about the safety systems and their perceptions of the benefits.

Drowsy driving poses a significant safety risk. The development and refinement of driver state detection systems promises the ability to detect drowsiness and prevent crashes. However, while various approaches to driver state detection show promise (e.g. Lee et al. 2013; Schwarz et al. 2015), the problem of how the vehicle should respond remains unanswered. To assess the efficacy of different countermeasures, it is necessary to develop experimental methods that replicate the motivational conditions associated with drowsy driving while keeping drivers in a controlled and safe environment.

The objective of this study is to compare the impact of in-vehicle drowsiness countermeasures in a driving simulator. This study will add to the state of knowledge by systematically comparing drowsy drivers' performance in a simulation that incorporates lane departure warnings and a drowsiness mitigation system to performance of participants without such systems.

A.1. Explain the circumstances that make the collection of information necessary. Identify any legal or administrative requirements that necessitate the collection.

a. Circumstances making the collection necessary

NHTSA was established to reduce the number of deaths, injuries, and economic losses resulting from motor vehicle crashes on the Nation's highways. As part of this statutory mandate, NHTSA is authorized to conduct research as a foundation for the development of traffic safety programs. This collection of information is necessary to evaluate the effectiveness of in-vehicle countermeasures for drowsy driving. In 2014, NHTSA attributed 846 crash fatalities (2.6% of total fatalities) to drowsy driving. A recent study found 28% of drivers reported having driven drowsy in the last month. While recent research has identified methods for detecting drowsiness with vehicle- and driver-based sensors, limited research has investigated countermeasures for drowsiness, particularly in drives lasting over one hour under the conditions where drowsy driving crashes tend to occur. This request is for OMB approval of a research study to investigate the effectiveness of in-vehicle drowsiness countermeasures in a driving simulator.

b. Statute authorizing the collection of information

Title 23, United States Code, Chapter 4, Section 403 authorizes the Secretary of Transportation to conduct research and development activities, including demonstration projects and the collection and analysis of highway and motor vehicle safety data and related information needed to carry out this section, with respect to all aspects of highway and traffic safety systems and conditions relating to - vehicle, highway, driver, passenger, motorcyclist, bicyclist, and

pedestrian characteristics; accident causation and investigations; and human behavioral factors and their effect on highway and traffic safety, including distracted driving. [See 23 U.S.C. 403(b)(1)(A)(i), 23 U.S.C. 403(b)(1)(A)(ii), 23 U.S.C. 403(b)(1)(B)(iii)].

A.2. Indicate how, by whom, and for what purpose the information is to be used. Except for a new collection, indicate the actual use the agency has made of the information received from the current collection.

The University of Iowa will conduct this study under a task order on an Indefinite Deliverable Indefinite Quantity contract with NHTSA. Study participation will be voluntary and solicited via email advertisements. The research team at the National Advanced Driving Simulator at the University of Iowa will collect data. Potential participants will complete a phone screening (FORMS 1441) to determine eligibility to participate in the study.

For those eligible to participate in the study, a research team member will make appointments for a screening session and answer any questions participants may have about the study. During the screening session, potential participants will come to the National Advanced Driving Simulator where a research team member will review study procedures and obtain signatures on an informed consent document approved by the University of Iowa Institutional Review Board (FORM 1443). Participants will then complete a short drive in the driving simulator to evaluate simulator sickness and complete a wellness survey (FORM 1444) to evaluate symptoms. Drivers who show symptoms of simulator sickness will be excluded from further participation and compensated for their time.

The sample will consist of 75 young male drivers between the ages of 21 and 30. Previous epidemiological research has shown that this group of drivers is overrepresented in drowsy driving crashes. The 75 consented participants will complete a screening visit lasting one hour and a study visit lasting nine hours. Prior to the study visit, participants will be asked to wear an activity monitor and to complete a food and activity log (FORM 1445) to confirm that they are awake by 8 AM the day of the visit and do not sleep during the day or consume caffeine after 1 PM. Participants will arrive at the lab at 11 PM, complete a sleep and food intake survey (FORM 1446) and remain awake until starting the study drive at 2 AM. During this time, participants will complete subjective sleep questionnaires (FORM 1447) every thirty minutes. Participants will then drive the simulator for four hours, from 2 AM to 6 AM, to assess the effectiveness of drowsiness countermeasures. During the drives, participants will have the option to stop to rest. During rest breaks, participants will complete the subjective drowsiness survey (FORM 1448) to evaluate drowsiness. Following the drive, participants will complete a questionnaire (FORM 1449A, B, or C depending on the countermeasure condition to which participants are randomly assigned) to understand their acceptance, trust, and perceptions of the drowsiness countermeasure they experienced in the study drive.

The information collected is to be used by University of Iowa researchers. This information will support the evaluation of driver drowsiness countermeasures. Additional information collected will inform us whether our driver state detection algorithm functioned appropriately. Questions regarding drowsy driving and sleep habits will allow us to improve our drowsiness detection algorithms and countermeasures, as necessary.

A.3. Describe whether, and to what extent, the collection of information involves the use of automated, electronic, mechanical or other technological collection techniques or other information technology. Also describe any consideration of using information technology to reduce burden.

The NADS participant registry, an electronic database of individuals who have participated in previous studies or expressed interest in participating, will be used to recruit participants. Participants will be recruited by phone or email. Questionnaire data will be collected electronically using electronic forms via Qualtrics (<https://uiowa.qualtrics.com>). Data from the simulator are recorded and backed up automatically. Computer programs (MatLab and R) will be used to reduce simulator data to summary measures (e.g., means, standard deviations) and to perform statistical analyses and generate results figures.

A.4. Describe efforts to identify duplication. Show specifically why any similar information, already available cannot be used or modified for use for the purposes described in Item 2 above.

Information from previous related studies was used to develop the algorithms for this study. The simulator drives used in this study will be three hours longer than those in previous studies, to better replicate real-world drowsy driving situations. The research literature contains few driving studies evaluating the effectiveness of drowsiness countermeasures in drives longer than one hour. This information collection is necessary to aid our understanding of how in-vehicle technology changes drowsy driver behavior during longer drives.

A.5. If the collection of information involves small businesses or other small entities, describe the methods used to minimize burden.

The collection of information does not involve small businesses except insofar as data collection activities will be supported by a small business contractor to NHTSA.

A.6. Describe the consequence to Federal program or policy activities if the collection is not conducted or is conducted less frequently, as well as any technical or legal obstacles to reducing burden.

This information will be collected once. Evaluating in-vehicle drowsiness countermeasures requires testing them in a manner that approximates the conditions in which drowsy driving crashes occur. That is, if these data are not collected, it will not be possible to understand the effectiveness of drowsiness countermeasures over four-hour drives.

A.7. Explain any special circumstances that require the collection to be conducted in a manner inconsistent with the guidelines set forth in 5 CFR 1320.6.

No special circumstances require the collection to be conducted in a manner inconsistent with the guidelines in 5 CFR 1320.6.

A.8. Provide a citation for the FEDERAL REGISTER document soliciting comments on this collection of information, a summary of all public comments responding to the notice, and a description of the agency's actions in response to the comments. Describe efforts to consult with persons outside the agency to obtain their views.

A copy of the 60-day Federal Register Notice, which notified the public of NHTSA's intent to conduct this information collection and provided a 60-day comment period, was published on Date: May 17, 2018 (Vol. 83, No. 96, Pages 23040 - 23042). No comments were entered into the NHTSA docket in response to the 60-day Federal Register Notice. A 30-day Federal Register Notice was published on August 8, 2018 (Vol. 83, No. 153, Pages 39155 - 39156).

A.9. Explain any decision to provide any payment or gift to respondents, other than remuneration of contractors or grantees.

Participants will be offered \$150 as compensation for completing the study. Pay will be pro-rated at \$15/hour. Compensation will be \$15 for the screening visit and \$135 for the study visit. Past experience indicates that anything less than \$150 total compensation would likely result in a failure to recruit enough participants given that the simulator drives begin at 2:00 a. m. and last up to four hours.

A.10. Describe any assurance of confidentiality provided to respondents

As stated in the consent form, no individual results or personal information will be published. Published documents will provide only summary statistics that cannot be used to identify an individual. Links between individual names and study numbers will be securely stored according to the provisions of the University of Iowa Institutional Review Board. Participants will sign a video release form allowing video image and auditory data to be publicly released, either separately or in association with the appropriate engineering data for scientific, regulatory, educational, outreach, legislative, or research purposes.

A.11. Provide additional justification for any questions of a sensitive nature, such as sexual behavior or attitudes, religious beliefs, and other matters that are commonly considered private.

We inquire about general health history as a safety precaution to screen for conditions that could prove dangerous to the individual or a research staff member. The responses to these health history questions are not recorded, but simply used as a screening tool.

A.12. Provide estimates of the hour burden of the collection of information on the respondents.

The total estimated burden to complete the collection of information will be 827.5 hours.

Number of Respondents: We will contact 120 individuals for the phone-screening portion of the study. Eighty-five individuals will be screened, and 75 will be enrolled in the study drive to obtain the desired 75 completed data sets.

Estimated Burden on Respondents:

Form	Participants	Min./Participant	Estimated Burden in hours
Qualification			
Phone Screening	120	15	
Total	120	15	30
Screening			
Consent Form	85	20	
Training Presentation	85	15	
Screening Drive	85	15	
Wellness Survey	85	10	
Total	85	60	85
Testing			
Sleep and Food Intake Survey	75	10	
Activity Log	75	30	
Wait for Study Drive	75	255	
Training Presentation	75	5	
Stanford Sleepiness Scale	75 x 10 instances	10	
Study Drive	75	240	
Drive Break Survey	75 x 2 instances	10	
Post-Drive Survey	75	10	
Total	75	570	713 hours
Total Burden			828 hours

Estimates of the individual components are provided below:

FORM 1441 Phone Screening ensures that respondents are eligible for participation. We will approach 120 individuals to achieve a target of 85. Also ensures that participants are self-described “morning people,” as part of the phone screening. Respondents will take approximately 15 minutes to complete the questions resulting in a burden of 30 hours.

FORM 1443 Consent Form describes the study procedures and potential risks of participation. We will screen 85 individuals to achieve a target of 75. Participants will take approximately 20 minutes to complete the form, resulting in a burden of 28 hours and 20 minutes.

Training Presentation provides a summary of the screening drive prior to the participant entering the simulator. We will screen 85 individuals to achieve a target of 75. Participants will take approximately 15 minutes to complete the presentation, resulting in a burden of 21 hours and 15 minutes.

Screening Drive acclimates participants to the driving simulator and screens for simulator sickness. We will screen 85 individuals to achieve a target of 75. Participants will take approximately 15 minutes to complete the task, resulting in a burden of 21 hours and 15 minutes.

FORM 1444 Wellness Survey evaluates symptoms of simulator sickness immediately after the screening drive. We will screen 85 individuals to achieve a target of 75. Participants will take approximately 10 minutes to complete the form, resulting in a burden of 14 hours and 10 minutes.

FORM 1446 Sleep and Food Intake Survey records the time of last caffeine, meal, and duration and times of sleep and naps. We will enroll 75 individuals. Participants will take approximately 10 minutes to complete the form, resulting in a burden of 12 hours and 30 minutes.

FORM 1445 Activity Log records sleep, activity, and food/beverage intake in the twenty-four hours prior to the study visit. We will enroll 75 individuals. Participants will take approximately 30 minutes total to complete the log, resulting in a burden of 37 hours and 30 minutes.

Wait for Study Drive is the time between participants arriving for the study and beginning the study drive, during which they can engage in tasks such as reading or watching movies, but not sleep. We will enroll 75 individuals to achieve a target of 75. Participants will wait approximately 255 minutes, resulting in a burden of 318 hours and 45 minutes.

Training Presentation provides an overview of the study drive procedures and drowsiness countermeasures. We will enroll 75 individuals. Participants will take approximately 5 minutes to complete the presentation, resulting in a burden of 6 hours and 15 minutes.

FORM 1447 Stanford Sleepiness Scale evaluates self-rated sleepiness on a scale from 1 to 7, recorded every half hour as participants wait for the study drive and immediately before and after the drive. We will enroll 75 participants who will take the survey ten times for 1 minute to complete the survey, resulting in a total burden of 12 hours and 30 minutes.

Study Drive is the main experiment in the driving simulator to test the effects of in-vehicle drowsiness countermeasures on driving behavior. We will enroll 75 individuals. Participants will take 240 minutes to complete the study drive, resulting in a total burden of 300 hours.

FORM 1448 Drive Break Survey is administered during voluntary breaks in the drive to evaluate participants' rationale for resting. We will enroll 75 individuals. Participants are expected to take an average of two breaks and five minutes to complete the survey, for a total burden of 12 hours and 30 minutes.

FORM 1449 (A, B, C) Post-Drive Survey evaluates decision making throughout the study drive and preferences toward the drowsiness countermeasure. We will enroll 75 individuals. Participants will take approximately 10 minutes to complete the form, for a burden of 12 hours and 30 minutes.

A.13. Provide an estimate of the total annual cost to the respondents or record keepers resulting from the collection of information.

There will be no start-up or record-keeping costs to participants to obtain these data. Participation is voluntary and nobody will be required to participate. Subjects will be compensated for their time and effort for participating in the study procedures, so there will be no costs for participating. Using the national average hourly wage of \$26.92 (Bureau of Labor Statistics, 2017), the study would take 828 hours at an estimated cost of about \$22,300.

A.14. Provide estimates of the annualized cost to the Federal Government.

Total estimated cost to the Government for this one-time information collection is \$427,085. Since data collection will take less than a year, the annualized cost is the same.

A.15. Explain the reasons for any program changes or adjustments in Items 13 or 14 of the OMB 83-I.

The collection of this information is associated with a new project. As such it requires a program change to add the estimated 828 hours for the new collection to NHTSA's existing burden.

A.16. For collection of information whose results will be published, outline plans for tabulation and publication.

The current plan is for the contractor to produce a draft technical report in 2019 with publication of a final technical report in 2020. The technical report will provide summary statistics and tables as well as the results of statistical analysis of the information, but it will not include any personal information.

A.17. If seeking approval to not display the expiration date for OMB approval of the information collection, explain the reasons that display would be inappropriate.

NHTSA will display the expiration date for OMB approval.

A.18. Explain each exception to the certification statement identified in Item 19, "Certification for Paperwork Reduction Act Submissions" of the OMB Form 83-I.

No exceptions to the certification are made.