



## DEPARTMENT OF TRANSPORTATION

### National Highway Traffic Safety Administration

[Docket No. NHTSA-2025-0059]

#### Agency Information Collection Activities; Notice and Request for Comment; Distraction:

#### Modern Voice Command Interfaces

**AGENCY:** National Highway Traffic Safety Administration (NHTSA), Department of Transportation (DOT).

**ACTION:** Notice and request for comments on a request for approval of a new collection of information.

**SUMMARY:** In compliance with the Paperwork Reduction Act of 1995 (PRA), this notice announces that the Information Collection Request (ICR) summarized below will be submitted to the Office of Management and Budget (OMB) for review and approval. The ICR describes the nature of the information collection and its expected burden. This document describes a collection of information for which NHTSA intends to seek OMB approval to conduct research on safety-related aspects of voice command interfaces (VCIs), specifically how VCIs affect distracted driving behavior and cognitive workload. A Federal Register Notice with a 60-day comment period soliciting comments on the following information collection was published on February 10, 2026. NHTSA received four comments. Study improvements resulting from comments received do not affect the burden calculation..

**DATES:** Comments must be submitted on or before [INSERT DATE 30 DAYS AFTER THE DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**ADDRESSES:** Written comments and recommendations for the proposed information collection, including suggestions for reducing burden, should be submitted to the Office of Management and Budget at [www.reginfo.gov/public/do/PRAMain](http://www.reginfo.gov/public/do/PRAMain). To find this particular

information collection, select “Currently under Review – Open for Public Comment” or use the search function.

**FOR FURTHER INFORMATION CONTACT:**

For additional information or access to background documents, contact Jeffrey Dressel Office of Vehicle Safety Research, Human Factors/Engineering Integration Division NSR-310, West Building, U.S. Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC 20590; jeffrey.dressel@dot.gov, 202-493-0492.

**SUPPLEMENTARY INFORMATION:**

Under the PRA (44 U.S.C. 3501 *et seq.*), a Federal agency must receive approval from the Office of Management and Budget (OMB) before it collects certain information from the public and a person is not required to respond to a collection of information by a Federal agency unless the collection displays a valid OMB control number. In compliance with these requirements, this notice announces that the following information collection request will be submitted OMB.

***Title:*** Distraction: Modern Voice Command Interfaces

***OMB Control Number:*** New data collection

***Form Number(s):***

- NHTSA Form 2071; Eligibility Questionnaire
- NHTSA Form 2072; Scheduling Form
- NHTSA Form 2073; Pre-Study Materials
- NHTSA Form 2074; Appointment Confirmation Form
- NHTSA Form 2075; Informed Consent Document
- NHTSA Form 2076; Daily Health Survey
- NHTSA Form 2077; Simulator Sickness Questionnaire (SSQ)
- NHTSA Form 2078; Task Novelty Assessment
- NHTSA Form 2079; Debrief

***Type of Request:*** New information collection

***Type of Review Requested:*** Regular

***Requested Expiration Date of Approval:*** Three years from date of approval

***Summary of the Collection of Information:*** The National Highway Traffic Safety

Administration (NHTSA) is seeking approval to collect information from the public as part of an effort to understand the effects of currently or near-to deployed (modern) voice command interfaces (VCIs) in vehicles. The research compares multiple tasks across prominent VCI systems to identify the effects on cognitive workload and distraction.

Participation in the research involves one study session at Dynamic Research, Inc. (DRI) to complete a series of drives in a driving simulator. Participants will complete tasks using a voice command interface (VCI) system that they are familiar with in a vehicle model they drive regularly. Data collection will involve human-subjects data collection and all data collection procedures will be approved by DRI's Institutional Review Board (IRB). Data collection will only begin upon receipt of PRA clearance. Data collection will occur in four phases, one phase for each vehicle that must be installed and instrumented in the driving simulator.

Data from a final sample of 144 participants will be used to compare the six VCI systems, resulting in 24 participants per VCI system group. The researchers anticipate participant attrition at several steps of the recruitment process. First, a recruitment survey (NHTSA Form 2071: Eligibility Questionnaire) will be sent to potential respondents in DRI's participant database as well as posted on social media sites to aid in the recruitment process (n = 1330 respondents). Next, 198 individuals will be identified based on eligibility and counterbalancing criteria and invited to schedule a session and complete pre-study forms. The researchers anticipate an attrition rate of 10 percent with 178 participants completing NHTSA Form 2072: Scheduling Form, NHTSA Form 2073: Pre-Study Materials and NHTSA Form 2074: Appointment Confirmation Form. Upon arriving to the study session, the researchers expect 17 participants will experience simulator sickness based on prior research, resulting in a sample size of 160 for completion of the study. Informed by previous research, 16 participants (10 percent) are

expected to be removed from the final dataset due to problems with data quality, leaving a final sample size of 144 participants.

As indicated, participants will be recruited from DRI's participant database, as well as the general populace as needed. Participants will be restricted to individuals who have experience with the targeted system/vehicle model being evaluated in the data collection, possess normal or corrected-to-normal vision and hearing, are 18-70 years old, are fluent in English, possess a valid driver's license, drive a predefined number of miles per year, are able to participate in the study for 2.5 hours, can abstain from alcohol, recreational and illicit substances for the 12 hours before the data collection session, have no medical condition that limits or restricts driving and lack of motion sickness, require no special driving equipment, have had no seizures within six months, not using sedatives or psychotropic medications, and not pregnant. Sociodemographic characteristics will be balanced between groups as outlined in the NHTSA Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices.

Participants will physically sign NHTSA Form 2075: Informed Consent Document the day of their session, before beginning the experiment. Participants will complete Intake Procedures, including NHTSA Form 2076: Daily Health Survey to ensure that participants are feeling well enough to participate, correctly reported their age and sex (for balancing of conditions), and complete a driving simulator familiarization drive. The study involves participants driving a vehicle model (in a simulated environment) that they are familiar with and using a VCI and a manual interface to accomplish a series of tasks. Currently, nine drives are planned, including one simulator familiarization drive, and eight study drives. Study drives consist of seven task drives, and one safety-critical event (SCE) drive. The task drives will be counterbalanced to control for order effects. Due to the possibility of subsequent driver behavior change post the SCE, the SCE drive will occur last. Participants will also be randomized into completing a VCI task or visual-manual task during the SCE. The SCE event is anticipated to be a covered-to-revealed road obstruction requiring participant intervention, such as braking to avoid a crash.

Participants will undergo training before each task drive to ensure understanding and execution ability. Tasks will consist of three common tasks executed with the VCI, the same three tasks executed manually using the touchscreen interface, and one unique task that is not shared among the other systems only to be completed through the VCI. An example task would be navigating to a nearby grocery store and adding a waypoint to an enroute gas station. After each training session, participants will be asked a one-item question to ascertain task novelty.

The tasks may change slightly based on the capabilities of VCI systems and interfaces after PRA approval, however, anticipated burden will not change. Similarly, vehicles will be chosen based on system availability including Android Auto, Apple CarPlay, Google Built-In as well as the functionality of the original equipment manufacturer (OEM) systems. The researchers anticipate assessing six systems across four vehicles identified based on both the annual technology scan and the ability to recruit participants that regularly use that system. The six systems will consist of three third-party systems (Android Auto, Apple CarPlay, Google-Built-In), and three OEM systems.

During training prior to the task drives, the researchers will document and classify the types of errors made to answer one of NHTSA's research questions. The researchers will collect data to ascertain the effects of each task on both driver performance, distraction, and cognitive workload. Metrics of driver performance include standard deviation of lane position (SDLP), standard deviation of speed (SDS), and speed differential (SDf). Driver distraction metrics are gathered from eye-tracking data, including mean glance duration (MGD) of, total glance time (TGT), and the proportion of long glances (PLG) that are longer than two seconds, all of which are calculated per NHTSA's distraction guidelines. Cognitive workload will be assessed via pupil diameter (PD), heart rate variability (HRV), and tactile detection response task (TDRT) miss rate and response time.

***Description of the Need for the Information and Proposed Use of the Information:***

NHTSA's mission is to save lives, prevent injuries, and reduce the economic costs of road traffic crashes through education, research, safety standards, and enforcement activity. As vehicle technologies advance, they have the potential to dramatically reduce the loss of life each day in roadway crashes. Alternatively, the systems may not reach this potential or could potentially decrease safety when drivers do not understand how to safely interact with the systems or do not understand the capabilities and limitations. This new information collection request is for single study to understand the effects of voice command interfaces on driver cognitive workload and distraction across the most common VCI systems. This research supports NHTSA's mission of safety.

- **NHTSA Form 2071; Eligibility Questionnaire** – This questionnaire establishes whether participants are eligible to participate. The components include (1) a PRA statement informing participants about the rules governing federally funded research; (2) a privacy notice of data collected and used per California state laws; (3) consent for eligibility questionnaire and study introduction and description to inform participants about the study specific data to be collected; (4) eligibility questionnaire to identify participants based on eligibility criteria; (5) general health questionnaire to identify potential health concerns that prevent participation; and (6) contact information for scheduling purposes. To participate in the study, individuals must have experience with the system/vehicle, have normal or corrected-to-normal hearing, be 18-70 years old, meet specific vision requirements (e.g., wear contacts while driving), English fluency, possess a valid driver's license, drive a predefined number of miles per year, have the ability to participate in the study for 2.5 hours, abstain from alcohol, recreational and illicit substances for 12 hours before the session, have no medical conditions that limit or restrict driving and lack of motion sickness, require no special driving equipment, have no history of seizures within six months, not taking sedatives or psychotropic medications, have a valid social security number or tax identification number, are not pregnant. Among those deemed eligible, the

researchers will ensure a balanced representation of ages and sex. The researchers anticipate 330 responses from DRI's driver database and 1000 responses from external sources (e.g. social media), with an average completion time of 10 minutes.

- **NHTSA Form 2072; Scheduling Form** – This form is required as it serves to establish potential participant interest in participating and scheduling a session. The data collected consists of the participant's name, study date, and time. This is an email sent to eligible participants to confirm their interest in participating in the study. The researchers anticipate contacting 198 potential participants to schedule a session, of which 178 are expected to follow through to form completion and session scheduling. The researchers anticipate six minutes to complete scheduling. This includes one minute to read the email and an average of five minutes to review their schedule and select timeslots. A link to the vehicle's manufacturer privacy policy per NHTSA's connected vehicles recommendation is provided. Participants are not required to review it, so it was not calculated into the burden estimate.
- **NHTSA Form 2073; Pre-Study Materials** – This form is required as it provides participants with (1) a privacy notice for describing types and purposes of data collection per California state law (read), (2) a confidentiality agreement to protect proprietary DRI information and technology (read and sign), (3) a copy of the informed consent for participant records (signatures will be obtained at the scheduled session), (4) an indemnification form to hold DRI harmless and allow participation in the study (read and sign), (5) a general information questionnaire to collect participant information (i.e., mailing address, demographic information, health condition). Participants will also receive a copy of the informed consent for their record. The researchers anticipate that it will take nine minutes to read and complete the Pre-Study Materials that is administered to all 178 participants.

- **NHTSA Form 2074; Appointment Confirmation Form** – This form is required to remind participants of their scheduled study session, which will be emailed 48 hours before the appointment. The email is anticipated to take 1 minute to read and will be sent to all 178 participants. Participants will be asked to respond to the email confirming their attendance, and a researcher will collect their response and store it for reference before the study session. This information will consist of the participant's name, whether they affirmed attendance, and an alternative study session date and time, if necessary. This email contains the link to the pre-study materials (see above) and a reminder that they must be completed before the study. A link to the vehicle's manufacturer privacy policy per NHTSA's connected vehicles recommendation is provided. Participants are not required to review the manufacturer privacy policy, so it was not calculated into the burden estimate.
- **NHTSA Form 2075; Informed Consent Document** – This form is required as it provides the participants with the description of the study, informs the participants of their rights during the study, and obtains written informed consent. The informed consent document will be printed on paper for participants to physically sign at the beginning of their session. The researchers expect the informed consent process to last 17 minutes.

**Intake Procedures**– The intake process is required to ensure participant information for compensation, as well as review the driver's license to confirm validity, confirm the driver's age, review eligibility status, and confirm demographic information to aid in balancing demographics across conditions per NHTSA's guidelines. Furthermore, a daily health survey is collected to ensure participants are feeling well enough to participate. Finally, participants will complete the simulator familiarization drive to ensure they can adequately control the vehicle. The subcomponents of burden can be seen below. The entire procedure (as seen in the burden table below) is anticipated to take approximately 21 minutes.

- **Eligibility Confirmation** – A subcomponent of this process, which is required, is to verify the participant's demographic information (i.e., age and sex) via their license to ensure proper balancing of experimental conditions. This subcomponent is expected to take approximately two minutes.
- **NHTSA Form 2076: Daily Health Survey** - A subcomponent of this process will contain a daily health survey that will be administered to ensure participants are feeling well enough to participate. This subcomponent is expected to take approximately three minutes to complete.
- **Simulator Familiarization Drive** – This subcomponent is necessary for preparing participants for driving in the simulator. Simulator driving may feel different from regular driving and requires an adjustment period to successfully control the vehicle. Additionally, participants who experience simulator sickness can withdraw from the study. Before entering the vehicle, participants will receive training on the operation of the vehicle, VCI and manual interface systems, as well as the Tactile Detection Response Task (TDRT), which is expected to last approximately 10 minutes. Participants will then enter the vehicle and receive additional training, lasting about two minutes. Next, participants will complete a three to five-minute (four-minute average) familiarization drive to practice driving and responding to the TDRT. Training on the operation of the vehicle and the familiarization drive will take approximately 16 minutes to complete.
- **NHTSA Form 2077; Simulator Sickness Questionnaire** – This form is required to ascertain whether participants feel well enough to continue after the simulator familiarization drive and subsequent study drives (administered nine times). The researchers anticipate that 17 participants will experience simulator sickness and will withdraw from the study, returning a sample size of 160 participants who complete the study session. The SSQ is important to administer after the last drive because some

participants may feel motion sickness due the SCE and would require monitoring from study staff until the symptoms pass. The SSQ is anticipated to take two minutes to complete.

- **Data Collection Activities** – This process is required because it contains the information necessary to answer NHTSA’s research questions. It is composed of three subcomponents: task training, study drives, and a task novelty assessment form. Each subcomponent is discussed in greater detail below. The subcomponents of burden can be seen below. The entire procedure (as seen in the burden table below) is completed eight times as is anticipated to take approximately nine minutes per trial, resulting in overall completion time of 72 minutes.
  - **Task Training** – Before each task drive, participants will receive verbal training on how to complete the task from the research staff. This is necessary because participants may not initially comprehend the task, inhibiting task completion and therefore estimates of distraction and cognitive workload. Participants will complete practice trials in the vehicle. Three trials must be completed successfully before participants complete the associated task drive. This subcomponent is anticipated to take four minutes to complete per trial, for a total completion time of 32 minutes.
  - **NHTSA Form 2078: Task Novelty Assessment** – After training, but before the drive, a single item form entitled Task Novelty Assessment will be administered to assess the frequency of task completion in the participant’s daily drive. This subcomponent is anticipated to take one minute to complete per trial, for a total completion time of eight minutes.
  - **Study Drives** – This set of procedures will be where the primary information collection takes place. Specifically, measures of driver performance, distraction and cognitive workload will be collected via the driving simulator, TDRT and

physiological sensors (eye-tracking and HRV). The study drives include eight drives, which are made up of three common VCI task drives, three common visual-manual interface task drives, one unique VCI task drive, and one safety-critical event (SCE) drive. The task drives will be counterbalanced to control for order effects. Due to the potential behavior change post SCE, the SCE drive will occur last, with a covered-to-revealed road obstruction. The common tasks shared by VCI and visual-manual input will be tasks that are regularly completed in vehicles, as identified by the technology scan. The unique task drive will assess a task that many other systems cannot perform (e.g., sending an email in Apple CarPlay). Each drive is estimated to average four minutes per trial (with a range between three and five minutes), for a total completion time of 32 minutes.

- **NHTSA Form 2079: Debrief** - The debrief is necessary to explain the study purpose and procedures, as well as provide the participant an opportunity to ask questions.

Participants will complete an honorarium form after the completion of the debrief. The debrief and honorarium confirmation is expected to last five minutes.

**60-Day Notice:** A Federal Register notice with a 60-day comment period soliciting public comments on the following information collection was published on February 10, 2026 (91 FR 5984). NHTSA received a total of four comments from: Automotive Safety Council, CPAC Foundation Center for Regulatory Freedom, Consumer Reports, and Alliance for Automotive Innovation. The following excerpts summarize the key points submitted by commenters for NHTSA's consideration; all cited references have been removed for brevity. When applicable, to facilitate a clear mapping of the agency's response to the specific issues raised, the points are numbered to correspond with the numbered responses below.

The Automotive Safety Council (ASC) commented with support for NHTSA's planned research to determine the current state-of-the-art capabilities that Voice Command Interfaces (VCI) provide to vehicle drivers and passengers.

ASC offered specific suggestions and questions for consideration in the research study.

Regarding the subject recruitment and sample size (1), ASC asked for the technical reason to exclude pregnant participants (a), if there are constraints concerning physical conditions which may affect subjects' voices (b), and if additional recruitment would be necessary to achieve the target sample size and maintain counter-balancing (c).

The second point raised by ASC was in reference to the OEM vehicles included in the simulator, and how they would be presented (2).

A third question was related to the Safety Critical Event (SCE), whether a within-subject manipulation of the task modality (VCI vs. visual-manual) could be considered for that event (3).

They also questioned, since the hardware/software and audible path may be different for each system, how these differences will be accounted for in the study protocol and/or analysis (4).

The ASC suggested inclusion of driver reaction time and time-to-collision be measured and analyzed (5).

They also asked how the eye tracking visual areas of interest (AOIs) will be defined, and suggested NHTSA consider alignment with Euro-NCAP's driver engagement protocols (6).

Regarding assessment of cognitive workload (7), ASC asked two questions regarding TDRT: if there a potential concern about the added workload required (a) and if passive measures could also be used (b).

They also had a suggestion regarding task training, asking the potential benefit of block training of all tasks in one sequence (8).

Regarding study drives (9), ASC asked two questions: if the task used for the SCE will be selected randomly from the set of all trained tasks, or if the same task will be used for all subjects

(a), and whether SCE task selection should be selected based on a general workload expectation

(b).

Regarding drive duration (10), ASC asked whether (approximately) four minutes per trial is sufficient duration to allow subject immersion, leading to a naturalistic response, and whether multiple tasks be included in longer drives (b).

Finally, ASC also provided some suggestions regarding considerations for future research phases (11). They suggested that cases where the VCI fails to execute the intended task and/or executes the wrong task be considered (a), and to consider ambient and/or cabin noise factors in VCI performance (b).

**Response:**

NHTSA appreciates ASC's feedback on this topic. Many of the suggestions will be integrated into the full research and analysis plan. Regarding ASC's specific points:

1.
  - a. There will be a provision to exclude those who are pregnant due to the increased risk of simulator sickness.
  - b. There will be no constraints planned regarding health or physical conditions that affect the subject's voice, since these individuals are part of the general driving population.
  - c. Recruitment will continue until the target sample size and counterbalancing is achieved.
2. The full OEM vehicles will be included in the simulator environment with fully functional cabins.
3. To ensure data integrity, the safety critical event is designed as a between-subjects factor.  
  
Given the risk of a crash or significant event during the event, NHTSA is concerned about 'carryover effects.' If a participant experiences a strong emotional or behavioral reaction in the first session, particularly if a crash occurs, it will likely bias their

performance in any subsequent sessions. Utilizing a between-subjects design allows us to obtain clean, unbiased data by preventing the adverse behavior and heightened awareness that follows a safety critical event. To ASC's point, NHTSA will ensure sufficient statistical power is achieved to make this comparison robustly as a between-subjects factor.

4. To account for hardware and software variations across tested systems—such as microphone orientation and voice amplitude, our analysis will include vehicle/system type as a predictor variable. Furthermore, the simulator provides a controlled environmental baseline, effectively isolating these system-specific differences by eliminating external variables like ambient background noise and engine interference.
5. NHTSA will incorporate this into the study design. The researchers will be collecting and analyzing metrics of driver performance including driver reaction time and time-to-collision.
6. The study defines Areas of Interest (AOIs) to include the instrument cluster, infotainment screen and controls, on road (including mirrors), and off-road locations. Eye-tracking data collected from this study will have sufficient quality to calculate long distraction and short distraction (VATS) as defined in the Euro-NCAP protocols, and NHTSA will consider the use of these variables in the analysis.
7.
  - a. The researchers do not anticipate that the TDRT will impose a significant secondary workload. The task is designed for minimal cognitive burden and will be applied consistently across all study conditions. This allows the TDRT to serve as a reliable baseline for comparison when no other secondary tasks are being performed.
  - b. While the researchers acknowledge the value of passive or subjective measures, the researchers have opted not to include additional one-item workload scales to

minimize participant burden. Because the TDRT provides continuous, objective workload data, the researchers believe further repeated measures are unnecessary for the scope of this analysis.

8. The researchers have opted for individual task training over a blocked sequence to ensure mastery of the unique procedural steps required for each system. While block training may offer a more realistic 'mixed' scenario, it risks degrading task-specific proficiency. By requiring three successful trials per task, the researchers ensure that performance results reflect a high level of competency with each individual interface before data collection begins.

9.

- a. The task selected for the safety critical event will be the same task across all participants and will be a repeated task from the earlier study drives.
- b. The task selected for the safety critical event is anticipated to be higher workload and has the longest task completion time, which also ensures the participant will be performing the task during the safety critical event.

10.

- a. The researchers have found that 4 minutes provides sufficient time for subject immersion. Research indicates that driving performance typically stabilizes within 30 seconds; by initiating tasks 1.5 to 2 minutes into the drive, the researchers ensure the participant has reached a steady state of naturalistic driving before the evaluation begins.
- b. The researchers have opted against combining multiple tasks into longer drives to preserve the integrity of the training protocol. Because each task requires specific, individualized training to ensure proficiency, keeping the trials separate prevents procedural confusion and ensures that the data reflects a clean interaction with each unique system.

11.

- a. The researchers share ASC's recognition of importance of tracking VCI reliability. For instances where the system fails to execute the intended task or executes an incorrect command, the researchers will formally document the occurrence. This data will be used to identify potential patterns or commonalities among specific tasks, command structures, or system types where failures are most prevalent.
- b. Regarding environmental factors, the current study is conducted in a controlled simulator environment without passengers. Consequently, ambient and cabin noise are not variables within the present scope. This controlled design effectively evaluates the VCI systems under near optimal conditions, which should reflect best on their intended use and design. Additionally, noise cancellation capability is anticipated to improve as these technologies develop, lowering the cost/benefit ratio of including ambient and cabin noise as additional variables in this study. Manipulating ambient and cabin noise as additional variables in this study would exponentially increase the study duration, burden on participants, and cost. However, these factors may provide valuable context for future real-world or high-fidelity environmental research. Researchers will note this issue raised by ASC in the final report.

The CPAC Center for Regulatory Freedom supported NHTSA's effort to better understand the safety implications of modern voice command interfaces, and also recommended careful attention to analytical discipline, real-world applicability, and the limits of inference.

CRF offered specific suggestions for consideration in the Research Study:

1. Interpret proxy measures of distraction and cognitive workload with caution.

2. Align all metrics with clearly defined, decision-relevant safety questions and avoiding unnecessary or low-value data accumulation.
3. Recognize the limitations of simulator-based research and avoid overgeneralizing findings.

In addition, CRF suggested that NHTSA interpret research appropriately when considering future rulemaking and guidance, and recommended some points; in summary:

4. Ensure that research findings are not used to justify prescriptive design mandates, technology-specific requirements, or de facto performance thresholds. Take a technology-neutral approach to future guidance. Ensure that early-stage research does not lead to premature regulatory hardening. Maintain flexibility in future policymaking by recognizing the evolving nature of both technology and the empirical evidence base.

**Response:**

NHTSA appreciates the Center for Regulatory Freedom's (CRF) specific suggestions for the research study, and has taken each into thoughtful consideration. Regarding some of the specific points:

1. NHTSA agrees that the relationship between proxy measures and safety outcomes is complex, and the researchers will highlight these limitations in the final report.
2. To ensure burden-to-utility discipline, the scope of this study is intentionally focused on a controlled comparison between voice-command and visual-manual task completion. This specific design allows for high internal validity and the isolation of driver performance variables, avoiding unnecessary data accumulation while directly addressing decision-relevant safety questions.
3. The researchers agree that simulator environments have inherent limitations regarding real-world generalizability, environmental noise, and system latency. To address this comment, these factors will be clearly delineated in the final report to ensure findings are

interpreted within the appropriate context. To prevent premature generalization, results will be situated within a broader evidentiary framework. NHTSA remains committed to a performance-based, technology-neutral approach that preserves flexibility for future innovation while contributing to the evolving body of empirical knowledge.

4. NHTSA appreciates CRF's comments. NHTSA maintains a technology-agnostic approach to rulemaking and guidance and considers robust research literature when doing so.

NHTSA also received suggestions from Consumer Reports regarding the Research Study. They stated, in summary, that the study will compare three common tasks performed through the VCI with the same tasks performed manually, along with one additional voice-only task, and that the notice also describes a simulator familiarization drive, but does not explicitly identify a baseline. They suggested that including a comparable baseline condition here could make the study more useful by providing a clearer benchmark for the voice and manual task comparisons.

They also suggested that the study should include a way to measure how demanding participants found each task, suggesting that a more subjective post-task workload assessment could provide useful additional context for interpreting such measures, and would allow NHTSA to evaluate whether participants' perceptions align with the observed effects.

Consumer Reports also explained that, while participants will use a voice command interface with which they are already familiar in a vehicle they drive regularly, and the study will document errors made during training before the task drives begin, the extra effort required to address and respond to a failed voice interaction may increase distraction and should be reflected in the protocol.

**Response:** NHTSA appreciates Consumer Reports' review and suggestions for the study.

NHTSA acknowledges the importance of comparing secondary task performance against a baseline driving condition. To address this without increasing participant drive time, each individual trial will include a dedicated baseline period where no secondary task is being

performed. These periods will be integrated into the final analysis, allowing for a direct, within-participant assessment of the magnitude of distraction relative to ordinary driving.

NHTSA recognizes the value of understanding participant perceptions of task demand. However, the current study is designed to prioritize objective, physiological, and performance-based indicators of workload. To maintain a strict burden-to-utility discipline and prevent participant fatigue, subjective questionnaires were deemed outside the immediate scope of our primary research questions. However, to incorporate Consumer Reports' suggestion, ad hoc, overt comments made by participants regarding workload will be noted but not solicited.

NHTSA acknowledges the importance of capturing driver errors and the challenges associated with VCI use. The current study is designed to capture frequent users of the system and includes training to ensure participants are proficient using the system, similar to owning the vehicle and using the vehicle for 3 months. This allows for an understanding of the impacts of using the VCI as intended to make more controlled comparisons to visual-manual tasks. While errors related to speech recognition and interaction failures are recognized as an important aspect of real-world use, the variability and inconsistency of such errors was considered out of scope for the present study. However, these concerns were addressed in a previous phase of this project, where research staff novice to using VCI's completed an in-vehicle task analysis and documented the errors they experience when performing a much broader list of tasks. Findings from that effort will be documented and summarized in the final report.

Finally, Alliance for Automotive Innovation also offered several suggestions for consideration in the Research Study, these are summarized below:

1. They suggested that NHTSA provide more precise definitions of the study's objectives, as it is currently unclear whether the intent is to assess the overall effects of VCIs on driver inattention, compare how different system designs influence driver performance, or both.

2. Alliance for Automotive Innovation also encouraged NHTSA to offer more comprehensive details regarding the specific tasks selected within the study, including how it will account for differences in how study participants interpret task instructions during testing, accounting for variation in terms of familiarity with the test vehicle and their general use of VCIs, and the nature of the email subtask.

They also recommended that NHTSA consider including a post-test questionnaire as part of this study to capture drivers' self-reported assessment of both driving and secondary task performance, stating that this may also provide additional insights to help inform future research. In addition, the Alliance for Automotive Innovation requested more information on the safety-critical event (SCE) task and whether this will be consistent among all participants. In other words, while participants will be randomized to complete either a VCI task or visual-manual task during the SCE, the agency should specify whether these tasks will be standardized across all participants.
3. Alliance for Automotive Innovation encouraged NHTSA to provide additional details on the documentation and treatment of user and system errors throughout the study's driving scenarios.
4. "NHTSA should provide more information on the purpose of the driver performance data that it plans to collect during task drives and how this will be compared against "normal" baseline driving behavior." The Alliance also seeks clarification on the relevance of pupil diameter (PD) and heart rate variability (HRV) as cognitive workload assessment values.
5. Alliance for Automotive Innovation suggested NHTSA should perform further assessments to detect and mitigate any issues regarding the adequacy of the study's sample size.
6. Finally, Alliance for Automotive Innovation recommended that NHTSA maintain its collaboration with industry stakeholders.

**Response:** NHTSA appreciates the questions and suggestions offered by the Alliance for Automotive Innovation. While the 60-day notice provides a high-level summary of research, many of the requested details will be specified in the full research and analysis plan, and we will fully take into account the provided input:

1. NHTSA has defined the primary objective of this research as understanding the impacts of VCIs on driver attention and other safety-relevant performance metrics. The study is specifically designed to evaluate the interaction between the driver and the interface rather than to serve as a comparative ranking of specific automotive brands. NHTSA acknowledges the inherent differences in hardware, software, and logic across various VCIs. To account for this variability and prevent system effects from confounding the results, vehicle type will be utilized as a predictor variable in our statistical models. This approach allows us to isolate the general effects of voice interaction while statistically controlling for the unique characteristics of each tested system.
2. The specific tasks included in the study will be finalized nearing PRA approval as the technology scan and task analysis components of this effort are updated annually to ensure the most recent vehicles and systems will be included in the final selection. For the study, there will be three common tasks that can be performed through voice commands and visual-manual input (e.g., navigation, text-messaging). All participants will complete task training prior to the task drives. The training will be specific to the system that is being tested. The task training will provide the participant with the pathway or voice commands required to complete the task, which will be specified in the final report. To account for differences in VCI use while driving, task training will require the participant to successfully complete the task three times before the drive to ensure proficiency. The selected tasks encompass varying levels of complexity, anticipated workloads, and completion times to demonstrate the full range of functions achievable via voice commands. While NHTSA recognizes the potential value of

capturing participant perspectives on driving and secondary task performance, such subjective data collection is outside the current project scope. This exclusion is a deliberate measure to minimize participant burden and maintain focus on objective performance metrics. To ensure experimental consistency, the safety-critical event will remain identical for all participants. The study design balances participants across two conditions: completing the task via voice commands or through visual-manual input. Furthermore, the specific task associated with the safety-critical event will be uniform across all subjects and will consist of a task repeated from earlier drives. To incorporate the Alliance for Automotive Innovation's suggestion, as mentioned above, ad hoc, overt comments made by participants regarding workload will be noted but not solicited.

3. NHTSA acknowledges the importance of understanding errors associated with voice commands. To incorporate this suggestion, errors and recovery tactics made during task training will be catalogued and summarized using descriptive statistics. Though, given that we are recruiting people who are familiar with these systems, it is possible there may not be enough errors to analyze in a robust manner. In addition, in an earlier phase of the project, the research team conducted a separate in-vehicle task analysis, where novice users performed the candidate tasks to identify and document potential errors. Findings from that effort will be documented and summarized in the final report.
4. NHTSA acknowledges the importance of specifying the driving performance metrics, and responsive to the recommendation, will be included in the final report. The measures collected in this study include standard deviation of lane position (SDLP), standard deviation of speed (SDS), speed differential (SDf), mean glance duration (MGD), total glance time (TGT), and the proportion of long glances (PLG) more than two seconds. Pupil diameter was included because it is a reliable indicator of cognitive workload (Zhang & Cui, 2022). Additionally, HRV was included as it has been shown to increase with perceived cognitive workload (Solhjoo et al., 2019).

5. The sample size was selected based on the 2013 Visual-Manual NHTSA Driver Distraction Guidelines for Electronic Devices, which provides task acceptance testing methods and participant sample size and demographics. In addition, to incorporate this suggestion to the research plan, a power analysis for the within-subject design and statistical model to be used will be conducted, raising confidence that the recruited sample size is sufficient. Detailed methods regarding the analysis will be included in the final report.
6. NHTSA thanks the Alliance for its recommendation to maintain collaboration with industry stakeholders. As part of an earlier phase of this project, the research team conducted interviews with industry representatives (OEMs and tier-one suppliers) to gather information regarding advancements in VCIs, design elements and feedback, error recovery, smartphone interface applications, and customer feedback. The summarized, anonymized findings from these interviews will be included in the final report. Based on Alliance's input, NHTSA will identify additional mechanisms of routine engagement with industry stakeholders throughout the study.

After thoughtful consideration of all the above comments, NHTSA will ensure that summaries of findings from task analysis and (anonymized) industry outreach phases of this research are included in the final report. These modifications do not yield material changes in the participant burden estimate from that which was published in the 60-day notice.

**Affected Public:** Individuals between 18 and 70 years old from Torrance, California and the surrounding areas who volunteer to take part in the driving studies or individuals who opted into receiving research-related emails from DRI will be contacted for participation. Respondents must meet specific eligibility criteria to be included in this information collection. Businesses are ineligible for this sample and will not be contacted.

**Estimated Number of Respondents:** The researchers estimate 1330 respondents to the eligibility questionnaire between DRI's participant database and social media recruiting. The target sample is 144 valid datasets with 24 participants per system, with attrition planned due to ineligibility, disinterest in participating, simulator sickness, and data collection issues (e.g., equipment malfunction, participant non-compliance).

**Frequency:** One-time collection.

**Estimated Total Annual Burden Hours:** The estimated total burden hours is 637 hours (see table below). All data collection is estimated to occur within the same year, so the annualized hours equal the total hours.

| NHTSA Form No. | Information Collection        | Number of Respondents | Time Per Response (Minutes) | Frequency of Response | Burden Hours <sup>1</sup> |
|----------------|-------------------------------|-----------------------|-----------------------------|-----------------------|---------------------------|
| 2071           | Eligibility Questionnaire     | 1330                  | 10                          | 1                     | 222                       |
| 2072           | Scheduling Form               | 198                   | 6                           | 1                     | 20                        |
| 2073           | Pre-Study Materials           | 178                   | 9                           | 1                     | 27                        |
| 2074           | Appointment Confirmation Form | 178                   | 1                           | 1                     | 3                         |
| 2075           | Informed Consent Document     | 178                   | 17                          | 1                     | 50                        |

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<sup>1</sup> Values are rounded.

| NHTSA Form No.     | Information Collection                                                                             | Number of Respondents | Time Per Response (Minutes) | Frequency of Response | Burden Hours <sup>1</sup> |
|--------------------|----------------------------------------------------------------------------------------------------|-----------------------|-----------------------------|-----------------------|---------------------------|
| 2076               | Intake Procedures (Eligibility Confirmation, Daily Health Survey, Simulator Familiarization Drive) | 178                   | 21                          | 1                     | 62                        |
| 2077               | Simulator Sickness Questionnaire                                                                   | 160                   | 2                           | 9                     | 48                        |
| 2078               | Data Collection Activities (Task Training, Task Novelty Assessment, Study Drives)                  | 160                   | 8                           | 9                     | 192                       |
| 2079               | Debrief (Honorarium)                                                                               | 160                   | 5                           | 1                     | 13                        |
| Total Burden Hours |                                                                                                    |                       |                             |                       | 637                       |

***Estimated Total Annual Burden Cost:*** Participation in this study is voluntary, and there are no costs to respondents beyond the time spent completing the questionnaires and travel costs for the visits to the study facility. The costs are minimal and are expected to be offset by the compensation that will be provided to the research participants.

**PUBLIC COMMENTS INVITED:** You are asked to comment on any aspects of this information collection, including (a) whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility; (b) the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used; (c)

ways to enhance the quality, utility and clarity of the information to be collected; and (d) ways to minimize the burden of the collection of information on respondents, including the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

**AUTHORITY:** The Paperwork Reduction Act of 1995; 44 U.S.C. Chapter 35, as amended; 49 CFR 1.49; and DOT Order 1351.29A.

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