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Explanatory Material About the Definition of a Task Used in NHTSA's Driver Distraction Guidelines, And Task Examples

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13. ABSTRACT (Maximum 200 words)

This report supplements the proposed NHTSA Driver Distraction Guidelines for Visual-Manual Interfaces with explanatory information and examples about the definition of a task. It is intended to assist those using these Guidelines. ***The contents of this report are the opinions of contractor personnel; they are not necessarily official NHTSA policy. This report is believed to be consistent with NHTSA's proposal of February 24, 2012.*** The material provided herein is offered to facilitate a common and shared understanding of the definitions needed for consistent and rigorous testing of tasks that may be performed using electronic devices that are within the scope of the NHTSA Driver Distraction Guidelines.

This report particularly focuses on the definition of a testable task, and on supporting definitions which are used in conjunction with it (for example, definitions such as "start of measurement" and "end of measurement"). These definitions are needed when device tasks are tested to determine whether the proposed acceptance criteria of the NHTSA Distraction Guidelines have been successfully met. This report provides numerous examples which illustrate how to apply the definitions for testing purposes, and discusses some of the challenges that exist in applying definitions to tasks in real system architectures.

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EXECUTIVE SUMMARY

This report supplements the proposed NHTSA *Driver Distraction Guidelines for Visual-Manual Interfaces* ("the Guidelines") with explanatory information and examples about the definition of a task. It is intended to assist those using these Guidelines. ***The contents of this report are the opinions of contractor personnel; they are not necessarily official NHTSA policy. This report is believed to be consistent with NHTSA's proposal of February 24, 2012.*** The material provided herein is offered to facilitate a common and shared understanding of the definitions needed for consistent and rigorous testing of tasks that may be performed using electronic devices that are within the scope of the NHTSA Driver Distraction Guidelines.

This report particularly focuses on the proposed definition of a testable task, and on definitions which need to be used in conjunction with it, when device tasks are tested to determine whether the NHTSA Distraction Guidelines have been successfully met (for example, definitions such as "start of measurement" and "end of measurement"). When the proposed NHTSA Distraction Guidelines are used, it is desirable that the definitions employed in them be clearly understood, so that different organizations use the definitions in the same way during testing so test outcomes have similar meaning across manufacturers.

To facilitate consistency in the application of testing practices, this report also provides numerous concrete examples which illustrate how to apply the definitions for testing purposes, and which illustrate some of the challenges that exist in applying definitions to tasks in real system architectures.

This report is structured into six chapters:

Chapter 1 provides introductory and explanatory material related to testing tasks.

Chapter 2 covers terminology and background concepts relevant for testing under the proposed NHTSA Distraction Guidelines.

Chapter 3 treats measurement issues, particularly the start and end of testing.

Chapter 4 provides explanatory material to assist in setting up testable tasks for evaluation.

Chapter 5 addresses the need to provide training on tasks prior to testing, and provides illustrative examples of training material.

Chapter 6 provides over 40 annotated examples of different types of testable tasks (navigation, entertainment, communication, interactive information tasks, and others), using step-by-step photographs taken from different vehicles on the market today.

GLOSSARY OF TERMS AND ACRONYMS

Alliance	Alliance of Automobile Manufacturers is an association of vehicle manufacturers that sell vehicles in the United States. It issued voluntary guidelines to limit potential distraction (starting in 2001, with updates [latest version: 2006]) that are referenced in this document.
COGNET	cognitive network model
CAMP DWM	Crash Avoidance Metrics Partnership (CAMP) Driver Workload Metrics (DWM), associated the name of a project to examine effects of secondary task on driving performance
CTA	cognitive task analysis
FMVSS	Federal Motor Vehicle Safety Standard
GDTA	goal directed task analysis
GPS	global positioning system
GVWR	gross vehicle weight rating, the maximum allowable total weight of a road vehicle or trailer when fully loaded (including the weight of the vehicle itself as well as passengers and cargo)
HCI	human-computer interaction
HMI	human-machine interface or human-machine interaction
HTA	hierarchical task analysis
HVAC	heating, ventilation, and air conditioning (system)
NHTSA	National Highway Traffic Safety Administration
PAD	portable and/or Aatermarket device
POI	points-of-interest, locations that are marked on a map (often, an electronically displayed map) that represent special categories of interest for a driver (restaurants, fuel stations, hotels, parks, museums, etc.).
U.S,DOT	United States Department of Transportation

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CHAPTER 1. INTRODUCTION AND SCOPE

This report supplements the proposed NHTSA Driver Distraction Guidelines for Visual-Manual Interfaces (contained in Federal Register, 2012) with explanatory information and examples about the definition of a task. These are intended to assist those using these Guidelines. ***The contents of this report are the opinions of contractor personnel; they are not necessarily official NHTSA policy. This report is believed to be consistent with NHTSA's proposal of February 24, 2012.*** The material provided herein is offered to facilitate a common and shared understanding of the definitions needed for consistent and rigorous testing of tasks that may be performed using electronic devices that are within the scope of the NHTSA Driver Distraction Guidelines.

This report particularly focuses on the proposed definition of a testable task, and on definitions which need to be used in conjunction with it, when device tasks are tested to determine whether the NHTSA Distraction Guidelines have been successfully met (for example, definitions such as "start of measurement" and "end of measurement"). When the proposed NHTSA Distraction Guidelines are used, it is desirable that the definitions employed in them be clearly understood, so that different organizations use the definitions in the same way during testing so test outcomes have similar meaning across manufacturers.

Before discussing definitions and terminology for testing, it is appropriate to begin with supplemental material to explain the planned *structure* of the NHTSA Distraction Guidelines followed by information about the *scope* of the proposed NHTSA Distraction Guidelines for Visual-Manual Interfaces.

STRUCTURE OF THE NHTSA DISTRACTION GUIDELINES

As discussed in NHTSA's Driver Distraction Program (NHTSA, 2010), NHTSA's intent is to "develop voluntary guidelines for minimizing the distraction potential of in-vehicle and portable devices." Electronic devices in a motor vehicle can divided into three broad classes, depending upon their origin. These devices may have been built into a vehicle when it is manufactured (i.e., original equipment devices), installed in a vehicle after it has been built (i.e., aftermarket devices), or brought into a vehicle (portable devices).

Drivers perform tasks using an in-vehicle electronic device by interacting with the device through its driver interface. The driver interfaces of these devices can be designed to accommodate interactions that are visual-manual, auditory-vocal, or a combination of the two.

For each of the three possible origins of in-vehicle electronic devices, both visual-manual and auditory-vocal interaction modes may be possible. Table 1 indicates the order in which NHTSA plans to develop its NHTSA Guidelines to address the different device origins and interfaces.

Table 1. Matrix Showing NHTSA Driver Distraction Guideline Phases Based on Device Origins and Interaction Types (From Federal Register, 2012)

	Origin of Device		
Type of Interaction	**Original Equipment**	**Aftermarket**	**Portable**
Visual-Manual	NHTSA Driver Distraction Guidelines, Phase 1	NHTSA Driver Distraction Guidelines, Phase 2	NHTSA Driver Distraction Guidelines, Phase 2
Auditory-Vocal	NHTSA Driver Distraction Guidelines, Phase 3	NHTSA Driver Distraction Guidelines, Phase 3	NHTSA Driver Distraction Guidelines, Phase 3

As of April 2012 when this report was written, NHTSA had only issued its Initial Notice (Federal Register, 2012) proposing Phase 1 of the NHTSA Driver Distraction Guidelines for original equipment electronic devices with visual-manual interfaces. The material in this report is believed to be fully consistent with this Initial Notice.

EXPLANATORY MATERIAL ON SCOPE

The scope for the proposed NHTSA Distraction Guidelines for Visual-Manual Interfaces covers electronic devices that are integrated into light vehicles (passenger cars, multipurpose passenger vehicles, and trucks and buses with a gross vehicle weight rating of not more than 10,000 lbs. (see Federal Register, 2012; p. 11,202). Phase 2 will extend the Phase 1 NHTSA Distraction Guidelines coverage to include portable and aftermarket electronic devices that are used in light vehicles.

The goal of the NHTSA Distraction Guidelines is to minimize potential driver distraction associated with non-driving-related visual-manual tasks. The NHTSA Distraction Guidelines:

> ." . . are appropriate for all information, navigation, communications, and entertainment systems integrated into the vehicle by the manufacturer. Note that, unlike the Alliance Guidelines[1], these NHTSA Distraction Guidelines are considered to be appropriate for both conventional and advanced varieties of information, navigation, communications, and entertainment systems." (Federal Register, 2012; p. 11,218)

There are three key concepts in the portion of the proposed NHTSA Distraction Guidelines dealing with scope:

1. The proposed Phase 1 NHTSA Distraction Guidelines apply to tasks performed using visual-manual interfaces. This means that tasks performed through interfaces using primarily voice-based interactions (i.e., through auditory-vocal interfaces), are not covered by the current guidelines. Auditory-vocal interfaces will be covered by Phase 3 of the NHTSA Distraction Guidelines. However, the Phase 1 Guidelines are applicable for tasks using mixed mode interactions, or a combination of visual, visual-manual and

auditory-vocal interactions. Specifically, the Phase 1 NHTSA Distraction Guidelines apply to those portions of such mixed-mode tasks that are visually and/or manually loading. Latter parts of this document will provide explanatory material on how to address testing of mixed-mode tasks.

2. To a limited extent, the proposed Guidelines also are appropriate to tasks intended for use by front seat passengers (users are referred to Section VII of the proposed Guidelines [Federal Register, 2012; p. 11,235]). The Guidelines do not cover a device's electrical characteristics, material properties, or performance; only it's driver interface.

3. Visual-manual task interfaces are covered by the proposed Phase 1 NHTSA Distraction Guidelines if they are part of electronic devices that have been integrated into the vehicle at the time it is manufactured as original equipment. Portable and aftermarket devices will be covered by the Phase 2 NHTSA Distraction Guidelines.

The NHTSA Distraction Guidelines apply when visual-manual interfaces are used for performing secondary tasks when vehicle's motor is running and the transmission is not in "PARK" (i.e., when the human operator is driving). More explanatory material on this is provided below.

Display of video-based entertainment or communications information, moving maps, scrolling text, photographic still or graphic images not related to driving, text consisting of more than 30 characters, and manual entry tasks of 6 or more button or key presses qualify for *per se lockouts, and must be locked out unless the vehicle is in Park,* according to the proposed NHTSA Distraction Guidelines (p. 11,237). This requirement for *per se lockout* applies to these tasks/ types of information under the proposed NHTSA Distraction Guidelines, regardless of where these types of information may be displayed.

Interfaces that fall beyond the scope of the NHTSA Distraction Guidelines include ones necessary to drive a motor vehicle (part of the primary driving task), interfaces involved in safety warning systems, and those associated with electronic devices for which a Federal Motor Vehicle Safety Standard (FMVSS) has specified an interface. In addition, the NHTSA Distraction Guidelines Initial Notice states:

> "The NHTSA Guidelines are not appropriate for collision warning or vehicle control systems. These systems are intended to aid the driver in controlling the vehicle and avoiding crashes and, therefore, are justified in capturing the driver's attention." (Federal Register, 2012; p. 11,218)

To further clarify what types of devices and tasks <u>are</u> covered by the Phase 1 NHTSA Distraction Guidelines, two tables have been developed. These tables are illustrative only and, are not intended to be an exhaustive listing of what is and is not in scope.

Table 2 shows devices and tasks *covered* by the Phase 1 NHTSA Distraction Guidelines. The second table, Table 3, shows devices and tasks *not covered* by the Phase 1 NHTSA Distraction Guidelines.

Table 2. Examples of Tasks for Which the Phase 1 NHTSA Distraction Guidelines Are Appropriate

CATEGORY	TASKS WITHIN SCOPE	TASKS NOT WITHIN SCOPE
Vehicle Information (if not related to primary vehicle control tasks)	Vehicle Information Center Emissions Controls Fuel Economy Information	Crash avoidance warnings Devices with interfaces specified by a FMVSS
Navigation	Destination Entry Route Following Real-Time Traffic Advisories Trip Computer Information Other Similar Tasks (point-of-interest, map-based, or location-based information)	Navigation tasks on portable devices are not within scope of Phase 1 but will be covered in Phase 2 of NHTSA Distraction Guidelines
Communications	Caller Identification Incoming Call Management Initiating and Terminating Telephone Calls Conference Telephoning Walkie-Talkie-Like Services Paging E-mail Reminders Instant Messaging Text Messaging Other, Similar, Tasks	Communication tasks on portable devices are not within scope of Phase 1 but will be covered in Phase 2 of NHTSA Distraction Guidelines
Entertainment and Infotainment(including interactive information tasks)	AM Radio FM Radio Satellite Radio Cassette Player Compact Disk Player Digital Music Player Television Video Displays Advertising Address Book Internet Searching Internet Content News Directory Services Other, Similar, Tasks	Entertainment and Infotainment tasks on portable devices are not within scope of Phase 1 but will be covered in Phase 2 of NHTSA Distraction Guidelines

Table 3. Examples of Tasks for Which the NHTSA Distraction Guidelines Are Not Appropriate

TASK FUNCTIONAL CATEGORY	TASKS NOT IN SCOPE
Interfaces related to primary driving Control tasks (steering, speed control, acceleration/deceleration, braking, or functions which enable these, including transmission/gears, as well as tasks related to forward, indirect, or rearward visibility, e.g., windshield clearing functions, windshield defogging functions)	Tasks within this functional category, which are related to primary driving control, are not in scope
Collision warning, crash avoidance, and active safety systems	Tasks/interfaces related to safety-enhancing prevention of inattention and crashes and/or mitigation of crash consequences are not in scope
Positioning, restraints and passive occupant protection, accommodation interfaces, and comfort controls (seat adjustments, restraint adjustments, mirror adjustments, heating, ventilation, and air conditioning controls, etc.)	Tasks/interfaces related to these basic positioning, accommodation, restraints and passive occupant protection, and comfort interfaces (many of these tend to be set up and adjusted prior to driving) are not in scope
Devices located solely rearward of the front seat (and intended for rear passenger use)	Rear-seat entertainment systems mounted on seatbacks are not in scope
Tasks available only when vehicle is in PARK	Tasks available only when vehicle is in PARK are not in scope

ADHERENCE TO THE NHTSA DISTRACTION GUIDELINES

The way to determine if a device's interface meets the NHTSA Distraction Guidelines is to evaluate whether tasks that can be performed using that interface meet all proposed criteria in the NHTSA Distraction Guidelines. If the NHTSA Distraction Guidelines are applicable to an electronic device or systems, ***all*** task that can be performed by a driver using the device's visual-manual interface(s) would be expected to adhere to the NHTSA Distraction Guidelines, (unless those tasks are not within scope *or* if they are not performable while driving. Thus, adherence to voluntary guidelines depends on evaluating tasks (and implies that all the tasks enabled by a device or system be identified; usually during the earliest conceptual stages of product planning and development). Therefore, the definition of a task, and its use in evaluations and testing, becomes important to the consistent application of the NHTSA Distraction Guidelines.

For simpler devices, there may only be a *few* tasks that can be carried out on a device. However, for many modern vehicles equipped with advanced infotainment and telematics systems, the

number of tasks which can be carried out within the vehicle may involve *hundreds* of tasks (by the time all navigation, communication, and entertainment tasks are identified and counted).

Given the large number of tasks for any new vehicle containing within-scope visual-manual devices, if product developers wish to apply the proposed NHTSA Distraction Guidelines, they will want to make their approach efficient and manageable. This can be accomplished in many ways, for example, by applying processes and procedures within the product development process proactively (for example by applying the proposed NHTSA Distraction Guidelines early during product development) and streamlining the verification process. Some product developers may incorporate these voluntary NHTSA Distraction Guidelines as part of their requirements set that drives device design from the beginning of their product development process. This can even be done during development of subsystems or components.

Subsystems and components are sometimes fully developed and tested *in advan*ce of a vehicle program. As subsystems are selected for a vehicle, their selection can be made partly on the basis that a subsystem or component has already been shown to meet the criteria in the NHTSA Distraction Guidelines (at least those that can be checked prior to vehicle-level integration).

Early in the product development process, manufacturers may also choose to apply analytic techniques to identify tasks that are "brand new/never evaluated before" versus those "previously tested" by a supplier, by the vehicle manufacturer in advance of the vehicle program, or during prior vehicle programs which may have used the same subsystem and may thus already have been verified as meeting the NHTSA Distraction Guidelines. Of course, initially upon first application of the NHTSA Distraction Guidelines, there will be a limited number of subsystems for which this will be true but, over time, more are likely to fall into this category. This would allow an engineering team to focus resources on those tasks that are "brand new" in an effort to ensure these new tasks are designed to meet the NHTSA Distraction Guidelines (as opposed to than spending effort on re-verifying previously released tasks/interfaces which have already been verified, and which remain unchanged). If a previously verified interface undergoes change, it would require re-verification.

Once early layouts or concepts for a device and its interface are developed, manufacturers may use task analysis, modeling, or other methods to make predictions (e.g., counting of task steps) about how well the new tasks will meet the NHTSA Distraction Guidelines. These predictions can perhaps be used to identify tasks in need of redesign and further improvement to achieve the criteria in the NHTSA Distraction Guidelines, and/or in need of further follow-up testing.

TASK TESTING METHODS

The type of proactive development process described above allows manufacturers who wish to apply the voluntary NHTSA Distraction Guidelines to identify, in an early or middle phase of the development process, a subset of new tasks performable with a device or system that "already meet the NHTSA Distraction Guidelines," and a subset that "do not" or "might not" meet the NHTSA Distraction Guidelines. Tasks in the latter categories may need testing**.** For tasks that need testing, one of the methods specified in the proposed NHTSA Distraction Guidelines document can be applied. Test methods under consideration for use in determining whether or not the NHTSA Distraction Guidelines have been met are described in the proposed

NHTSA Distraction Guidelines (Federal Register, 2012; p. 11,222). Note: NHTSA expects to reduce the number of test methods specified when it issues the final version of the Phase 1 NHTSA Distraction Guidelines. They will not be including all the test methods were set forth for comment in the initial, proposal, notice for the NHTSA Distraction Guidelines.

There is a useful distinction between *testing* and *other forms of evaluation* that may be applied during product development to determine whether tasks meet the proposed NHTSA Distraction Guidelines. In this document, *testing* refers to one of the methods described in the proposed NHTSA Distraction Guidelines. These methods are shown in Table 4, reprinted below from the NHTSA Distraction Guidelines Initial Notice (where it appears as Table 3, Federal Register, 2012; p. 11,222). *Other forms of evaluation* may be done early in product development; these may include those based on analysis or modeling, for example, and are not listed in the table below.

Table 4. Test Methods Listed in the Phase 1 NHTSA Distraction Guidelines

Option Letter	Test Name	Performance Measures	Acceptance Criteria	Testing Venue
EGDS	Eye Glance testing using a driving simulator	• Length of individual eye glances to device • Sum of individual eye glance durations to device	• 85% of individual glance durations less than 2 seconds • Mean of individual glance durations less than 2 seconds • Sum of individual eye glance durations less than 12 seconds	Driving simulator
OCC	Occlusion testing	• Sum of shutter open times	• Sum of shutter open times less than 9.0 seconds	Occlusion
STEP	Step counting	• Number of steps required for task	• Less than 6 steps required for task	Task analysis
DS-BM	Driving test protocol with benchmark	• Standard deviation of headway • Lane exceedances	• Performance measures not greater than benchmark values	Driving simulator
DS-FC	Driving test protocol with fixed acceptance criteria	• Same as *Option DS-BM*	• Performance measures not greater than specified values	Driving simulator
DFD-BM	Dynamic following and detection protocol with benchmark	• Length of individual eye glances to device • Sum of individual eye glance durations to device • Standard deviation of lane position • Car following delay • Percent of visual targets detected • Visual detection response time	• Option EGDS eye glance acceptance criteria ***plus*** • Performance measures less than benchmark values	Driving simulator
DFD-FC	Dynamic following and detection protocol with fixed acceptance criteria	• Same as *Option DFD-BM*	• *Option EGDS* eye glance acceptance criteria ***plus*** • Performance measures less than specific values	Driving simulator

For those choosing to apply the NHTSA Distraction Guidelines, it is expected that every task enabled by a within-scope system would adhere to the NHTSA Distraction Guidelines. In the process of evaluating each task, it becomes possible to document the basis on which this determination is made (of each task having met the NHTSA Distraction Guidelines) and users of the NHTSA Distraction Guidelines may find this helpful. It is not necessarily the case that the determination of a task's adherence to the NHTSA Distraction Guidelines would be based on *new* "testing" for every task within each new vehicle program. Within a proactive product development approach of the type described in the prior section, it could be that only some tasks within a system would need to be tested during a new vehicle program. Tasks that are brand new (and never tested before), those that are complicated, or which have been determined through

analysis, modeling, or other methods not to meet the NHTSA Distraction Guidelines in early phases of development are likely to be those needing testing.

It may be convenient and helpful for those applying the NHTSA Distraction Guidelines to track the status of each task using documentation so as to establish that all tasks have been evaluated in some way (e.g., have been tested on a prior product program and remain unchanged; have been tested by a supplier with test data provided; have been evaluated through analysis, modeling, or other means; or have been tested anew) to determine if they adhere to the criteria in the proposed NHTSA Distraction Guidelines. Thus, establishing a tracking system to document the analysis, modeling, evaluation, or test outcome that established each task's adherence to the proposed NHTSA Distraction Guidelines may be helpful, particularly if there are large numbers of tasks being assessed.

One example of record-keeping on task evaluation and adherence is provided in Table 5, as an illustration of the many possibilities that exist for tracking adherence of tasks within a system. Different organizations will each likely develop their own method of tracking. This one is offered just as an example; should it be helpful to any organizations new to this type of work.

Table 5 contains only an excerpt of the documentation needed for tests performed on a full system. Specifically, it shows results of visual demand testing done on five tasks. Because there are several metrics to be verified, each section of the tracking document provides the outcomes for a different metric covered by the proposed NHTSA Distraction Guidelines. The first section of five rows shows the test results for "total eyes-off-road-time." The second section of five rows shows the test results for "single glance duration." The third section of five rows shows the test results for "percent long glances." The decision threshold, or criterion-to-be-met, for each metric is shown in the fourth column of the table. Color coding is used to provide at a glance visual summaries of areas that have met the criteria and those that may need further attention.

Table 5. Illustrative Example of Documentation to Track Task Testing

SAMPLE HYPOTHETICAL RECORD OF GUIDELINE TASK EVALUATIONS IN HYPOTHETICAL SYSTEM							
TASK	**Adherence?**	**Guideline**	**Criterion**	**Basis**	**Record of Outcome**	**Relevant Results**	**Comment**
1A - Hard Radio Tuning Task	Yes	Visual Demand Part 1	12 s TEORT	Testing	Test Report 1080[1]	24 of 24 met, TEORT averaged to 10.5 sec	No action needed
2A - Change entertainment mode to XM and select preset station	Yes	Visual Demand Part 1	12 s TEORT	Prior Testing	Test Report 450[2] + Analysis on 4-05-12 verifying no system changes since test	23 of 24 met, TEORT averaged 7.5	No further testing needed; no action needed
3A - Switch presets and adjust volume up	Yes	Visual Demand Part 1	12 s TEORT	Testing	Test Report 1080	Predicted TEORT was 4.5, and actual step count in task is 4	No action needed
4A - Cancel route	Yes	Visual Demand Part 1	12 s TEORT	Testing	Test Report 1080	Predicted TEORT was 3.2, and actual step count is 3	No action needed
5A - Dest Entry by Keypad	No	Visual Demand Part 1	12 s TEORT	Testing	Test Report 1080	0 of 24 met, TEORT averaged >12 sec	LOCKED OUT
1A - Hard Radio Tuning Task	Yes	Visual Demand Part 2	2 s Single Glance Duration	Testing	Test Report 1080[1]	23 of 24 met	No action needed
2A - Change entertainment mode to XM and select preset station	Yes	Visual Demand Part 2	2 s Single Glance Duration	Prior Testing	Test Report 450[2] + Analysis on 4-05-12 verifying no system changes since test	24 of 24 met	No further testing needed; no action needed
3A - Switch presets and adjust volume up	Yes	Visual Demand Part 2	2 s Single Glance Duration	Testing	Test Report 1080	24 of 24 met	No action needed
4A - Cancel route	Yes	Visual Demand Part 2	2 s Single Glance Duration	Testing	Test Report 1080	21 of 24 met	No action needed
5A - Dest Entry by Keypad	No	Visual Demand Part 2	2 s Single Glance Duration	Testing	Test Report 1080	19 of 24 met, single glance dur averaged >2 sec for 5	LOCKED OUT
1A - Hard Radio Tuning Task	Yes	Visual Demand Part 3	<15% long glances (>2s)	Testing	Test Report 1080[1]	21 of 24 met	No action needed
2A - Change entertainment mode to XM and select preset station	Yes	Visual Demand Part 3	<15% long glances (>2s)	Prior Testing	Test Report 450[2] + Analysis on 4-05-12 verifying no system changes since test	24 of 24 met	No further testing needed; no action needed
3A - Switch presets and adjust volume up	Yes	Visual Demand Part 3	<15% long glances (>2s)	Testing	Test Report 1080	24 of 24 met	No action needed
4A - Cancel route	Yes	Visual Demand Part 3	<15% long glances (>2s)	Testing	Test Report 1080	23 of 24 met	No action needed
5A - Dest Entry by Keypad	No	Visual Demand Part 3	<15% long glances (>2s)	Testing	Test Report 1080	13 of 24 met, >15% of glances exceeded 2 sec	LOCKED OUT

[1]Test Report 1080 (hypothetical) contains the results of testing done using the test protocol EGDS (Eye Glance Testing in a Driving Simulator)

[2]Test Report 450 (hypothetical) contains the results of testing done at a prior time using both OCC (Occlusion) and EGDS (Eye Glance Testing in a Driving Simulator)

CHAPTER 2. DEFINING TASK, TESTABLE TASK, AND RELATED TERMS

The effort to determine whether or not a device's interface meets the proposed NHTSA Distraction Guidelines depends upon an evaluation of the *tasks* performable using an interface. If the NHTSA Distraction Guidelines are to be used in a common and consistent manner, a clear conceptualization of what constitutes a task is required, along with a clear definition of "task" (and supporting definitions) that allows it to be easily applied for purposes of testing,. This chapter is therefore focused on providing background and explanation in these areas:

1. Terminology of goal-driven activity.
2. Definitions related to "task."
3. Explanatory material to support application of terminology and definitions.

THE TERMINOLOGY OF GOAL-DRIVEN ACTIVITY

A useful terminology for defining the notion of a "task" arises from methodologies for task analysis which have existed within the human factors discipline for a number of years. Hierarchical task analysis and goal-directed task analysis are both forms of task analysis that have contributed important concepts to the current understanding of human goal-driven activity. Both methods start with determining the goal states sought by human beings (usually, human operators interacting with a machine system). HTA is focused on decomposing goals into tasks accomplished through specific means or operations (often using control inputs). GDTA is focused instead on decomposing goals into the decisions that must be made to achieve a goal, and the information required to support or achieve it. It is possible to use these analysis concepts together as part of a larger set of terminology. In the descriptions that follow, common shared elements from these traditions (as well as other important elements from each tradition) have been used to convey an understanding of driver goal-driven activity.

When individuals are driving, they typically have a purpose for any given trip; that is a goal or an objective. The goal may be to go from the location where they are presently located to another location, it may be to drive to a destination where they have other activities in which to engage, or it may be to drive for enjoyment. While en route during a trip, a driver also typically behaves in a goal-oriented way: seeking entertainment while driving, checking time to arrival, and so on.

These goals structure the behavior in which a driver engages. Each is comprised of sub-goals (depending upon the complexity of each of the higher-level, overall, goals). For example, in order to reach the goal of driving to an intended destination, the driver needs to break the task down into lower-level sub-goals that are more actionable; such as the sub-goals of getting into the vehicle, starting it, following the route to the destination, parking the vehicle, and shutting off the vehicle. To achieve any of these individual sub-goals, a driver will typically need to carry out a subtask (which itself may be comprised of even lower-level structured sequences of sub-goals and subtasks). For example, when working to meet the sub-goal of starting the vehicle, the driver may carry out the subtask of "turning the ignition to the on state" comprised of actions such as inserting the key into the ignition and rotating the cylinder clockwise to the "start position" (with gear in "PARK") until the engine "turns over" and "ignites." In this way, driver behavior oriented toward goal achievement can be understood in terms of a sequence of goals, tasks, sub-goals, subtasks, and individual operations used to accomplish an overall goal.

THE HIERARCHY OF ACTION IN GOAL-DRIVEN BEHAVIOR

As the prior section discussed, much of human behavior is oriented around goals, and this is as true of behavior during driving as it is of other areas of life. In analyses of behavior, goal-driven behavior is often characterized in hierarchical terms. The use of terms which connote hierarchical relationships is used as a *convenience* for codifying behavior rather than intended as a strict description of how natural behavior actually occurs (since, in natural behavior, there may be whole or partial recursions of operations or tasks, interruptions or suspensions of tasks, and initiations of new goals and sub-goals during various phases of activity, all of which make actual behavior look much less regular than a strict hierarchy would suggest). Nonetheless, *generally speaking*, a hierarchy of concepts such as the one depicted in Table 6 can be useful for the purpose of establishing *terminology* that can be used to evaluate tasks which are enabled in devices/systems offered for use during driving.

Table 6. Sample Hierarchy of Terminology Applying to Goals and Tasks

Goals (These are desired states to which current states are compared and, if there is a difference, action must be taken to resolve the difference in order to move the current state toward the desired state.)

Tasks (These are sequences of actions or operations that can be used to operate on states of the world, in order to move or change from one state of the world to another.)

Sub-goals (These may be spun off or created to enable one or more "moves" *intermediate* to an end goal, at a time when it becomes apparent that the change of state needed to move toward the higher-level goal state cannot be achieved in a single operation or in a single sequence of operations but require more than one sequence of operations. This may result in the creation of one or more sub-goals, and then subtasks to achieve them, in order to complete the overall task, and thereby achieve the end-goal.)

Subtasks (These are lower-level sequences of actions or operations which move *part* of the way between a current and a desired goal state; that part which will meet a sub-goal toward which the subtask sequence of activity is directed.)

Lower-Level Sub-Goals and Subtasks (This hierarchical breakdown of goals and tasks can be applied in a further, lower-level application, until the (sub-subtask) action sequences are small enough to manage easily in satisfying sub-goals, and in eventually meeting the top-level goal.)

Elementary Operations (These are individual control inputs, information-gathering operations, information-processing operations, or decision-making operations that singly or together in sequence comprise a task or steps in a task:

Finding and Gathering Information
Processing
Decisions
Control Inputs (and Responses)

This *type of terminology* may be applied in a task analysis, such as the one shown below in Table 7. Again, this illustrates the goal of "starting a vehicle."

Table 7. Example of Applying Concepts From Goal/Task Hierarchy

Goal: Start vehicle while in "Park"
Task: Turn the ignition control to the "on" state
Sub-goal: Enable ignition cylinder to rotate
Subtask: Release ignition lock (while gear is in PARK)
Operations: Check that vehicle's gear is in PARK
Find appropriate key
Find vehicle's ignition cylinder
Grasp and insert key into ignition cylinder
Maintaining grasp, **rotate key in ignition cylinder clockwise** until feedback of click is heard and release is felt (releasing lock)
Sense release of lock (auditorily and tactilely/haptically)
Subtask is completed and sub-goal is achieved when this condition (release of lock) is met

Sub-goal: Turn ignition cylinder to "on" state
Subtask: Turn ignition on
Operations: Continue grasp on key
Place foot on accelerator pedal
Continue rotation to position labeled "on" located at first détente past lock release *(while gently) applying accelerator pedal (with) gearshift still in PARK*
Concurrently apply gentle accelerator pedal pressure
Concurrently sense for détente/engine ignition
Continue rotation until détente/ignition is reached
Sense cues of engine turn over and ignition starts (audible confirming cues and/or visible confirming cues (e.g., emissions, or instrument panel displays, if available)
Verify engine is running (auditorily and/or visually)
Subtask is done and sub-goal achieved when this "engine running" condition met

The overall top-level task is done when both subtasks have met their respective sub-goals and the overall task's completion thereby achieves the desired goal state, that of starting the vehicle.

Human Motivation and "Persistence Toward Goals"

Humans who are engaged in goal-directed behavior show remarkable persistence in their efforts to achieve the desired goal state. The first demonstration of this was by Zeigarnik (1927), who found that interrupted or uncompleted actions engendered a strong motivation to complete the action. Today, scientists agree that once a person initiates a task (or are given a task and accept it); he or she tends to persist towards its completion until the goal is achieved (Fox & Hoffman, 2002). Additional effects have been noted in the literature. For example, according to the *goal gradient* effect (Hull, 1932), people who are closer to their goal exert comparatively more effort.

In more recent years, the foundation for modern approaches to task motivation has been formed primarily around two themes (Nunes & Dréze, 2006). One is the notion that persistence is a function of what might be called *inertial tendencies* toward task completion once an action sequence is started, coupled with an individual's *expectancy of success and value* upon attaining the goal (Atkinson, 1957; Klein, 1991). The other is the notion of *task tension* (Lewin, 1935). Tension is said to arise when internal needs are aroused that can only be relieved by attainment of an external goal. The perceived desirability of the goal reflects its ability to relieve the tension. Motivation to persist toward such a goal can be enhanced by a third factor; the psychological distance between the current state and the goal state. According to this notion, the closer someone is to his/her goal, the more task tension there is, and the greater the persistence to complete the task.

The concept of "persistence toward a goal" is introduced here both to provide context for the terminology used and also because it is useful for distinguishing the level of sub-goals and subtasks from the level of goals and tasks, and is useful in coding data on task performance. This is a topic addressed in more depth later but, for now, it is important to note that drivers will persist with task activity toward ***a goal*** before they stop. However, they will not normally be satisfied by stopping activity when they reach ***a sub-goal*** (instead, they will persist beyond a sub-goal, continuing toward the next sub-goal, until the overall goal is attained). Thus, if during task analysis, it becomes necessary to determine whether a unit of activity is at the goal/task level or at the sub-goal/subtask level the concept of "persistence" can be useful.

One distinguishing attribute of the sub-goal/subtask level is that a driver will not usually be satisfied stopping with the achievement of a sub-goal. A sub-goal typically does not have meaning in and of itself as a desired state of the world, but is meaningful only as a stepping stone toward a higher-level goal. If drivers are observed on a complex task (one consisting of multiple subtasks), their behavior will not "stop" with subtask completion and sub-goal achievement but persist until the overall goal of the task is reached. An example here would be dialing a phone number: few people would "stop" task activity after dialing an area code. This is a sub-goal, but it does not accomplish a unit of work or a change in the state of the world that has meaning. Nothing meaningful happens as the result of dialing an area code only. Nearly all people would persist in continuing to dial the remaining digits of a phone number, until the call itself went through, before their task behavior demonstrated a substantial "stop" (or a pause), signaling the beginning of a new task, or a change in the nature of activity (e.g., initiating conversation after the call connected). Thus, the concept of human persistence toward a goal can be useful during the analysis and development of tasks for testing purposes. It will be referenced again later in this report.

Additional Background for Understanding and Analyzing Tasks

The task analysis and human-computer Interaction literature provide further background that is relevant for understanding tasks. Hierarchical task analysis was introduced in the late 1960s as a formal discipline (Shepard, 2001). The HCI literature built upon some of this terminology (the seminal work was by Card et al., 1983). Cognitive task analysis evolved around the year 2000 (through the application of cognitive architectures for modeling behaviors).

A review of the task analysis literature, starting with HTA, reveals that it has been widely used in human factors practice since it was first proposed (Shepard, 2001). It has led to the development of various techniques for conducting task analysis (Jonassen et al., 1989). Using these techniques, tasks can be analyzed along several dimensions. Common results from task analyses include the decomposition of tasks into subtasks and task elements, *including the steps to complete a task* (needed for the test method of "count steps" in Table 4). A task's resource requirements can also be identified analytically, as well as the simultaneous or successive nature of task components and their durations. In addition, these techniques are sometimes used in conjunction with ability and skills analysis or assessment techniques (e.g., Fleischman, 1975, 1991). A useful example from CTA, which reveals the way tasks are structured and defined within the CTA approach, is depicted in Figure 1.

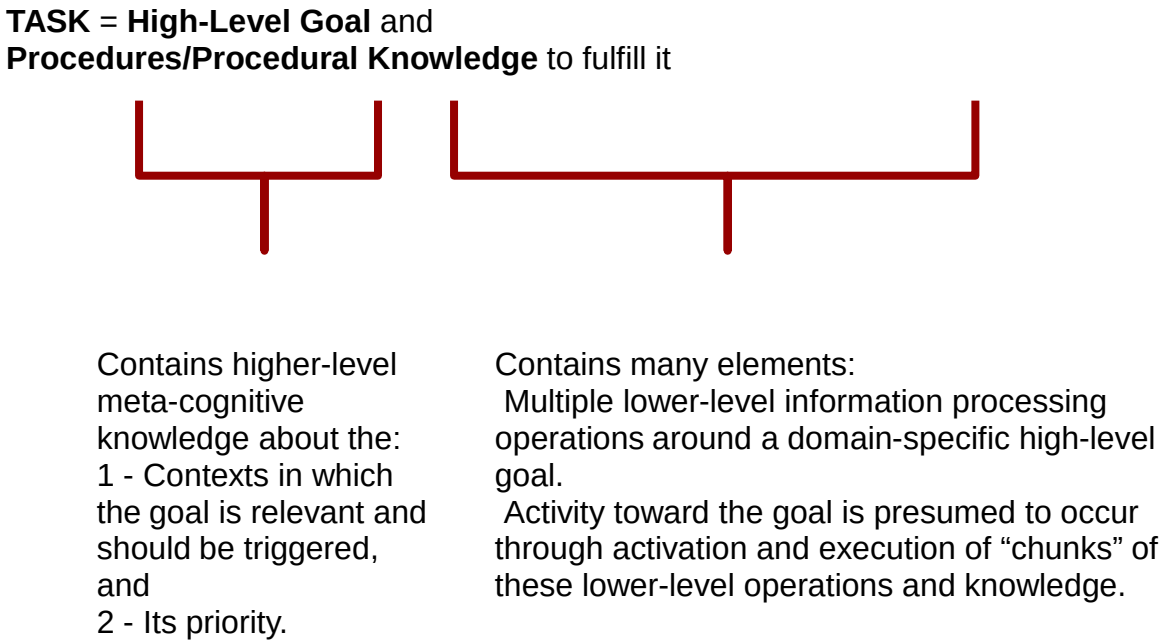


Figure 1. Structure of Typical "Task" Definition From Cognitive Task Analysis (Adapted From Zachary et al., 2000)

The HCI literature began to emerge in the late 1980s with the book *The Psychology of Human-Computer Interaction* by Card et al. (1983). It was one of the first to widely introduce the terminology. Chapter 9 of this book discusses the terminology for "overall tasks" and "unit tasks." This literature laid the groundwork for CTA, which was subsequently developed.

A useful example from CTA, which reveals the way tasks are structured and defined within CTA, is depicted in Figure 1. It comes from a model called COGNET developed by Zachary, Ryder, and Hicinbothom (first published in a book issued in 1998 then re-issued in 2000) for a domain other than driving. In COGNET:

." . . it is assumed that information processing activity is presumed to occur through the activation and execution of chunks of *procedural knowledge*, each of which represents an integration or compilation of multiple lower-level information processing operations around a domain-specific high-level goal. This combination of the **high level goal** and the **procedural knowledge needed to fulfill it** are referred to as a *cognitive task"* (Zachary, Ryder, & Hicinbothom, 2000, p. 14, emphasis in bold was added by authors of this report)."

The task is thus modeled as containing both the goal and the knowledge and procedures for accomplishing it. Again, from Zachary, Ryder, & Hicinbothom, 2000, p. 14:

"All the knowledge compiled into each task is activated whenever the high-level goal defining that task is activated. Each task-level goal includes metacognitive knowledge that defines the contexts in which a task is relevant. This metacognitive knowledge is simply a description of the contexts under which the goal should be activated. Thus, the high-level goals are activated according to the current problem context, as defined by this metacognitive 'Trigger.' In addition to this Trigger, another piece of metacognitive knowledge defines the relative priority of that goal in the current context, so that attention can be allocated to the goal with the highest priority given the current context. This second piece of metacognitive knowledge is called the Priority expression."

These common features (described by the two quoted excerpts above) provide the structure for describing a cognitive task in COGNET.

Distinctions Important for Using the NHTSA Distraction Guidelines

The internal structure given to a task within CTA is interesting and instructive. However, it is typically used in *modeling* to describe mental processing and, as a result, differs slightly in both its purpose and its content from that used in the proposed definitions in the NHTSA Distraction Guidelines for limiting and testing distraction for devices. Thus, although a short description is provided here as background, it is important to keep in mind that the framework used for the NHTSA Distraction Guidelines differs slightly from CTA (as will be explained at the close of this section).

The internal structure used in cognitive modeling (again, quoted from Zachary et al., 2000) has been described as follows:

"Each task has two main parts: **The Task definition**, and **The Task body**."

The Task definition identifies the high-level goal involved and a specification of when that goal is activated and the priority it will have when activated.

A cognitive task is defined in the following form:

TASK <task-goal-name> … A*ctivation Condition /Priority (formula). . .*<task body>

The task body is a hierarchy of lower-level information processing operators, based strongly on the GOMS (Goals-Operators-Methods-Selection Rules) notation of Card et al. (1983), but with customizations to allow for:

- manipulation of concepts on the blackboard (a formalism used in cognitive modeling);
- evaluation of GOAL conditions on the basis of the blackboard *context*; and
- interrupting and suspending the current task." (from Zachary et al., 2000, p. 14)

One of the key differences between the traditions of CTA and earlier traditions of HTA lies in the amount of "human interaction and human processes" included in the *definition of a task*. As can be seen above, the task definition contains the human user's knowledge about the activation conditions and priority for the task, and the associated task body includes (in addition to the operations for performing the task) the mental procedures which govern interruption/suspension (and resumption) of the task. In contrast, in the early days of task analysis, tasks tended to be defined strictly in terms of elements of the task environment (in terms of the buttons, pathways, and operations used on the machine interface to perform the task and reach the goal), and these were cleanly separated from the human operator (Shepard, 2001). *The task thus reflected the design of the device and its interface quite apart from the human operator.*

Occurring largely after 2000, and in connection with CTA, there has been a shift towards viewing the human and the machine as an interacting system in defining a task. There has also been a shift towards including not just the actions taken by the human operator on the machine or device, but also the resources and inputs required by the human to make those actions. In other words, the *entire* human-machine *interaction* is now accomplished as part of a task. In this view, the human and the machine interface are considered within a systems-perspective as an *interacting unit*. However, within this approach it can become very difficult to draw the line between machine and human in the definition of a task. Therefore, even though CTA can be useful for purposes of doing basic research on cognitive processing and human performance (research intended to deepen our understanding of human mental activity; e.g., through modeling of cognitive behavior), it is an approach that may have disadvantages for applications focused entirely or primarily on the device/human-machine interface. Device- or HMI-focused applications require a treatment of the device and HMI cleanly separated from the human operator (so that the device/HMI may be tested relative to NHTSA Distraction Guidelines and improved).

Therefore, because the objective of the NHTSA Distraction Guidelines is to improve device/HMIs (in an effort to reduce distraction arising from them) and because the NHTSA

Distraction Guidelines apply to devices and their HMIs (not their human operators), the CTA approach is not an ideal framework from which to take definitions. This is because it does not allow a clean and separate focus on the HMI but treats the HMI and the driver as a single interacting entity. Therefore, the definition of a task used in the NHTSA Distraction Guidelines relies on the *earlier* traditions of HTA in which task operations are defined strictly in terms of the device/HMI side of the interaction in the vehicle and human operations are cleanly separated from the device. Such an approach focuses the task definition on the device and HMI, over which a product developer exerts control. This is *not* to say that understanding the human operator is not important. Understanding the human as part of the task is central to preventing distraction. However, the definition of task used here must harness the understanding of the human while at the same time allowing for the device interface to be conceptually treated as separable and separate from the human so it can be improved through design and engineering.

Applying Additional Factors to Support Usability of the HMI

Before leaving this background material, it should be noted that neither the definitions nor the test methods used under the NHTSA Distraction Guidelines preclude the application of additional factors (beyond those identified in the NHTSA Distraction Guidelines) that may be deemed useful in enhancing HMI usability during development of devices for vehicles. For those vehicle manufacturers who choose to use these voluntary NHTSA Distraction Guidelines, there may be other considerations that they may wish to incorporate in their product development processes as well. These might include, for example: (a) the quality of the HMI, (b) how frequently each task will be performed, (c) how relevant a task is to driving, and (d) how each task is valued by the driver among the activities undertaken within the vehicle. It is possible to *both* apply the NHTSA Distraction Guidelines and *also* incorporate other considerations in the HMI development process.

USE OF TASK TERMINOLOGY WITHIN THE NHTSA DISTRACTION GUIDELINES

Terminology about goals and tasks within the NHTSA Distraction Guidelines is used to specifically describe the interactions carried out with in-scope devices using visual-manual interfaces. Thus, the terminology is intended to apply to goals and tasks (and any lower-level sub-goals, subtasks, and operations comprising them) a driver carries out on in-scope devices and systems. The purpose of this terminology is to allow for consistent definition of “units of task activity” whose adherence to the NHTSA Distraction Guidelines may be tested.

Key Definitions From the NHTSA Distraction Guidelines

The proposed NHTSA Distraction Guidelines set forth specific definitions for which this report provides supplemental information. Two of the key definitions are those discussed below.

> **Goal**
>
> A goal is a device state sought by a driver. Goal achievement is defined as achieving a device state that meets the driver's intended state, independent of the particular device being executed or method of execution. (Federal Register, 2012; p.11236)

In the definition of "goal" used in the Phase 1 NHTSA Distraction Guidelines, the state sought by a driver is defined in terms of a "device state." This means the goal is defined in terms of a state that can be observed objectively on the HMI. The individual who has the goal is the "participant in the test." All the participants in a test will be given the goal by a tester (and goals for testable tasks will typically be meaningful ones, which might be performed by real drivers on the devices). More will be said about this later; suffice it to say now that planning prior to testing will identify the "goals" and "tasks" given to participants during testing. An example of a goal that is a "device state" would be "radio on" (as in, "Your goal is to turn the radio on. Please begin now."). This is a state of a device that can be objectively verified, perhaps in several ways, depending on the design. For example, a radio in the "on" state will produce "sound" (if its volume is set to an audible level), it may generate visual messages on the associated display, and its associated control may have an indicator which will identify the state to which it is set.

Goals (unlike sub-goals, described next) typically are hardware-*independent*, and may be achieved in virtually any vehicle. Their achievement can be verified regardless of the particular method used to achieve the goal. For example, "turn the radio on" is a goal that typically could be achieved in *any* vehicle equipped with a radio. Also, *regardless* of whether it is turned on with a push-button, a rotary knob control, or with a voice command, achievement of the goal state (of the radio being "on") can be verified objectively from the state of the device itself.

> **Sub-goals**
>
> A sub-goal is an intermediate state on the path to the goal toward which a driver is working. It is often distinguishable from a goal in two ways: (1) it is usually not a state at which the driver would be satisfied stopping; and (2) it may vary in its characteristics and/or ordering with other sub-goals across hardware/interface functions, and thus is system dependent. (Federal Register, 2012; p.11,236)

Worthy of comment in this definition are the ways in which sub-goals may be distinguished from a goal. First, a sub-goal is usually not a state at which a driver is typically satisfied stopping (unless it happens to be the last sub-goal in the larger task, and thus coincides with goal achievement). As previously discussed, since achievement of a sub-goal represents only partial goal achievement, intermediate to the final goal state being sought, drivers typically will persist beyond a sub-goal and continue with task activity through to the next sub-goal and beyond, until

the task is completed. Secondly, sub-goals may be hardware or HMI dependent. They may vary in their details and in their order within a task, depending on the device, its functionality, and/or its HMI. For example, when entering a destination into a navigation system, one system may require entry of the STATE first and another may require its entry last. This is an indication that the entry of the STATE portion of the destination is a sub-goal within the entire task of entering a destination. The nature and order of the sub-goals depends upon the particular navigation system being used. Chapter 6 contains several examples of testable tasks comprised of lower-level sub-goals, and subtask sequences achieving each of them as intermediate states along the path to achieving the task goal (see Testable Task 2E in Chapter 6 for an illustration of this).

Task versus Testable Task

Within the proposed NHTSA Distraction Guidelines, some additional definitions are truly central to their successful application. These definitions relate to the concepts of "task" and, most importantly, "testable task." Below is the definition of a task appearing in the Alliance Guidelines. It has provided an excellent foundation for a task definition, one upon which further advances can be made with the emergence of the Phase 1 NHTSA Distraction Guidelines.

> ***Task***
>
> A task is defined as a sequence of control operations (i.e., a specific method) leading to a goal at which the driver will normally persist until the goal is reached. An example is obtaining guidance from a navigation system by entering a street address using the scrolling list method until route guidance is initiated. (Alliance, 2006; p. 66).

There are several important features of this definition:

- The concept that a task is **driven by a driver's goal**.
- The concept of a **sequence of operations.**
- The concept that humans **tend to persist** toward a goal.

However, the proposed NHTSA Distraction Guidelines and this report have provided the opportunity to improve upon this foundation:

- **To augment the core definition by:**
  - Slightly reframing it for clarity and precision,
  - Adding explanatory information, definitions to be used in conjunction with the core definition,
  - Providing guidance on applying the definitions,
  - Providing examples and photos that will help users of the definitions, and
  - Providing examples of 'how to document' what testing was done, what tasks were tested, what outcomes resulted.

- **To simplify/clarify language in the definition and accompanying material by:**
  - Clarifying that a task involves the use of a specific method to achieve a goal, and

- Clarifying start and end states for tasks and how they differ from start and end of measurement.

- **To resolve treatment of special issues:**
  - Differences between tasks and subtasks,
  - Differences between tasks and dependent tasks,
  - How much "behavior" to include in a task (related in part to start/stop of measurement),
  - What to do about transitions into a task (e.g., the fact that a given task could perhaps be accessed from multiple different points),
  - What to do about concatenated tasks,
  - What to do about task interruption/resumption issues, and
  - What to do about natural tasks and driver-extended tasks (in natural use).

- **To provide a framework or context for how to think about the interleaving of secondary tasks with the (primary) driving task,** and effects of secondary tasks on multiple dimensions of driving.

One key change from the general human factors literature about tasks in the proposed NHTSA Distraction Guidelines relates to a slight re-framing of the concept of a task. What is really needed for guidelines and testing on limiting distraction is a definition for a "**testable task.**" This is a task is *operationally* defined (*for the purpose of testing)* in place of a task definition that works for all possible task types. This new concept is to be *explicitly distinguished* from more general, common terminology about "tasks" (it serves a different purpose).

Testable Task

The term testable task is introduced for specific use with the proposed NHTSA Distraction Guidelines. It employs a definition similar to the task definition used in the Alliance Guidelines, but one with the intention of a more precise and narrower scope. It is defined as follows:

> **Testable Task**
>
> means a sequence of control operations performed using a *specific method* leading to a goal toward which a driver will normally persist until the goal is reached. (Federal Register, 2012; p.11,236)

This definition of a testable task retains many of the important elements of the task definition used in the Alliance Guidelines (2006), while incorporating explicitly the notion of a "specific method" (third item below), resulting in the following set of key concepts:

- The concept that a task is **driven by a driver's goal**.
- The concept of a **sequence of operations.**
- The notion that this sequence represents a **specific method** of reaching a goal.
- The concept that humans **tend to persist** toward achieving their goal.

Again, in this formulation, a task is tied to a specific method of reaching a goal. If a different method is used to reach the goal, it constitutes a *different task* even though the goal may remain the same. For example, if a driver's goal is to phone a colleague, it might be done in several ways on a vehicle-embedded system that offers telecommunication services. The call might be placed by performing the task of dialing the colleague's 10-digit phone number. Alternatively, the call might be placed by performing a contact-selection task using the address book's list of contacts. These two tasks are distinct and different methods of reaching a goal and, under the definition of a testable task, they are different testable tasks. While the tasks serve the same goal, and achieve the same device state when performed successfully, they are different specific methods.

The proposed NHTSA Distraction Guidelines indicate that a testable task begins with the device at a previously defined Start State (must be identified in advance of testing) and proceeds from there. The task continues until the device attains a previously defined End State, or Goal (assuming that the testable task is successfully completed). Data collection begins at the "Start of Data Collection" and continues until "End of Data Collection." These "Start" and "End" points of data collection are defined with precision in the proposed NHTSA Distraction Guidelines and are discussed later in this report.

One example of a testable task is shown in Figure 2. More examples of testable tasks can be found in Chapter 6 of this report.

Description of a Testable Task for Destination Entry

In the vehicle from which this example was taken, route guidance support may be accessed in a visual-manual mode via a touch screen, used in combination with hard buttons along either side of the display. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a separate testable task to represent each method. The example below illustrates the method of destination entry using "points of interest" (or POIs).

Purpose of Example

This example illustrates a method of destination entry using POI search. It also illustrates:

- **Advance setup** of a testable task prior to testing (the need to create a number of "points of interest" within the navigation system in advance of testing to enable the function to be tested to work during testing)
- **How to set up a task that must be tested while driving (rather than in a stationary lab setting).** Some tasks (such as those enabled by navigation functions only become available when a vehicle is in motion and actively following a route). This task is one of those, and thus serves as one example of how to set up such a task for testing.
- **How to make a general task "testable"** by giving it specificity (e.g., "Obtain route guidance to 150 South Main Street, Blacksburg, Virginia, by selecting it from previous destinations.") In this case, because the system is capable of displaying a number of different categories of POIs, it is necessary to load (in advance of testing), instances of each type of POI and to load several instances of each type of POI (so that for any category selected, some reasonable amount of visual search will be needed to perform the task neither the least nor the most extreme amount of search that might be required).
- **How to define the "start state" for a testable task**
- **How to define the "end state" for a testable task** (which is distinct from end of measurement)

HIGHER-LEVEL GOAL: Obtain Route Guidance to a specific address

TESTABLE TASK: Obtain route guidance to 150 South Main Street, Blacksburg, Virginia, by selecting it from previous destinations.

Starting Configuration/State of Device: Entertainment system should be off. But navigation system should be on, and top-level navigation screen (top-level function screen) should be displayed.

Steps are shown on next page.

Figure 2. Example of Testable Task

	
Initial Top-Level Navigation Screen (start state).	Press “Dest” hard button on the right.
	
Press “Previous Dest” on touch screen.	Select “150 S. Main St, Blacksburg, VA” on touch screen.
	
Press “Set as Destination” on touch screen.	Press “Start Guidance”.

Figure 2 Continued. Example of Testable Task

Task End State is reached when the system first accepts the final control input from the driver to "Start Guidance." This happened in this example on this last screen (when the driver's touch on the "Start Guidance" button is successful). It is then reflected subsequently in system state changes that confirm this (by displaying the route to the POI, and/or by giving voiced guidance instructions to the POI).

Start of Measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Obtain route guidance to 150 South Main Street, Blacksburg, Virginia, by selecting it from previous destinations. Please begin now."

End of Measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally (e.g., by making the final touch and glance in the sequence of interactions comprising the task, thereby achieving the goal state, and ceasing further activity on the task).

Figure 2 Continued. Example of Testable Task

The terminology of a testable task standardizes the way tasks are identified and used for testing device adherence to guidelines pertaining to distraction. The term testable task is used to explicitly distinguish the definition from the more general terms related to "task," and to make clear that under the NHTSA Distraction Guidelines, the object of focus is specific to tasks used for *testing* distraction (relative to a set of guidelines or limits). The term testable task is intended to set the notion apart from more general, common parlance about "tasks." It is *not* intended to accommodate all possible task types that can be found, imagined, or conceived of in driver behavior (or might fall under the more general term "task").

Rather, testable tasks are those that can be operationalized in a practical and reasonable way for valid, meaningful, and repeatable testing of devices, in terms of the four attributes identified above (i.e., a task is driven by a goal, task is done by a sequence of control inputs, representing a specific method of reaching a goal, and the goal is one toward which the driver will persist until reached). The notion of a testable task thus is offered as a definition that is narrower in focus than the notion of "task" in order to provide for consistency and repeatability across system architectures, task types, and organizations. It encompasses less breadth than the set of all possible activities that may be called tasks (and less breadth than might be studied for research purposes). As such, it may not be able to accommodate every naturally occurring task activity or related behaviors. The definition of testable task sacrifices some breadth of coverage in order to gain precision, clarity, and repeatability across all testing for adherence to the proposed NHTSA Distraction Guidelines. Research endeavors, of course, may wish to explore tasks that lie beyond the definition of "testable tasks."

One of the key reasons for this is that there is an important distinction to be drawn between the needs of task definitions for *research* and the needs for *product evaluations*. For *research* there

may be a desire to have a task definition broader and more encompassing of behaviors in order to capture the full spectrum of human processes that science is interested in identifying and understanding. In contrast, the needs for *product evaluation* require specificity and a narrower focus to assure that the "object of measurement" (the task design as enabled by a device) is truly what is captured during testing. This is necessary so that test outcomes can be applied toward improving the design of the task/device (as opposed to other, broader factors of the driving environment that may lie outside the control of the manufacturer). Thus, the definition of "task" for product evaluation (a testable task) may need to be different than the definition of a "task" for research in many instances. These two venues (*research* versus *product evaluation*) differ in other important ways as well since their objectives are different. Both endeavors are extremely important and critical to forward progress in reducing distraction. However, for the purpose of testing devices, a definition is needed to properly focus upon the HMIs to be improved.

The definition of a testable task was also intended to provide a reasonable balance of precision and flexibility for application to real systems (like that of the Alliance definition of task [Alliance of Automobile Manufacturers, 2006]), since real systems have variability in their structure and operation, and the definition must be able to accommodate tasks in all of them.

TYPES OF TASKS

There are several types of tasks that are distinct and need to be treated in specific ways under the Phase 1 NHTSA Distraction Guidelines. These include:

Dependent Task

means a task that cannot be initiated until another task is first completed. Their start state is thus dependent upon the end state of another, antecedent, task.

An antecedent task that is followed by a dependent task can be distinguished from a task that contains two subtasks by examining the end states of both the antecedent task and the dependent task. For the antecedent task/dependent task case, both tasks will end with the achievement of a driver goal (i.e., two driver goals will be achieved, one for the antecedent task and one for the dependent task). In contrast, for a task composed of two subtasks, only one driver goal will be achieved. (Federal Register, 2012; p. 11,236)

An example of a dependent task (a task type also used in the Alliance Guidelines) is that after choosing a restaurant from a navigation system's POI list (antecedent task), the driver is offered an Internet function option of making a reservation at the restaurant (dependent task). The dependent task of making a reservation can only be initiated following the successful completion of the task of selecting a restaurant from within the navigation system. Thus, the activity of "making a reservation at a restaurant" is not a subtask, but a distinct and separate task. It may be tested as a distinct and separate task; one which has a "start state" of choosing a restaurant from a POI list within navigation and an "end state" of having successfully made the reservation. (In Chapter 6, see testable task Examples 2A, 2B, and 2M, as well as 4A.1-A.5.)

Antecedent Task

An antecedent task is one which precedes another task.

An example of an antecedent task is the task of selecting a restaurant from a POI list. It came before the dependent task of "making a reservation."

Additional types of tasks relevant under the NHTSA Distraction Guidelines are "primary tasks" and "secondary tasks."

Primary Task

Means a task related to the primary task of driving; used for controlling vehicle motion or used for controlling forward/indirect/rearward visibility.

A non-exhaustive list of primary task types are listed in Table 2.

Secondary Task

Means, in these guidelines, any interaction a driver has with an in-vehicle device that is not directly related to the primary task of driving.

Secondary tasks may relate to the adjustment of driver positioning, restraints, accommodation, comfort, convenience, communications, entertainment, gaining information, or navigation. More generally, but not of relevance to this document, secondary tasks can include both the preceding types of tasks as well as tasks such as eating, drinking, grooming, and many other possibilities. However, only some secondary task types are within scope for the Phase 1 NHTSA Distraction Guidelines (as listed in Table 2).

ADDITIONAL TASK RELATED TERMS

Subtask

Means a sub-sequence of control operations that is part of a larger testable task sequence and which leads to a sub-goal that represents an intermediate state in the path to the larger goal toward which the driver is working.

Subtasks should *not* be treated as separate dependent tasks during testing. For example, entering the street name as part of navigation destination entry is not a separate task from entering the street number; rather, these are subtasks of the same task. (Federal Register, 2012; p. 11,236)

Like sub-goals, subtasks are sub-sequences of activity that represent achievement of only an intermediate step along the path to goal achievement, namely the sequence of activity required to reach a sub-goal. Drivers typically will persist beyond a sub-goal and continue with task activity through to the next sub-goal (and beyond), until the task is completed. And, like sub-goals or tasks, subtasks may be hardware or HMI dependent. They may vary in their details and in their order within a task, depending on the device, its functionality, and/or its HMI. As in the earlier example, when entering a destination in a navigation system, one system may require entry of the STATE first and another may require its entry last. This is an indication that the subtask sequence of entering the STATE portion of the destination is a subtask within the entire task of entering a destination. The nature and order of the subtasks (done to reach sub-goals) depends upon the particular navigation system being used.

Control Input

Means a transaction between the driver and the device that is intended to affect the state of a device. Control inputs may be initiated either by the driver or as a response to displayed information initiated by the device itself.

For the visual-manual interfaces covered by this version of NHTSA's Guidelines, control inputs are restricted to physical control actions. (Federal Register, 2012; p. 11,235)

Although other elementary operations (besides physical control actions) may be involved in task activity (for example, voice-based operations), the Phase 1 NHTSA Distraction Guidelines, control inputs are restricted to physical control actions taken by the driver.

SPECIAL ISSUES

A small number of special issues warrant brief consideration before proceeding to a discussion of measurement concepts in Chapter 3.

Multiple Paths to a Goal from a Start State

Today's vehicles feature systems with a wide variety of architectures and functionalities. Some systems, by design-intent, offer multiple ways of reaching a goal state from a start state for certain tasks. When such a choice is intentionally offered by a system, it is desirable that all such paths to a goal state meet the proposed criteria in the NHTSA Distraction Guidelines. It is often not possible for a driver to know which path to a goal is the easiest, best, or preferred path. Therefore, to the extent that all design-intent methods for reaching a goal can be designed to meet criteria, it facilitates successful user experiences. Of course, sometimes customers discover ways of reaching a goal state that were never intended by a manufacturer. Such idiosyncratic pathways would not typically be foreseeable, or testable, nor expected to necessarily meet the guidelines.

Success in Task Completion

In testing tasks, one issue important for test integrity, is the topic of which data are to be retained and analyzed as valid test trials. The proposed NHTSA Distraction Guidelines say that a test participant must be successful in completing a task during the test in order for it to be considered as valid. This is defined in the box below.

> **Success in Task Completion**
>
> Means that a test participant has performed a testable task without substantial deviations from the correct sequence(s) of control inputs and achieved the desired end state for a testable task. (Federal Register, 2012; p. 11,236)

Determining whether the performance of a task is successful or not is thus based on the goal that was established for the task, whether that goal is achieved by the test participant's actions during the test, and whether it is achieved using the specified "method of task execution." Typically, it will be important for the testing staff to provide training to test participants on the method of task execution to be used (see Chapter 5 on training for participants). If a test participant does not reach the goal state for a task, that test trial is unsuccessful, and should not be included in test data. However, it is also possible for participants to meet their goal, yet deviate substantially from the correct sequence of operations that they were supposed to use. When this happens, the trial should be identified as "unsuccessful." Whether a trial is successful or not needs to be determined both by: (1) whether the goal state was reached, and (2) by the number and magnitude of any deviations from the intended sequence of control inputs (these deviations must be substantial to constitute an "unsuccessful task completion").

An operational definition of "substantial deviations" was not offered in the proposed NHTSA Distraction Guidelines. One possible criterion would be to evaluate whether the combination of

deviation and magnitude increased the length or difficulty of the task by more than 15 percent. If so, such a deviation might be considered substantial enough to render the trial "unsuccessful." If some other operational definition is utilized, it is should be documented as part of the test documentation.

A tally should be kept of all unsuccessful test trials for each participant. If more than 50 percent of test trials are unsuccessful while testing a sample of test participants, then that task is deemed an "unreasonably difficult task" for performance by a driver while driving. According to the proposed NHTSA Driver Distraction Guidelines, unreasonably difficult tasks are not recommended for performance while driving and should be locked out.

If a particular task has a high percentage of unsuccessful completions (but less than 50 percent), the testing staff can examine what this may indicate and take appropriate action. For example, is training in need of improvement or is the task itself one that may need to be improved before further testing resumes?

Interruptions/Suspensions of Task Activity

The interruption and resumption of tasks are typically not observed during distraction assessment of "testable tasks." In a formal test setting, once participants are given a request to perform a task, they usually perform it from start to finish without interruption. The phenomenon related to spontaneously interrupting a task during its performance, or of suspending task activity to attend to another matter (task interruption and resumption) is typically observed as a manifestation of higher-level attentional management strategies during *natural driving*, and only under certain circumstances. At this time, these do not usually appear to be a property of **tasks/devices** alone. (That is, it may not be possible to change task interruption/resumption behaviors through techniques exclusively focused on device design/function alone, but may instead require a more systems-oriented approach that addresses more elements than just the device interface.) This phenomenon appears to emerge from executive attention strategies used by the driver for multitasking under certain conditions. These multitasking executive attention strategies are not yet fully understood. Therefore, at this time, task interruption and resumption are identified as requiring further research. It is important that they be explored and understood more deeply. At the current time, design practices should be related to structuring tasks so that they may be easily interrupted and resumed by a driver, and readily allow the driver to return attention to the roadway, have been described in Alliance Principles 3.3 to 3.5 (Alliance of Automobile Manufacturers, 2006).

Concatenation of Tasks

Concatenation of tasks is not addressed under the Phase 1 NHTSA Distraction Guidelines, and it is not called for during testing. In applying the proposed NHTSA Distraction Guidelines, testable tasks should be developed which represent reasonable *single* tasks (of a typical nature) without concatenation.

The state of knowledge about driver task engagement does not yet permit anticipation of all possible concatenations of tasks in strings while driving, or of the longest possible search that a driver might conduct. While it is recognized that sometimes drivers may string tasks together, or

concatenate them, this type of behavior is one that has not yet been analyzed in data from naturalistic driving studies. These driver behaviors (stringing of tasks together, or persisting with activity of a certain type for unusual amounts of time) appear to relate to open-ended goal pursuit, or to states in which goal-seeking evolves dynamically over an epoch. As such, the behaviors do not appear amenable for testing under definitions tied to achievement of a specific goal within a test, using a specific method of control interaction.

As a result, in applying the proposed NHTSA Distraction Guidelines, develop testable tasks that represent reasonable single tasks. Testers should evaluate reasonable and typical, or average list lengths, search conditions, and so forth rather than trying to represent the worst-imaginable cases when they evaluate testable tasks.

Testing Mixed-Mode Tasks

Some task interactions involve mixed-mode interactions: a mixture of both auditory-vocal and visual-manual interactions. Because such tasks do involve some visual-manual interaction, it is appropriate that the visual-manual components of these tasks meet the proposed Phase 1 NHTSA Distraction Guidelines. The reason for doing so is to examine the extent of visual and manual demand experienced by drivers during performance of these tasks. Examples of such tasks are provided in Chapter 6 to illustrate how such tasks can be structured for this purpose (in particular see the examples from Vehicle 4 in Chapter 6).

Portable or Aftermarket Devices

As mentioned in Chapter 1, portable and aftermarket devices fall outside the scope of the Phase 1 NHTSA Distraction Guidelines. However, future phases are planned to cover these types of devices. For portable and aftermarket devices, testable tasks are developed for them just as they would be for embedded devices. Chapter 6 provides several pertinent examples. See, for instance, testable task Examples 1D, 2I, and 2K.

Interleaving of Tasks with Driving

How tasks are interleaved with the primary task of driving remains a topic of much research; in particular the issue of how attention is allocated and shifted between multiple tasks being coordinated concurrently during driving. This issue is of fundamental importance to the understanding of distraction. It is one of the reasons that many of the testing protocols identified by NHTSA in the proposed NHTSA Distraction Guidelines provide for the secondary testable task to be tested *within the context of* a primary driving task (e.g., in a driving simulator scenario). This provision of context (both primary and secondary tasks having to be interleaved during testing), together with acquisition of a variety of key performance measures, will help illuminate the effects of multitasking under these tested conditions.

CHAPTER 3. THE START AND END OF TASKS AND TASK TESTING

This chapter covers terminology needed for measurement during testing; particularly for starting and ending data collection, and for starting and ending tasks. It also addresses the handling of eye glance data.

Measurement Start and End

Start of Data Collection (Federal Register, 2012; p. 11,236) means the time when the experimenter tells command indicating the same thing). Test participant eye glances and vehicle driving performance are examined only after the start of data collection. If a test participant's eye glance was in progress at the start of data collection, only the portion of it after the start of data collection is used. If the eyes were in transition at the moment when data collection began, then the glance prior to the transition need not be coded. As explained elsewhere, the device should be in its start state when the start of data collection occurs.

To give an illustration, the task start state occurs at the time when the tester tells the participant to begin. This can be done, for example, by using a task request such as, "Your task is to dial your friend Joe at 303-5588 using the phone available through the vehicle touch screen. Please begin now." (The word "now," when it occurs, would identify the starting point for data collection.)

During training (see Chapter 5), participants should be instructed to refrain from any and all activity on the task until they hear the word "now." They should neither look at nor begin to reach for or touch the device to be used for the task until they hear the word "now."

End of Data Collection (Federal Register, 2012; p. 11,236) means the time when the test participant tells the experimenter "done" or indicates the same thing in a non-verbal manner. Test participant eye glances and vehicle driving performance are examined only before the end of data collection. If a test participant's eye glance was in progress at the end of data collection, only the portion of it before the end of data collection is used. If the eyes were in transition at the moment when data collection ended, then the glance after the transition need not be coded.

If the end of data collection occurs when the device is at the desired end state for a testable task, and if the specific method of achieving it has been used, then the test participant has successfully completed the testable task (assuming that no substantial deviations from the specified method of completion have occurred). If a test participant says that he/she has completed the task, but then resumes activity on the task, it becomes a judgment call as to whether data collection has really ended. Cues beyond the test participant's statement of completion must be considered (such as whether the device goal state has been achieved, whether errors have been made or not, what the glance pattern has been, and so forth, in order to determine what the appropriate "end of data collection" should be for that trial.

Task Start and End States

Start State for a Testable Task (Federal Register, 2012; p. 11,236) means the pre-defined device state from which testing of a testable task always begins. There are several alternatives for this, depending upon the type of task:

1. For some testable tasks there is only one place from which the task can be initiated, and that screen would correspond to the Start State.

2. Some testable tasks can be initiated from more than one place (screen). In this case, one of these screens should be selected as the Start State, according to the proposed NHTSA Distraction Guidelines. The desire here is to reduce the amount of testing needed to meet the NHTSA Distraction Guidelines. It is generally not necessary to test all possible transitions into a testable task.

    a. This may be the "home" screen from which the driver initiates all tasks in the system, including the performance of the testable task

    b. This may be the top-level "system function" screen for the category of functions from which the testable task comes (in other words, the top-level navigation screen, top-level communications screen, or top-level entertainment screen).

    These two options are quite different, so it is important that a tester select the one which will provide a fair and reasonable test for a task. From a user (or driver) perspective, the most appropriate selection will be the one representing the most typical size and range of transition that drivers make when entering the task during typical use while driving. Under the Alliance Guidelines (2006), it is suggested that the "system function" screen always be used. See Chapter 6 for some examples of home screens that may be used.

3. For Dependent Tasks, the Start State would be enabled by the End State of the antecedent testable task. See Chapter 6 for several examples of this.

End State for a Testable Task (Federal Register, 2012; p.11,236) means the pre-defined device state sought by a test participant to achieve the goal of that testable task. See Chapter 6 for examples of end states.

Handling Eye Glances During Measurement

Under the proposed NHTSA Distraction Guidelines, eye glances and control inputs related to the task should be included in data collection within the bounds specified.

At Start of Data Collection

According to the proposed NHTSA Distraction Guidelines (Federal Register, 2012; p. 11,236), test participant eye glances are to be examined only *after* the point when data collection is

started. (This is true for other types of data as well). If a test participant's eye glance to the device was in progress at the start of data collection, only the portion of it falling after the "starting point" of data collection should be used. The task start state occurs at the time when the tester tells the participant to begin; for example by using a task request such as, "Your task is to dial your friend Joe at 303-5588 using the phone available through the vehicle touch screen. Please begin now." The word "now," when it occurs, would identify the start of data collection.

At End of Data Collection

According to the proposed NHTSA Distraction Guidelines (Federal Register, 2012; p. 11,236), once the end of data collection has been reached, test participant eye glances are not to be examined after that point (nor are any other data). If a test participant eye glance is in progress at the end of data collection, only the portion of it before the end of data collection is used. If the end of data collection occurs when the device is at the desired end state for a testable task, then a test participant has successfully completed the testable task (assuming that no substantial deviations from the specified method of completion have occurred).

The figure below (Figure 3) provides an illustration of circumstances in which small portions of glances prior to the start of data collection and after the end of data collection should be excluded from the data for the task. In this case, a glance has led the start of data collection (the test participant may have begun to look at the display screen upon first hearing the words "address book" instead of waiting for the word "now" in the phrase "please begin now." At the end of the task, the participant's glance on the display persists beyond the last control input, and beyond the pronouncement of "done!" This "extra" glance time should also be excluded.

The rationale for excluding the "extra" glance time at the beginning of a test when participants have not yet been tasked to start the process to achieve the goal is that they may be working on their own goal of thinking through the task to be better prepared for completing the goal of the device test when it begins (which is extraneous to the task at hand and properly part of another process or goal).

The rationale for excluding the "extra" glance time at the end of a test is that the goal has been achieved after completion of the last step of a task. If the goal has been achieved, then the device is no longer requiring the user to look at it in order to achieve the goal. Therefore, the glance is indeed extraneous or reflective of another process in the participant's mind.

While the excluded portions of glance time may, in fact, be reflective of visual demand associated with the task, it was necessary to specify the rules of scoring that could be consistently and reliably followed by all organizations who may apply the proposed NHTSA Distraction Guidelines. And while some loss of veridicality may occur with this scoring rule, it is deemed less problematic than opening the scoring practice to inclusion of unspecified numbers or amounts of trailing and leading glances. (It can be very difficult to determine whether glances immediately prior to and after an interaction are part of a task interaction or extraneous, and reflective of another process). In service of a desire to standardize scoring consistency and practices, this is the practice described by the proposed NHTSA Distraction Guidelines.

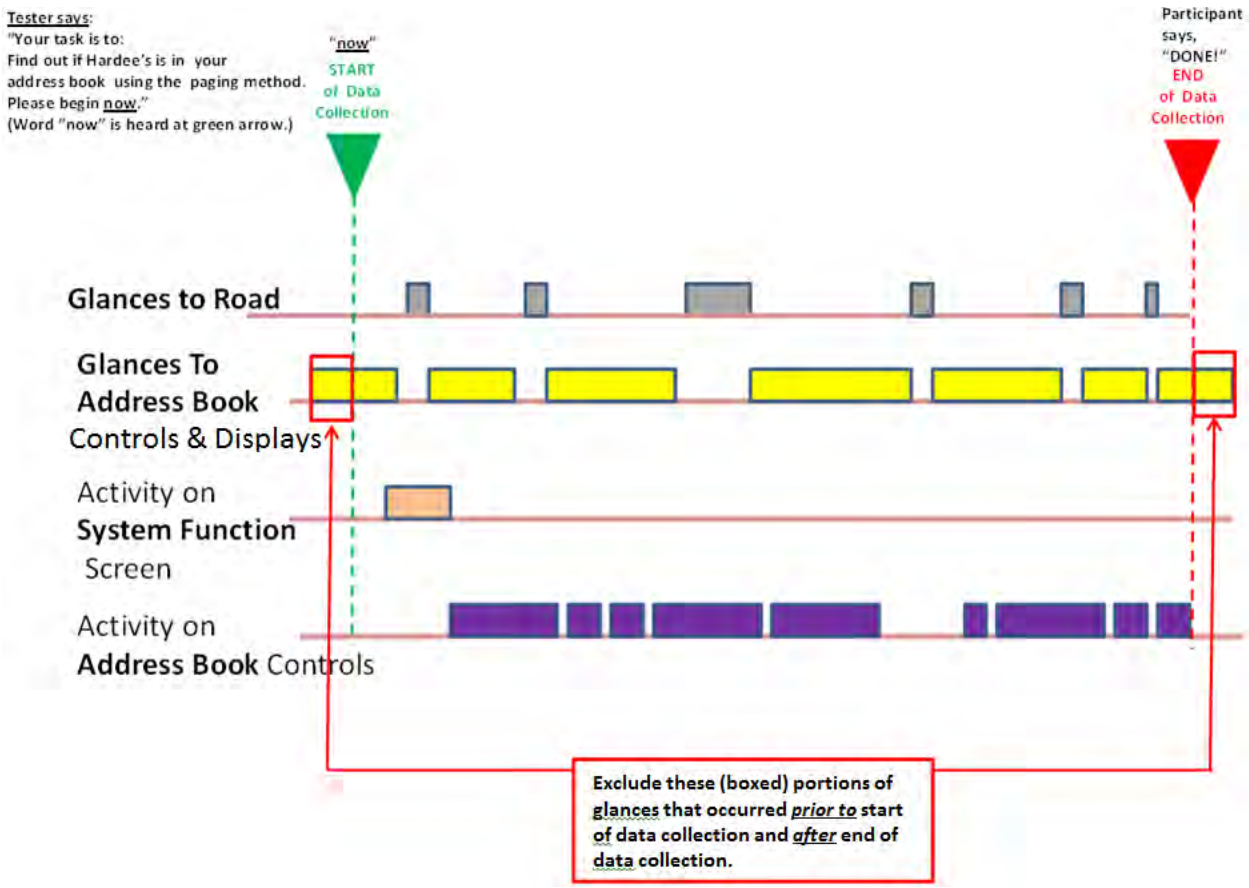


Figure 3. Glances at Start and End of Data Collection (Illustrative Only)

SPECIAL ISSUE – SYSTEM RESPONSE DELAYS

A special issue that may warrant consideration during measurement is one that has been noted by others: the possible effect of a system's response delay. System response delay, which can be introduced during tasks that involve connectivity to and communication with systems off-board the vehicle, tend to be variable. Sometimes they are short (e.g., < 1.5 seconds), but may in other instances be longer (>1.5 seconds). Another recommendation in the proposed NHTSA Distraction Guidelines is that system response delay be kept to 0.25 seconds or less. This is a short enough system response delay not to become an issue.

CHAPTER 4. SETTING UP TESTABLE TASKS FOR TESTING

Prior to testing, it is important that adequate preparation take place. This includes completely defining testable tasks, as well as preparing the device or system so that it may be properly tested. This chapter provides information to support this preparation process, and to facilitate common practices for testing devices and systems.

Identify testable tasks

First, in getting ready to prepare a test of tasks on a system or device, it is useful to identify, name, and list all tasks that can be done within a system or device. Furthermore, it may be useful to identify tasks new, tasks that have been previously tested, and tasks that will need to be analyzed or tested. The subset of new tasks and those needing to be analyzed or tested are the ones that need to be developed into testable tasks.

Establish Goal for Each Testable Task

For each testable task, a goal needs to be defined. That goal should be expressed in terms of a device state. See Chapter 6 for examples. Often, developing goals and testable tasks will be an iterative process, wherein the tasks and goals are co-developed together as a system.

Define Each Testable Task

Once a list of testable tasks and goals has been defined, a task analysis should be performed on each testable task to define the method to be used, and the step-by-step sequence of operations to be used by test participants in completing the task during testing. This task analysis will define the start state for the task, as well as the specific method to be used to move from the "start state" to the "goal state" namely the control input steps a test participant will use to reach the goal. This analysis, then, will also provide the basis for developing task training, and for developing the scoring protocol for scoring the task as successful (or not). Two examples of such task analyses are provided below in Tables 8 and 9.

Table 8. Sample Task Analysis for Destination Entry Task

TASK A
Goal: Enter destination of 1040 South Elm Street, Greenlee, Indiana
Task: 1. Look for and find the system function button (a soft button) which brings up "NAVIGATION" functions. 2. Press system function button to bring up the main "NAVIGATION" screen. 3. Press the (soft) button which allows for "Address Entry." 4. Press (soft) button for entry by "Street and House Number." 5. At prompt, enter name of state and city: a. Either use keypad to enter "state" using letter-by-letter entry, then "city" using letter-by-letter entry, OR b. Select state from list at top of screen by touching it, then select city from the next list that appears by touching it. 6. At prompt, enter name of street: a. Either use keypad to enter name of street letter-by-letter, OR b. Select street from list at top of screen by touching it. 7. At prompt, enter address: 8. Push "GO" so the map will display and route instructions will begin. 9. Look at map and receive first instruction.
Device: Embedded navigation system with large color screen near top of center stack

Table 9. Sample Task Analysis for Phone Dialing Task

TASK B
Goal: Place call to person at 765-9367
1. Move hand toward phone, using eyes to guide its position. 2. Push "Phone" to select phone functions. 3. Select "dialer." 4. Recall phone number. 5. Move hand and eyes to phone keypad. 6. Enter digit. 7. Enter digit. 8. Enter digit. 9. Enter digit. 10. Enter digit. 11. Enter digit. 12. Enter digit. 13. Push « send .»
Device: Embedded phone displayed on touch screen

Setting Up Testable Tasks

Selecting Data Entry Items

Some tasks require participants to enter inputs and those inputs may have a variety of different lengths (e.g., city names for navigation systems, songs, artists). For these types of data entry items, a typical length input should be used. Precise averages need not be used and there may be some variation in length from input to input. For example, for the input of city names into a navigation system, a length of 9 to 12 letters could be used.

To illustrate how task inputs for tasks might be developed for use in testing under the NHTSA Distraction Guidelines, one salient example is that of preparing destination entries. Table 10 shows the destination entry items used in the Crash Avoidance Metrics Partnership Driver Workload Metrics study (Angell et al., 2006). These are reasonable examples of address entries that would meet the conditions (quoted above) from the proposed NHTSA Distraction

Guidelines and were appropriate for testing address-entry via a scrolling visual-manual method on the Magellan system used in the CAMP DWM study. For that study, each destination for entry was constructed so that each address would have a nearly identical number of key presses for entry (if the most efficient method of scrolling and spelling were used in each case). Nearly all of the addresses required 40 key presses, plus 7 "Enter" key presses to be successfully input into the system. The range of key presses was from 38 to 40 (not all characters appeared on the screen at one time). The seven "Enter" key presses were consistent for each address. In addition, destinations were configured to be unfamiliar to all participants. Due to the design of the study, six pairs were needed; each task was tested on six trials, with a repeated (or replicated) measurement performed of each of these. **Important Note**: *If these addresses were to be used for testing some other type of navigation system as part of a product evaluation, then they would each need to be re-analyzed to determine whether the same or similar numbers of key presses would be needed to enter each of the destinations using the particular navigation system and destination entry method to be tested.* However, the method for preparing destination entries (ensuring they are each of reasonable length, require similar numbers of key presses for entry, and are equally unfamiliar to test participants), can be generalized as an approach to preparing task inputs needed for testing.

Table 10**. Illustration of Types of Inputs That Can Be Used for Testable Tasks**

	Sample Destination Entry Items for Use in Testing (From CAMP Driver Workload Metrics Project; Angell et al., 2006)	
Test Trial	Replication #1	Replication #2
0	Practice Item A01 2653 Ferndale Ave Hamburg, NY	Practice Item A02 5904 Heckert Rd Bakerstown, PA
1	Test Item A11 9841 Amanda Ln Algonquin, IL	Test Item A12 3245 Althea Dr Algonquin, IL
2	Test Item A21 1365 Gateway Dr Fargo, ND	Test Item A22 2976 Madison Av NW Fargo, ND
3	Test Item A31 3637 Water St Jackson, WI	Test Item A32 1977 Sherman Rd Jackson, WI
4	Test Item A41 1547 Lago Vista Ln Katy, TX	Test Item A42 6368 Magnolia St Katy, TX
5	Test Item A51 8476 Fairbrook Ln La Porte, TX	Test Item A52 1258 Garfield St La Porte, TX
6	Test Item A61 7069 Fahey Dr Indianapolis, IN	Test Item A62 1401 Gabriel Rd Indianapolis, IN

For the evaluation done in the CAMP DWM study, each destination entered by a test participant was presented on paper positioned on the center console at the beginning of each trial. The rationale for doing this was that drivers have been observed (during natural driving) to carry their

destination addresses into the vehicle on paper, which they lay on the console or tape to the dash when they enter the vehicle. Each destination appeared in 36-point Times New Roman font, centered on the paper. The item's label did not appear on the page, only the destination itself was printed on the page. The destinations were prepared in advance on pages of paper for positioning on the console, one at a time.

A destination was entered by the test participant in each trial, in response to the task request, **"Your task is to enter a destination into the navigation system using the scrolling list function. Please read the address from the paper at the right. Please begin now."** Participants were instructed not to begin the task until they heard the words, "Please begin now." If a destination was entered correctly, the trial was scored as "fully successful." Otherwise, it was scored "not successful."

The task of dialing a phone number is another good example for determining how to develop task inputs. There are several factors to be considered in setting up phone numbers to be used for testing. One factor is to determine the length of the phone number (7 or 10 digits). Another factor is phone number familiarity; whether participants will be asked to dial numbers that they know and recall from memory or whether participants will be given numbers unfamiliar to all of them. A third factor is to try to use phone numbers that will not interrupt someone on the other end of the call if the call is initiated but not terminated before the other party "hears" the call (it's difficult to have enough familiar numbers for testing to prevent this).[2]

It may be appropriate to consider testing at least two numbers of each length, one familiar, and one not familiar. The use of unfamiliar phone numbers for entry entails additional careful decisions about how to present and access the unfamiliar number. Some of these decisions can only be meaningfully made by the tester, in the context of the system being evaluated.

Setting Up Lists for Searching

When systems or devices are prepared in advance of a test, a list of items must often be entered by testers, so that the functions within the system can be properly exercised during testing of tasks. A rule of thumb that may be followed in preparing lists in a system (in advance of testing) is to set up lists each a reasonable length; neither so short that they are not meaningful representations of what drivers actually put into their system (and provide underestimates of demand when tested), nor so long as to be an extreme beyond what drivers typically use (representing the worst possible imaginable scenario). The lists used should be meaningful, and represent the range of list-lengths typically used by drivers for various functions. Among the lists of items that may need to be prepared in advance are these:

1. **Lists of contacts** (for navigation, phoning, and messaging tasks). Contact information for individuals will need to be entered for most letters of the alphabet, and typically enough contacts entered for each letter to fill a screen (usually 4 to 7 contacts for most letters of the alphabet).

[2] Familiar numbers may also call you back during testing.

2. **Lists of names, addresses, and phone numbers** (for directories or address books separate from "contacts"). Again, names for individuals will need to be entered for most letters of the alphabet, and typically enough names entered for each letter to fill a screen (often four to seven names for most letters of the alphabet).

3. **List of previous destinations** (used in route guidance). Sometimes these will need to be carefully entered or arranged so that the address of interest for the task to be tested is in the appropriate position for testing.

4. **List of favorites** (destinations, music, etc.) These will need to be entered. The tester will need to use judgment on how many need to be entered, and decisions will need to be based partly on the system and its capabilities/constraints. If the system is based on "paging," then there should be enough items entered to fill each page, and enough pages to be representative/meaningful (e.g., four) per category.

5. **List of presets.** These, too, will need to be set up and stored in advance.

6. **List of restaurants, and entries for other categories** that may become part of either address book functions, yellow pages functions, or even displayed as POIs (restaurants, fuel stations, stores, etc.) so that there will be a reasonable number of pages in the system (in systems capable of paging), and a reasonable number of items per page that appear when the system is used. Again, this means a reasonable number of items per category will need to be entered.

7. **Playlists** (on CDs, or on iPods, or on hard drives of the infotainment system) so there are songs from different artists, genres, etc. It may be advisable to test several playlist lengths when testing search tasks related to entertainment. For example, a recent study by Lee, Roberts, Hoffman, and Angell (2012) examined drivers' use of playlists on MP3 players while driving, and studied playlists of three lengths (20 songs, 75 songs, and 580 songs), arranged alphabetically. The short lists needed little or no scrolling, the medium lists needed one full scroll, and the long lists needed multiple scrolls to find the target song. Drivers reported the number of the song in the displayed list to indicate they had found the song they were searching for and to help identify the task end state. This study is an example of one where a range of playlist lengths was tested. Alternatively, if information is available about the number of songs that drivers typically store on the device being tested (and the variability among drivers), then playlists representing a reasonable range based on those data could be tested.

Another factor influencing task performance in list searching, besides list length, is the nature of the list structure (whether the items are arranged alphabetically, or not organized at all, or are organized in some other way altogether, such as by category) and the presence/absence of any intelligent list search functions. Testers should be aware of these factors and consider them carefully as they develop testable tasks involving searching.

Setting Up Other Items for Searching

In preparing systems for testing, there are some additional system functions that may need attention. These include:

1. **Points-of-Interest**. POIs are usually indicated on map displays by navigation functions using symbols or icons. If a test will need to examine POI-related tasks, it will be necessary to set up a sufficient number of POIs so that a reasonable number can appear for the needs of the task to be tested, and that an appropriate set of icon types will be displayed.

2. **Choosing External Media.** When tasks such as "playing a book on CD" or "uploading music from a USB drive" are to be tested, which require the use of external media, care should be taken to select appropriate samples that can meaningfully represent the range of most typical and representative use, rather than selecting them from the tails of the distribution (from the extremes of easy or difficult).

General System Setup

Selecting or Setting up the Home Screen

As already mentioned, under the NHTSA Distraction Guidelines, one home screen may be used for testing even when several may be available for use in this regard. The only further comment that may be appropriate in this regard is that some systems allow home screens to be customized (i.e., to be set up by the customer) and to be configured to contain whatever functions the driver may desire. For the purposes of testing, while it is acceptable to use one of the customizable home screens as the home screen for testing, it should be configured by the tester and that it remain configured in the same way for all test participants in a given test (for consistency of results).

System Functions Requiring Connectivity Beyond the Test Environment

When testing in a static setting (such as in a simulator), it may not be possible for the vehicle involved in the test to receive radio transmissions, or to be connected to satellite radio, or have other types of connectivity. Degrees of connectivity will depend on many things, including the attributes of the testing facility. In some cases, simple solutions such as adding repeaters inside a building or extending an antenna/receiver to outside the building may improve connectivity. In other cases, it may be necessary to conduct a test of a vehicle function (entertainment, telecommunications, or navigation) with certain elements missing (for example, with the audio feedback turned off). If this is necessary, it is advisable to note it in the test documentation.

Systems Functions Requiring Vehicle Movement

Navigation, route guidance, and, *particularly,* route-following tasks may present certain challenges for testing. Typically, many of these tasks would need to be tested while driving on the road because, in order for the systems to generate instructions or information, the vehicle's GPS unit must be moving spatially in order to map to the navigation database. When a vehicle is

stationary in a test setting (e.g., in a simulator), the GPS unit does not move. This presents a technical hurdle in getting the navigation unit to generate route guidance instructions for a non-moving vehicle during simulation and, moreover, to have those instructions match the simulated world a driver is viewing on the simulator screen. A few rare simulators may have a way to "trick" both a route guidance system to be tested and the simulator into jointly creating the test conditions to make a test of route-following tasks possible; but this set of tasks, for the moment, may need to be addressed through on-road testing, or other testing solutions.

CHAPTER 5. TRAINING ON TASKS PRIOR TO TESTING

For consistent testing of tasks to occur under the voluntary proposed NHTSA Distraction Guidelines, it is essential that training be given to participants on the tasks to be tested. To ensure high-quality test results, task training should be done in a careful and appropriate manner. This is particularly the case since test participants may be naïve about the devices being tested.

One example that may be considered for administering task training was the training protocol used by the CAMP DWM Study (Appendices B, D, and G, in Angell et al., 2006). This study employed a five-step task training protocol to train participants:

- Set up the task,
- Explain the task,
- Demonstrate the task,
- Provide practice on the task, and
- Test mastery of the task.

This training protocol is illustrated for five tasks in Tables 10, 11, 12, 13 and 14 (for the tasks of Easy Radio Tuning, Hard Radio Tuning, Manual Cell Phone Dialing, Navigation Destination Entry Using Scrolling, and "Just Drive"). In this approach, the experimenter (after ensuring that the device to be used for the task has been properly set up for testing), explains the device, its HMI, and the task to the test participant. Then the experimenter demonstrates how to perform the task. After this, the experimenter allows the test participant to perform a practice trial using the task. Then, as a final step in training, the experimenter asks the test participant to perform the task a *second time*, this time to assess the participant's mastery of the task. Thus, the final performance trial is considered a "criterion trial" that assesses whether the participant can do the task correctly. The experimenter records whether or not the task is correctly performed on the criterion trial. If the task is not performed to the criterion of "correct," then the criterion trial is re-administered (after the setup state is first reinstated). This may be repeated for a maximum of three criterion trials.

While it is desirable to have a participant achieve and demonstrate mastery to a criterion of correct performance, it is also necessary to control for the total amount of task exposure and practice that each participant receives, within a reasonable range, which is the reason for restricting the number of criterion trials to a maximum of three. Use of this training protocol with more than a hundred participants across a broad range of task types and task difficulties has shown that virtually all participants (across a broad range of ages) achieve successful criterion performance within three criterion trials. For tasks involving long sequences of inputs, training typically includes instruction on how to correct errors (see Tables 10 and 11 for content on this). When participants do not achieve successful criterion performance during training, yet **do** go through three criterion trials, a tester should take note, and consider what it is preventing the test participant from being successful. (Each criterion trial provides the tester with an opportunity to further instruct the test participant in the event there are any misunderstandings of the task).

If repeated criterion trials (to a maximum of three), together with any additional instruction after each criterion trial, still result in incorrect performance by a test participant, the tester should take special note. If this occurs on a single task, it need not disqualify a test participant from the

test if the tester believes the participant understands the task and has the capability to perform it correctly (since it is quite possible that the individual would complete the task successfully on the next attempt). However, if a participant is having more generalized difficulty mastering more than one task (e.g., difficulty with multiple tasks within a set), then the participant may have unusual challenges that did not surface during participant recruitment, and may not be representative of the general driving population for product testing under the NHTSA Distraction Guidelines . If multiple tasks within a test set are not mastered by an individual (based on an inability to achieve criterion trial performance for multiple tasks during training), the tester may need to decide if such a test participant should be replaced.

Training may be given immediately before the testing of each task or may be 'blocked' and given on several tasks prior to a block of test trials on those tasks. Both approaches have been utilized with success in prior work. Blocked training imposes greater demands on test participants' memory, to remember how to perform several tasks, which may be difficult if the tasks are entirely new or if there are a large number of tasks. However, the 'blocked' approach may also reflect the more typical way in which tasks are usually performed while driving. Drivers do not typically stop and familiarize themselves with a single task immediately before performing it. It is more usually the case that they familiarize themselves with the operation of a range of various devices before driving their vehicle. If training is "blocked" before testing, or if blocks of training and testing alternate, some care should be exercised to make sure the number of tasks within a block is not so numerous as to prevent mastery and successful performance by test participants in the ensuing block of test trials.

Table 11. Sample Training Protocol for Easy Radio Tuning Task

TASK: Radio Tune "Easy"
Set Up the Task. *(Note: This must be done prior to every radio task)* • **Check radio to ensure that it is turned "ON."** • **Check to ensure that all radio presets are set to 100.1 FM on both FM1 and FM2 (if not, set it again).**
Explain the Task. The radio/CD entertainment system will be used for multiple operations during our test session today. The first operation that I will show you with this system will be to tune the radio. Before we begin, let me point out the TUNE knob, which will be used to tune to a requested radio frequency. As you turn it to the right, it adjusts the radio frequency upward and if you turn it to the left, it adjusts the radio frequency downward. Prior to the radio task, the radio will be turned ON and the radio will be set to 100.1 FM. Your first task involves tuning the radio to a specific frequency and you can do that by using the TUNE knob and turning it one way or the other, to get to the specific frequency that has been requested. You will be asked to tune to various stations on the FM band during our test session today.

Demonstrate the Task.

Let me show you how to do this task. The task request will say something similar to, "Your task is to tune the radio to 104.3. Please begin now." When I hear this, I would reach for the radio and turn the tune knob to the right until I reach 104.3 FM <tester performs task while talking> and then I would say "Done" to indicate my completion of the task. Okay, do you have any questions?

Provide Practice on the Task.

I would now like you to practice tuning the radio. Let me play the task request for you <task requests are pre-recorded to assure all participants receive them in a correctly stated and properly paced way, as well as in a proper sequence, counterbalanced across test performances> and you may proceed on the word "Now" when you hear the words "Please begin now." Remember to say the word "Done" when you are finished. <Play task request>

Test Mastery of the Task (Criterion-Test-Trial).

Okay, let's do it one more time.

This time I will be recording whether or not the task is successfully completed. Ready?

<Play task request>

Record on datasheet whether task is completed successfully.

Note any special codes or comments.

Repeat the criterion trial if task was not fully successful but first re-verify task setup states.

This may be done up to three times (recording success of attempt each time.) Go on to the next task if successful completion is achieved or if three criterion trials are run.

Scoring Key: Score as Y if correct radio station is selected. Otherwise, score N.

Task Requests To Be Used During Training and Criterion Test Trial

Practice and Criterion Task: Radio Tune Easy 3 (Practice)

Your task is to tune the radio to 101.9 FM. Please begin now.

Radio Tune Easy 1

Your task is to tune the radio to 104.3 FM. Please begin now.

Radio Tune Easy 2

Your task is to tune the radio to 97.1 FM. Please begin now.

Table 12. Sample Training Protocol for Hard Radio Tuning Task

TASK: Radio Tune "Hard"
Set Up the Task (*Note: This must be done prior to every radio task.).* • **Push Preset 1 (it should be set to 100.1 FM).** • **Press AM band.** • **Press "OFF."**
Explain the Task. As mentioned earlier, the radio/CD entertainment system will be used for multiple operations over the next couple of days. The first operation with this system was to tune the radio. Your second task will also be to tune the radio; however this task will be slightly different. Before we begin, let me point out the POWER knob to turn on/off the radio unit, the TUNE knob that will be used to tune to a requested radio frequency, and the FM button to switch to the FM band. As you turn the TUNE knob to the right, it adjusts the radio frequency upward and if you turn it to the left, it adjusts the radio frequency downward. Prior to this radio task, the radio will be turned OFF and the radio will be set to the AM band. Your task will involve turning ON the radio, switching to the FM band by pushing the FM button, and then tuning to a particular frequency by using the TUNE knob. Remember to say "Done" to indicate that you have completed the task. Your task will involve turning ON the radio, switching to the FM band by pushing the FM button, and then tuning to a particular frequency by using the TUNE knob. Remember to say "Done" to indicate that you have completed the task.
Demonstrate the Task. Let me show you how to do this task now. Your task request will be similar to this: "Your task is to turn on the radio, switch to the FM band, and tune to 107.5. Please begin now." When you hear the word "Now," reach for the POWER button on the radio unit and press it to turn it on. Then press the FM band button to switch to the FM band and then turn the tune knob to the right to tune the radio to 107.5 FM and say "Done" to indicate completion of task. Okay, do you have any questions?
Provide Practice on the Task. Now I would like you to practice tuning the radio. Let me play the task request for you and you may proceed on the word "Now" when you hear the words "Please begin now." Remember to say the word "Done" when you are finished. <Play task request>
Test Mastery of the Task (Criterion-Test-Trial). Let's do it one more time. This time I will be recording whether or not the task is successfully completed. Ready? <Play task request> Note any special codes or comments. Repeat criterion trial if task was not fully successful and re-verify task setup states. **This may be done up to three times (recording success of attempt each time). Go on to the next task if successful completion achieved or three criterion trials run.**
Scoring Key: Score as Y if frequency is correctly set and N if it is not correctly set.

Task Requests To Be Used During Training and Criterion Test Trial

Practice and Criterion Task: Radio Tune Hard 3 (Practice)

Your task is to turn on the radio, switch to the FM band, and tune to 101.9 FM. Please begin now.

Radio Tune Hard 1

Your task is to turn on the radio, switch to the FM band, and tune to 107.5 FM. Please begin now.

Radio Tune Hard 2

Your task is to turn on the radio, switch to the FM band, and tune to 93.1 FM. Please begin now.

Table 13. Sample Training Protocol for Manual Cell Phone Dial Task

TASK: Manual Dial Cell Phone

Set Up the Task *(Note: Must be done prior to every cell phone task.)***.**

- **Check that cell phone is ON.**
- **Check that phone is face open and placed in the cup holder with the headset cord attached to the phone.**
- **Write down participant's 10-digit phone number on paper to verify correct dialing.**

Explain the Task.

The cell phone that will be used over the next couple of days is sitting in the cup-holder with its face open. You will be asked to dial your home phone number including the area code. You DO NOT need to dial "1" on the phone. In order to make a call, you must pick up the phone from the cup-holder, dial the 10-digit number (by punching in the digits for the number), and then press TALK. At that point, you will say "Done" because you have completed the task of dialing your home telephone number. Then please press the END key IMMEDIATELY AFTER you press the TALK button to cancel the call. (This way you prevent your home phone from actually ringing. We don't want to bother anyone who may be home.) You may then place the phone back in the cup holder. A word of caution, please try to keep your fingers away from the wires on top of the phone as the connection is rather fragile.

Demonstrate the Task.

Let me show you how to do this task now. The task request may say, "Your task is to call home by manually dialing the phone. Please begin now."

I would pick up the phone and begin keying the number on the keypad. Once all 10 digits had been entered, I would press the green TALK button on the top left and say "Done." Then I would immediately press the red END button on the top right to cancel the call. Again, let me emphasize that after I press TALK I would say "Done" as I press the END key.

Should you accidentally misdial a digit, you can go back one number by pressing the CLR button. This removes the last digit you entered. If you would like to remove all the digits you have entered, e.g., the first digit was wrong and you have already dialed all 10 digits, press and hold the CLR button as I am demonstrating now.

Okay, do you have any questions?

Provide Practice on the Task

I would like you to practice manually dialing the phone to call home. Let me play the task request for you and you may proceed on the word "Now" when you hear the words "Please begin now." Remember to say the word "Done" when you are finished. <Play task request>

Now I would like you to practice manually dialing home again, but purposely misdial a digit. I would like you to practice with the clear button, so should you make a mistake, you know how to correct it. Let me play the task request for you again, and when you hear the word "Now," you may proceed to dial… but please misdial at least one digit and then use the clear button to erase that digit. Remember to say the word "Done" when you are finished. <Play task request>

Test Mastery of the Task (Criterion-Test-Trial).

Let's do it one more time. This time I will be recording whether or not the task is successfully completed. Ready? <Play task request>

Note any special codes or comments.

Repeat criterion trial if task was not fully successful and re-verify task setup states.

This may be done up to three times (recording success of attempt each time). Go on to the next task if successful completion achieved or three criterion trials run.

<When scoring, press the TALK button twice to see the last number dialed, to score correctness>

Scoring Key: Score as Y if number is correctly dialed, P (partially correct) if error is made but recovered from and goal state is reached, and N if number is not correctly dialed.

Task Requests To Be Used During Training and Criterion Test Trial

Practice and Criterion Task: Manual Dial Cell Phone (Practice)

Your task is to call home by manually dialing the phone. Please begin now.

Manual Dial Cell Phone 1

Your task is to call home by manually dialing the phone. Please begin now.

Table 14. Sample Training Protocol for Navigation Destination Entry Task

TASK: Navigation Destination Entry
Set Up the Task [Setup will need to be tailored to the particular navigation system under test.]. **• Navigation system should be turned ON with database CD loaded (if CD is not loaded there will be an error message).** **• First two screens should be cleared (the warning screens need not appear to participant). Do this by pressing enter.** **• Press <Menu> button to return screen to main menu (start point).** **• Stimulus material with the address must be ready and covered (so it is not visible).** **[The training will also have to be adjusted to correspond to the navigation system under test].**
Explain the Task. Have you ever used a navigation system before? Our next task will involve entering an address into a navigation system. We are going to be asking you to use one particular function of this system for entering destinations. It is called the scrolling list function. There are several buttons on the front of this display that you will have to press to enter the destination. Mostly, you will be using the four arrow keys and the enter button. Your task command will ask you to read an address from a paper that will be located on the cup-holder and enter it into the navigation system. Let me take you through a request step by step and you may ask any questions along the way.

Demonstrate the Task.

For example, the task request would say "Your task is to enter an address into the navigation system using the scrolling-list function. Please begin now." Read the address to be entered, 400 W. Jefferson Ave., Detroit, MI.

Then the next step in this process would be to select ADDRESS/INTERSECTION from the main menu on the navigation screen. ADDRESS/INTERSECTION is selected by pressing the up or down arrows until it is highlighted (by default it is highlighted to begin with), and then pressing ENTER. This takes you to the next screen where you would be given the choice of entering a CITY NAME or a STREET NAME. We would like you to enter the CITY NAME first for all destinations.

After pressing ENTER, you will see a screen of cities listed alphabetically. To scroll through this list, you can either use the up and down arrow buttons to move you one-by-one through the list, or you can press the left and right arrow buttons to move you to the next letter, in other words, pressing right when you are on a city that begins with "C" will take you to the first city that begins with "D." Do you understand how the scrolling buttons work? After you have located the desired city, in this case Detroit, press ENTER to get to the street selection screen. If you accidentally press ENTER at the wrong city, you can go back to the menu by pressing BACK and then selecting the correct city. After you arrive at the street selection menu, you must use the same controls as you did in the city selection menu to choose the correct street name. The same controls include the up and down buttons for line-by- line movement and the right and left buttons for categorical or sectional movements.

Once the desired street has been found, in this example, West Jefferson Avenue, press the ENTER key.

Now the system asks that you choose either an address range or an intersection. Because we have been given an address number and not a cross street, you will pick ADDRESS RANGE. The system will then let you know which address numbers are valid at the top of the screen and the desired address can be entered by using the up and down arrows to pick the first number, then the right arrow to go to the next number, and so on. Once the correct address number is entered, press ENTER and the system will ask for route details. You can then choose the QUICK AND SHORTEST TIME ROUTE option, then press ENTER and say "Done" to indicate completion of task.

Provide Practice on the Task.

Do you have any questions at this point? I'd like you to try the system on your own now. I will play the task request and I would like you to attempt to enter an address by scrolling. Remember that if you are stuck or have any questions, feel free to ask me. <Play task request>

Ok, good. Do you feel comfortable with that?

Let's try a few more practices, and I'd like you to purposely make a mistake in selecting the city, street and street number. Just in case you make a mistake later today, it is important that you know how to recover and complete the address entry.

I'm going to play another task request and I'd like you to start the task and make a few mistakes along the way to see what the system does and how you can get back on the right track. Feel free to take your time, make a few mistakes, and try to recover from them. Let me know if you have any questions.

Are you ready to begin? <Play task request>

Test Mastery of the Task (Criterion-Test-Trial).

I'd like you to enter an address on the navigation system by scrolling one more time. This time I will be recording whether you complete the task successfully.

Are you ready? Ok, let me play the request now. <Play task request>

<Note: Please record if task was correctly completed, and note any special codes or comments.>

Repeat criterion trial if task was not fully successful and re-verify task setup states before starting it.

This may be done up to three times (recording success of attempt each time). Go on to the next task if successful completion achieved or three criterion trials run.

Scoring Key: Score as Y if destination is correctly entered. (Yes, Successful)
Otherwise, score N. (No, Not Successful)

Practice and Criterion Task: Manual Dial Cell Phone (Practice)

Your task is to call home by manually dialing the phone. Please begin now.

Manual Dial Cell Phone 1.

Your task is to call home by manually dialing the phone. Please begin now.

Table 15. Sample Training Protocol for "Just Drive" Task

TASK: Just Drive.

***Special Note**: It may be appropriate or useful for product evaluations to include the additional "task" of "Just Drive." This could, for example, be a period (e.g., a 30-second period, or a 2-minute period) that is treated just like a task, but during which test participants are instructed to "just drive." (The task request can be, "Your task is to 'Just Drive.' Please begin now.") During this task, the participant would be asked to focus on driving (no secondary tasks of any type would be performed during the just driving period). Inclusion of such a task provides a good baseline of primary driving workload. Research has shown that this baseline, of attention focused on just driving, is different from the driving that occurs "in between" secondary task activities (which resembles more of a "let-down" and recovery period, than a baseline driving period). If a "just drive" task is included, it should be added to the task list sequence, as well as to training so that participants know what to do when they hear the task request during testing.*

Set Up the Task.

None

Explain the Task.

While driving in a driving simulator, or while driving on the road, we will occasionally ask you to drive and maintain your lane position, speed, and headway appropriately, and to monitor the roadway for objects and events just as you normally would when you drive. During this time you will not be asked to perform any other additional or secondary tasks. At the end of the task, you will hear the recording say "We are done," indicating the end of the task.

Demonstrate the Task.

I won't do a demonstration of this now. However, I would like to play the task request for you as practice (so that you know what the request will sound like). "Your task is to 'Just Drive.' Please begin now."

Provide Practice on the Task.

Just as before, when you hear the words "Please begin now," you would proceed with just driving. You will be on the road or in the driving simulator when this task is presented to you. <Play task request>

Test Mastery of the Task (Criterion-Test-Trial).

None

CHAPTER 6. ANNOTATED EXAMPLES OF TESTABLE TASKS

This chapter contains tables of actual task examples that have been annotated to illustrate testable tasks of the types that may be defined under the proposed NHTSA Distraction Guidelines, as well as to illustrate difficulties that may commonly arise in applying the definitions, along with ways to approach handling them.

Each example of a testable task was selected to illustrate something in particular that may be of interest to individuals using the proposed NHTSA Distraction Guidelines. Therefore, explanatory text to accompany each example is inserted throughout this chapter, as a means of pointing out certain aspects of different tasks, and the issues that can arise in the application of the definitions associated with distraction measurements.

These examples are organized around four vehicles (labeled: Vehicle 1, Vehicle 2, Vehicle 3, and Vehicle 4). Within each vehicle section, examples are organized by type of task, with navigation tasks first, entertainment tasks next, then communication tasks, and finally interactive information and other tasks last. Each example bears a color-coded label for task type in its upper right corner (yellow for navigation tasks, blue for entertainment tasks, green for communications tasks, and purple for interactive information tasks).

TASK EXAMPLES FROM VEHICLE 1

Disclaimer: These task examples were developed in an effort to illustrate real tasks in real vehicles, to provide documentation that could facilitate and support testing efforts. The examples are intended only to illustrate how to set up tasks for testing. They are ***not*** intended to provide an authoritative guide on how any given vehicle, device, or task operates.

TESTABLE TASK EXAMPLE 1A

Description

In this vehicle, route guidance support can be accessed in a visual-manual mode via a touch screen. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a testable task to represent each method. The example below illustrates the method of destination entry using the "street address method." Also, this vehicle offers multiple home screens, which are customizable. This example explains what to do about testing in this circumstance (namely, select one home screen for use in testing).

Purpose of Example

This example illustrates:

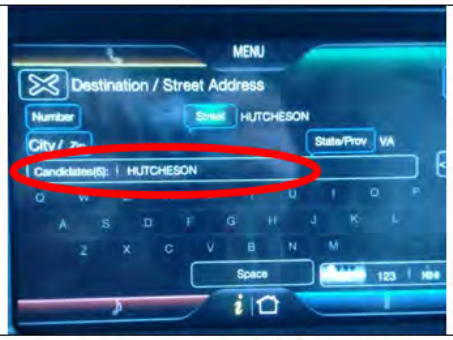
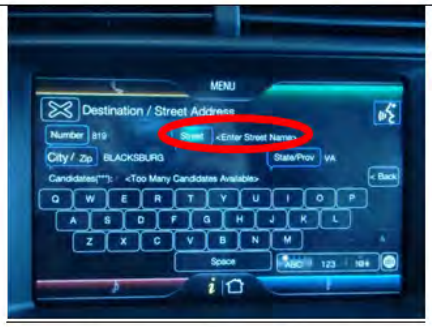
- **Selection of Start State for Task** when there is more than one "home screen" available: In this system, users can select from three different customizable home screens. Under the proposed NHTSA Distraction Guidelines, it is not necessary to test tasks using all three home screens. Just one home screen may be selected and used for purposes of testing.
- **Display of address to be entered.** To test address entry, the test participant needs to be given addresses to enter. This may be done, for example, by typing each address to be entered on a placard (e.g., 6 inches wide by 8 inches tall) using a 36-point font and placing it in the cup holder where it can be easily viewed on each test trial.

HIGHER-LEVEL GOAL for this example: Obtain route guidance to destination.

TESTABLE TASK: Obtain Route Guidance to 819 Hutcheson, Blacksburg, Virginia, using the street address first method.

Starting Configuration/State of Device: System on**.** Home screen selected. (More than one is available in the system, so one should be selected and always used to test this task). Address to be entered during task should be displayed on a card or paper positioned in a natural way (e.g., in cup holder of vehicle or on a sticky-note adhered to the center console), and typed in a font easily visible (e.g., a 36-point font).

Steps:

	
Touch green navigation bar in upper right of touch screen. (Its current label indicates direction of travel/heading and destination.)	Press “Street Address” on touch screen.
	
Begin to enter in each letter of the new destination’s street name by using keypad on the touch screen.	Street name pops up, and driver confirms by touching the bar (“Hutcheson”).
	
Touch button labeled “City/Zip” on screen.	Enter “B-L-A-C-K” using keypad.
	
This screen appears as a driver is typing in the letters of “Blacksburg.” The driver would then press “Blacksburg” on the touch screen.	Touch “Enter Street Number”.

Street number is entered at this point. (Numerals "8-1-9"; touch "Number.") (Note: There may be a screen missing or task sequence error at this point, due to sudden power loss (through no fault of vehicle) due only to experimental setup during task analysis).	Press "Start Route" on appropriate area of touch screen.
 Following the task end state (in prior step), this screen comes up indicating that the system accepted the driver's touch on the "Start Route" button (in the previous step) – and the system issues an audio prompt: "Please proceed to the highlighted route, then route guidance will start." (The display subsequently begins to change to highlight the route.)	

Task end state is reached when the system first accepts the final control input from the driver to "start route guidance." This happened in this example on the prior screen (when the driver's touch on the "Start Route" button was successful) and then is reflected subsequently in system state changes that confirm this (shown and described in the final cell of the table above).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Obtain Route Guidance to 819 Hutcheson, Blacksburg, Virginia, using the street address first method. Please begin now."

End of measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally.

TESTABLE TASK EXAMPLE 1B

Description

In this vehicle, route guidance support can be accessed in a visual-manual mode via a touch screen. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a testable task to represent each method. The example below illustrates the method of destination entry using the "favorite's method." Also, this vehicle offers multiple home screens, which are customizable. This example explains what to do about testing in this circumstance.

Purpose of Example

This example illustrates the same things as Example 1B, but using the alternate method of destination entry. In addition, it illustrates the need to create a "list of favorites" in advance of testing to enable the function to be tested to work during testing.

HIGHER-LEVEL GOAL for this example: Obtain route guidance to destination

TESTABLE TASK: Obtain route guidance to 719 Circle Drive, Blacksburg, Virginia, using the favorites list.

Starting Configuration/State of Device: System on**.** Home screen selected. (More than one is available in the system, so one home screen should be selected and always used to test this task; it should be the same home screen used to test the other destination entry method). Addresses to be entered during task should be displayed on a card or paper positioned in a natural way used by real drivers (e.g., written on a piece of paper positioned in the cup holder of vehicle or on a sticky-note adhered to the center console, typed or printed legibly in a font easily visible (e.g., 36-point font). Create a list of favorite destinations in advance of testing.

Steps:

	
Touch green navigation bar in upper right of touch screen. (Its current label indicates direction of travel/heading -- and destination.)	Press "Favorites" on touch screen.
	
Select "719 Circle Dr, Blacksburg" on touch screen.	Select "Set as Dest" on touch screen.
	
Select "Start Route" on touch screen.	Following the task end state (prior step), this screen comes up indicating that the system accepted the driver's touch on the "Start Route" button (in the previous step) and the system issues an audio prompt: "Please proceed to the highlighted route, then route guidance will start." (The display subsequently begins to change to highlight the route.)

Task end state is reached when the system accepts the final control input from the driver to "start route guidance." This happened in this example on the screen immediately above (when the driver's touch on the "Start Route" button was successful) and then is reflected subsequently in system state changes that confirm this (shown and described in the final cell of the table to the right).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Obtain Route Guidance to 719 Circle Drive, Blacksburg, Virginia, using the Favorites method. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1C

Description

In this vehicle, route guidance support may be accessed in a visual-manual mode through a touch screen.

Purpose of Example

This example illustrates the possible need to test some tasks in a moving vehicle; namely those involving route guidance. This is just one example.

HIGHER-LEVEL GOAL for this example: Cancel current route guidance.

TESTABLE TASK: Cancel current route guidance support.

Starting Configuration/State of Device: Navigation screen on. Route guidance in progress to a set destination, and a route is displayed.

Steps:

	
Route guidance is in progress.	Press "Menu" button to bring up top-level Navigation screen.
	
Press "Cancel Route" on the touch screen.	A pop-up screen appears, with an embedded yes-no query. Press "Yes" on touch screen.

Task end state is reached when the system has accepted the final control input from the driver ("Yes" to cancel route) subsequently reflected by system state changes confirming this. (NOTE: Example had to be developed in a stationary vehicle, so these cues cannot be specified here.)

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Cancel route guidance on the current trip. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1D

Description

This task example involves an iPod connected to the vehicle through an interface. When connected, the vehicle's screen is used to display iPod information and the vehicle's controls (touch-sensitive areas of the screen) are used to scroll and select. This task is interesting because within the task itself (at the subtask level, there are alternative ways to accomplish the task). Therefore, a ***specific*** method of accomplishing the task must be selected ahead of time for testing. Test participants should be trained to perform the task using that method during the test.

Purpose of This Example

This task example is useful for illustrating the following topics:

- **Advance setup** of a testable task prior to testing (importance of loading songs on the iPod, connecting the iPod to the vehicle, setting the entertainment function to "radio" or "CD" before test)
- **How to make a general task "testable"** by giving it specificity (e.g., "Play the song 'Let Her Cry' on your iPod") not "play a song on your iPod." In this case, the song is half-way down a list of five songs, requiring some visual search; neither the easiest nor the hardest instance of finding a song in the list. The method of "scrolling with the bar" to find the desired song in a list of songs must be identified and trained as the method to be used during a given test. (For completeness in testing the vehicle's system, both testable tasks available within this system for achieving the goal of finding and initiating play of a specific song should be tested, and a separate test of each them should be established and conducted but this example illustrates only one of them.)

HIGHER-LEVEL GOAL for this example: Listen to a specific song on iPod.

TESTABLE TASK: Find and initiate play of the song "Let Her Cry" on your iPod using the scroller.

Starting Configuration/State of Device: iPod Nano is connected to the vehicle via USB. Numerous songs of different genres and from different artists have been loaded on the iPod in advance of testing. In advance of the test, the entertainment system has been turned on, and set to a different mode (Radio or CD).

Steps:

	
Press lower left red bar on touch screen, which represents entertainment function (Label shows current song on radio at the moment.).	Select "Browse All Sources" (bottom of column on left).
	
Select "Music" (top of list).	Select "Songs".
	
Using the scroller, search the list until finding the desired song "Let Her Cry". This step consists of using the scroller to bring the song into view within the list on the screen. The scroller is not visible in this photo, but is located to the right of the song list. *Note: At the subtask level, the driver could also select songs G-H to move closer to the song in the list by pressing the down arrow on the right, rather than using the scroll bar. The choice of specific method (scroller or down arrow) to be used for song selection must be made in advance, and trained as the method to be used (and the one to be tested).*	Select the specific song "Let Her Cry" by pressing the song title on the touch screen.

The task end state would be reached when the driver successfully touches the area corresponding to the correct song selection on the touch screen subsequently indicated by the system starting to play the song.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Find and initiate play of the song 'Let Her Cry' on your iPod using the scroller. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1E

Description
In this vehicle, steering wheel controls may be used to adjust certain entertainment system functions.

Purpose of Example
This example illustrates how to set up a testable task using steering wheel controls.

HIGHER-LEVEL GOAL for this example: Turn up entertainment volume so it can be heard.

TESTABLE TASK: Adjust volume of the entertainment system upward by two increments on the steering wheel controls, so it is audible.

Starting Configuration/State of Device: Radio or CD should be set to "on" but volume should be adjusted to a very low, just barely audible level (right at the threshold between audible and inaudible). The Home screen should be showing on the main display screen. Note that users can select from three different customizable home screens, so one should be selected by the tester (in advance of testing) for testing this task.

Steps:

	System response is non-visual.
Press "+" side of rocker on steering wheel 2 times.	System accepts the button presses – and sound levels become perceptibly louder. (A display may also give an indication of volume increases in some modes – but no change was apparent on the particular screen examined for the example.)

Task end state is reached when the system has accepted the final control input from the driver to "increase volume" subsequently reflected by system state changes confirming this (sound level is louder).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Adjust the volume of the entertainment system upward by two increments on the steering wheel controls, so it is audible. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1F

Description

In this vehicle, when entertainment tasks are accessed in a visual-manual mode, a touch screen is used.

Purpose of Example

This example illustrates how to test the task of finding songs on a CD. This is just one example.

HIGHER-LEVEL GOAL: Listen to specific song on a CD.

TESTABLE TASK: Find and initiate play of the song "Final Heartbreak" by Jessica Simpson on the CD in the player.

Starting Configuration/State of Device: Ahead of time, buy or prepare a CD with songs that can be used during testing. Immediately prior to each test trial, turn on the entertainment system, and insert the CD in the CD player. Then set the entertainment mode to "satellite radio." Return the system to its home screen.

Steps:

	
Press red Entertainment bar on touch screen. It is labeled with whatever is currently playing.	Press "CD" on touch screen.
	
Press the forward arrows on touch screen, to advance through songs on the CD, watching for desired song title. It takes three presses to get to the target song in this example, at which point it will start playing.	Final device state at task end. Screen shows that the last touch press was accepted, and the target song has been selected and is playing.

Task end state is reached when the system has accepted the final control input from the driver ("third press on arrow" arriving at the song to be played) subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Find and initiate play of the song 'Final Heartbreak' by Jessica Simpson on the CD in the player. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1G

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a touch screen is used.

Purpose of Example

This example illustrates how to set up a testable task for dialing a 7-digit phone number by entering digits. This is just one example of a dialing task.

HIGHER-LEVEL GOAL: Place phone call.

TESTABLE TASK: Place a phone call to the restaurant by dialing the digits 951-1210.

Starting Configuration/State of Device: In advance of testing, pair a cell phone with the vehicle. Immediately prior to test trial, make sure a customizable home screen (the one intended for use with this task) is displayed on the screen.

Steps:

Touch the yellow bar on home screen to bring up the "phone menu".

Enter the digits "9-5-1-1-2-1-0" on the keypad shown on touch screen.

Press "Dial" (area with the green phone icon) toward right side of the touch screen.

Task end state is reached when the system has accepted the final control input from the driver ("dial") subsequently reflected by system state changes confirming this (e.g., audio feedback that the phone is ringing.)

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Place a phone call to the restaurant by dialing the digits 951-1210. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1H

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a touch screen is used.

Purpose of Example

This example illustrates how to set up a testable task for placing a phone call using contacts stored in the address book (of the phone). It is particularly useful for showing:

- **Advance setup** of a testable task prior to testing (importance of loading names of contacts into the cell phone used for testing, connecting the phone to the vehicle, setting the display to the home screen before test).
- **How to make a general task "testable"** by giving it specificity (e.g., "Place a call to your friend Rich by using the contacts stored in your address book.") In this case, the contact is fairly far down a list of contacts, requiring some visual search; neither the easiest nor the most extreme instance of finding a contact in the list. The method of "scrolling with the bar" to find the desired contact in a list of names must be identified and trained as the method to be used during a given test. (For completeness in testing the vehicle's system, both testable tasks available within this system for achieving the goal of finding and initiating a call to a contact using the address book should be tested, and a separate test of each them should be established and conducted but this example illustrates only one of them.)

HIGHER-LEVEL GOAL: Place phone call.

TESTABLE TASK: Place a phone call to your friend Rich using contacts stored in your address book and the scrolling function.

Starting Configuration/State of Device: Pair a cell phone with device. Store a list of contacts in the cell phone being used for testing. Turn system on. Make sure the home screen going to be used as the starting configuration is up and displayed.

Steps:

	
Touch the yellow bar on home screen to bring up the "Phone" menu.	Touch "Phonebook" on touch screen.
	
On the list of contact names that has appeared on the screen, search for the desired name by using the white vertical scroll bar on the right side of the screen, by touching it and moving it downward. (An alternate method would be to push the downward arrow twice on the touch screen but that would need to be tested separately.)	When the target contact comes into view, select "RICH," by touching it on the Touch screen.
	
Press "Dial" (with green phone icon) on touch screen. Phone will begin ringing, giving audio confirmation that touch input was accepted.	

<u>The task end state</u> would be reached when the driver successfully touches the area corresponding to the "Dial" button on the touch screen subsequently indicated by the ring of the phone (indicating that the system has placed the call).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Place a phone call to your friend Rich using contacts stored in your address book and the scrolling function. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 1I

Description

In this vehicle, when information tasks are accessed in a visual-manual mode, a touch screen is used.

Purpose of Example

This example illustrates how to formulate a testable task for "information tasks" that often end in visual search. This is just one example for making a task ("look up the weather") testable, by adding a response component that allows the tester to determine if the task is successfully done.

HIGHER-LEVEL GOAL for this example: Look up the weather conditions for today.

TESTABLE TASK: Determine and tell your passenger what chance there is for rain today in Detroit.

Starting Configuration/State of Device: System on. One of three Home screens displayed.

Steps:

	
Touch the bar labeled "Weather" on touch screen.	This brings up this screen, representing the final device state. Driver must search the screen to find the needed information (circled in green), and report it out loud to his/her passenger, "50% chance of rain".

Task end state is reached in this case when the driver reports out the information required by the task "50% chance of rain." This comes after the system makes the information available to the driver.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Determine and tell your passenger what chance there is for rain today in Detroit. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TASK EXAMPLES FROM VEHICLE 2

Disclaimer: These task examples were developed in an effort to illustrate real tasks in real vehicles, to provide documentation that could facilitate and support testing efforts. The examples are intended only to illustrate how to set up tasks for testing. They are ***not*** intended to provide an authoritative guide on how any given vehicle, device, or task operates.

TESTABLE TASK EXAMPLE 2A

Description

In this vehicle, route guidance support may be accessed in a visual-manual mode via a touch screen, used in combination with hard buttons along either side of the display. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a testable task to represent each method. The example below illustrates the method of destination entry using POIs.

Purpose of Example

This example illustrates a method of destination entry using POI search. It also illustrates:

- **Advance setup** of a testable task prior to testing (the need to create a number of points-of-interest within the navigation system in advance of testing to enable the function-to-be-tested to work during testing).
- **How to set up a task that must be tested while driving (rather than in a stationary lab setting).** Some tasks (such as those enabled by navigation functions only become available when a vehicle is in motion and actively following a route). This task is one of those, and thus serves as one example of how to set up such a task for testing.
- **How to make a general task "testable"** by giving it specificity (e.g., "Locate the Hardee's burger restaurant nearest your current route using POI search.") In this case, because the system is capable of displaying a number of different categories of POIs, it is necessary to load (in advance of testing), instances of each type of POI and to load several instances of each type of POI (so that for any category selected, some reasonable amount of visual search will be needed to perform the task; neither the least nor the most extreme amount of search that might be required).
- **How a task such as this one may serve as an "antecedent task" for several "dependent tasks" (see Tasks 2B and 2M).**

HIGHER-LEVEL GOAL: Locate a POI along your route using POI search.

TESTABLE TASK: Determine if there is a Hardee's burger restaurant near your current route and select its location using POI search.

Starting Configuration/State of Device: The entertainment system should be turned off. Route guidance should be initiated, and in-progress along a route near which the target POI falls. Further, the vehicle must be near this area. (Thus, this task is one that must be done while driving or, if stationary, must be in a vehicle momentarily pulled off route and parked).

Steps:

	
Display of current route (in-progress).	Press "POI" on the touch screen.
	
System displays a selection of types of POIs along bottom of screen that may be displayed on map. Press the "hamburger" icon on the touch screen.	System responds with visual message, indicating that it is plotting burger restaurants on the map. Wait for system response.
	
Search the map for newly-plotted POI symbols of hamburger restaurants. When the icon for "Hardee's" is found, touch its icon on the touch screen at the desired location	

Task end state is reached when the system first accepts the final control input from the driver to select the "Hardee's" POI (the touch on the POI icon for "Hardee's"). This happened in this example on this last screen (with the driver's touch on the POI button). It is then reflected subsequently in system state changes that confirm this (by offering further goals that driver may select after this point).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Determine if there is a Hardee's burger restaurant near your current route and select its location using POI search. Please begin now."

End of measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally.

TESTABLE TASK EXAMPLE 2B

Description

In this vehicle, route guidance support may be accessed in a visual-manual mode via a touch screen, used in combination with hard buttons along either side of the display. The example below illustrates a *dependent* task that may be initiated after a POI has been located and selected along a route.

Purpose of Example

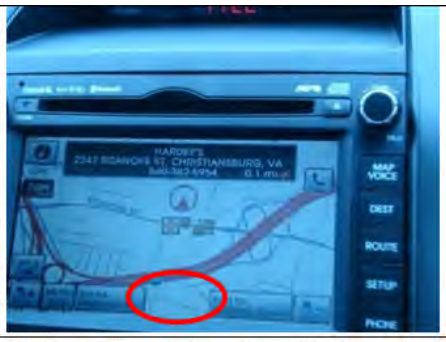
This example illustrates a method of destination entry available within the POI search function. It may be accessed as a *dependent* task (i.e., it follows the antecedent task (2B, described previously) of locating and selecting a POI along a route. The main purpose of this example is to illustrate how dependent tasks may be defined and tested.

HIGHER-LEVEL GOAL: Obtain route guidance instructions to a POI along your route.

TESTABLE TASK: Obtain route guidance instructions to the Hardee's burger restaurant that you have already selected as a POI near your current route, staying within the POI function.

Starting Configuration/State of Device: The entertainment system should be turned off. Route guidance should be initiated, and in-progress along a route near which the target POI falls. Further, the vehicle must be near this area and this task must follow Task 2B in which the POI has been located and selected. (Thus, this task is one that must be done while driving or, if stationary, must be in a vehicle momentarily pulled off route and parked).

Steps:

	
The task start state corresponds to the state of the system at acceptance of the touch input on the POI icon on the map for "Hardee's" burger restaurant occurred. This represents the end state of the antecedent task (TESTABLE TASK 2A, that preceded this task) and is the start task for this task. (It designates the Hardee's POI as the location of interest).	Press 'Set as Destination' on the touch screen (selecting "Hardee's" as the destination for route guidance instructions).
	
System gives visual feedback that it is calculating the route to the POI destination. Wait for system to calculate the route.	When route calculation is complete, press "Start Guidance".

Task end state is reached when the system first accepts the final control input from the driver to "Start Guidance." This happened in this example on this last screen (when the driver's touch on the "Start Guidance" button was successful). It is then reflected subsequently in system state changes that confirm this (by displaying the route to the POI, and/or by giving voiced guidance instructions to the POI).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task, i.e., "Your task is to: Obtain route guidance to the Hardee's burger restaurant nearest your current route using POI search. Please begin now."

End of measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally.

TESTABLE TASK EXAMPLE 2C

Description

In this vehicle, route guidance support may be accessed in a visual-manual mode via a touch screen, used in combination with hard buttons along either side of the display. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a testable task to represent each method (Examples 2C through 2H, excepting 2D for 'cancel route'). The example below illustrates the method of destination entry using POIs.

Purpose of Example

This example illustrates a method of destination entry using POI search. It also illustrates:

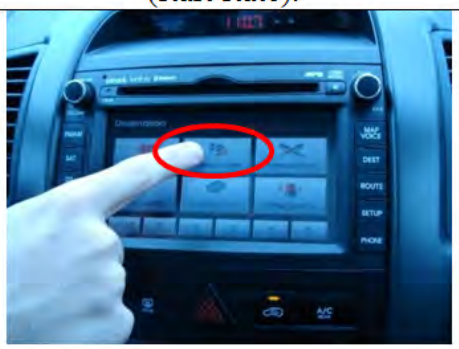
- **Advance setup** of a testable task prior to testing (the need to create a number of "points of interest" within the navigation system in advance of testing to enable the function to be tested to work during testing).
- **How to set up a task that must be tested while driving (rather than in a stationary lab setting).** Some tasks (such as those enabled by navigation functions only become available when a vehicle is in motion and actively following a route). This task is one of those, and thus serves as one example of how to set up such a task for testing.
- **How to make a general task "testable"** by giving it specificity (e.g., "Obtain route guidance to 150 South Main Street, Blacksburg, Virginia, by selecting it from previous destinations.") In this case, because the system is capable of displaying a number of different categories of POIs, it is necessary to load (in advance of testing), instances of each type of POI and to load several instances of each type of POI (so that for any category selected, some reasonable amount of visual search will be needed to perform the task; neither the least nor the most extreme amount of search that might be required).

HIGHER-LEVEL GOAL: Obtain Route Guidance to a specific address.

TASK: Obtain route guidance to 150 South Main Street, Blacksburg, Virginia, by selecting it from previous destinations.

Starting Configuration/State of Device: Entertainment system should be off. Navigation system should be on, and top-level navigation screen (top-level function screen) should be displayed.

Steps:

	
Initial Top-Level Navigation Screen (start state).	Press "DEST" button on the right.
	
Press "Previous Dest" on touch screen.	Select "150 S. Main St, Blacksburg,VA" on touch screen.
	
Press "Set as Destination" on the touch screen.	Press "Start Guidance".

Task end state is reached when the system first accepts the final control input from the driver to "Start Guidance." This happened in this example on this last screen (when the driver's touch on the "Start Guidance" button is successful). It is then reflected subsequently in system state changes that confirm this (by displaying the route to the POI, and/or by giving voiced guidance instructions to the POI).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Obtain route guidance to 150 South Main Street, Blacksburg, Virginia, by selecting it from previous destinations. Please begin now."

End of measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally.

TESTABLE TASK EXAMPLE 2D

Description

In this vehicle, the route guidance support may be accessed through a visual-manual mode using a touch screen and hard buttons along-side the display.

Purpose of Example

This example illustrates the need to test some tasks in a moving vehicle; namely those involving route following. This is just one example.

HIGHER-LEVEL GOAL: Cancel current route.

TESTABLE TASK: Cancel route guidance on the current trip.

Starting Configuration/State of Device: Main screen on, entertainment off, but set so that the device screen is showing the map for current destination. Route guidance should be initiated and a route in-progress.

Steps:

	
Map showing current route guidance.	Press "Route" button to the right of the screen.
	
Press "Cancel Route" on touch screen.	Press "Yes" on touch screen.

Task end state is reached when the system has accepted the final control input from the driver ("Yes" to cancel route) subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Cancel route guidance on the current trip. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2E

Description

In this vehicle, route guidance support can be accessed in a visual-manual mode via a touch screen and hard-buttons along-side the display. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a testable task to represent each method. The example below illustrates the method of destination entry using the "city-first method." This task consists of several subtasks, all of which must be completed in order to reach the task goal of initiating route guidance to the intended destination.

Purpose of Example

This example illustrates:

- **Selection of Start State for Task** when there is more than one "home screen" available: In this system, users can select from three different customizable home screens. Under the guidelines, it is not necessary to test tasks using all three home screens. Just one home screen may be selected and used for purposes of testing.
- **Display of address to be entered.** As in prior navigation examples, to test address entry, the test participant needs to be given addresses to enter. This may be done, for example, by typing each address-to-be-entered on a placard (e.g., 6 inches wide by 8 inches tall) using 36-point font and placing it in the cup holder or taped to the console where it can be easily viewed on each test trial.

HIGHER-LEVEL GOAL: Initiate route guidance for specific address.

TESTABLE TASK: Initiate route guidance to 105 South Main Street, Blacksburg, Virginia, by using the *city-first* manual-entry method.

Starting Configuration/State of Device: Home map screen on. Entertainment off.

Steps:

	
Initial home screen.	Press “DEST” button on the right.
	
Press “Address” on touch screen.	The **first sub-goal** is to enter the city. To do this, first press “City” on the touch screen.
	
Then, enter the letters “B-L-A-C-K-S-B-U-R-G” on keypad that appears on touch screen. This completes the first subtask, and achieves the first sub-goal of entering the city, an intermediate step en route to the task goal.	Next, a number keypad appears - to invite entry of the destination address (the **second sub-goal**). Press “1-5-0” on the number pad on the touch screen.
	
Then, press “Done” on touch screen. This completes the second subtask, achieving the second sub-goal, of entering the address, an intermediate step en route to the task goal.	The next screen invites entry of the street name – the **third sub-goal**. Enter “M-A-I-N” on touch screen.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Then, press “List” on touch screen. This calls up a list of addresses.</td><td>Find and press the full correct street name “S Main St” on touch screen, to select the correct street address. (This completes the third subtask, and achieves its sub-goal).</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Wait for system to calculate.</td><td>The fourth sub-goal is to set and start route guidance. To achieve this, begin by pressing “Set as Destination” on touch screen.</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>Then press “Start Guidance” on touch screen.</td><td></td></tr>
</table>

Task end state is reached when the system has accepted the final control input from the driver (“Start Guidance”) subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said “now,” in the request to perform the task as in, “Your task is to: Initiate route guidance to 105 South Main Street, Blacksburg, Virginia, by using the *city-first* manual-entry method. Please begin now.”

End of measurement would occur at the point when the test participant says “Done!” and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2F

Description

In this vehicle, route guidance support can be accessed in a visual-manual mode via a touch screen and hard-buttons along-side the display. Multiple methods of destination entry may be used to initiate route guidance support. Each of these should be tested using a testable task to represent each method. The example below illustrates the method of destination entry using the "street-first method." As with the prior example, this task consists of several subtasks, all of which must be completed in order to reach the task goal of initiating route guidance to the intended destination. The subtasks are not explicitly marked in this task flow (as they were in the prior example) but they are present nonetheless. This task (similar to the prior one) contains a system response delay, incurred for calculating the route (typically very short).

Purpose of Example

This example illustrates:

- **Display of address to be entered.** As in prior navigation examples, to test address entry, the test participant needs to be given addresses to enter. This may be done, for example, by typing each address-to-be-entered on a placard (e.g., 6 inches wide by 8 inches tall) using 36-point font and placing it in the cup holder or taped to the console where it can be easily viewed on each test trial.
- **Importance of pre-storing destinations in system** for use in testing.

HIGHER-LEVEL GOAL: Initiate route guidance for specific address.

TESTABLE TASK: Initiate route guidance to 105 South Main Street, Blacksburg, Virginia, using the *street-first* manual method of entry.

Starting Configuration/State of Device: Home map screen on. Entertainment off.

Steps:

	
Initial home screen.	Press “DEST” button on the right.
	
Press “Address” on touch screen.	Press “Street” on touch screen.
	
Press 1- 5- 0 on touch screen.	Press “Done” on touch screen.
	
Press M - A- I - N on touch screen.	Press “List” on touch screen.

	
List of street names appears on the screen. To bring the desired street name into view, press down scroll arrow button on touch screen.	Press down scroll arrow button on touch screen again.
	
Now the desired street name is in view. Press “S Main St (37)” on touch screen.	Press “B-L” on touch screen.
	
Select “Blacksburg” on touch screen.	Wait for system to calculate.
	
Press “Set as Destination” on touch screen.	Press “Start Guidance” on touch screen.

Task end state is reached when the system has accepted the final control input from the driver ("Start Guidance") subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Initiate route guidance to 105 South Main Street, Blacksburg, Virginia, by using the *street-first* manual-entry method. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2G

Description

In this vehicle, route guidance support can be accessed in a visual-manual mode via a touch screen and hard-buttons along-side the display. Multiple methods of destination entry may be used to initiate route guidance support. As mentioned previously, each of these may be tested using a testable task to represent each method. The example below illustrates the method of destination entry using the "POI search categories."

Purpose of Example

This example illustrates:

- **Display of address to be entered.** As in prior navigation examples, to test address entry, the test participant needs to be given addresses to enter. This may be done, for example, by typing each address-to-be-entered on a placard (e.g., 6 inches wide by 8 inches tall) using 36-point font and placing it in the cup holder or taped to the console where it can be easily viewed on each test trial.
- **Importance of pre-storing POI search categories**.

HIGHER-LEVEL GOAL: Initiate Route Guidance to specific destination.

TESTABLE TASK: Initiate Route Guidance to the nearest Target store, by using POI category search.

Starting Configuration/State of Device: Entertainment system off. Map screen on, set to home screen.

Steps:

	
Primary display screen.	Press “DEST” button.
	
Press “POI Search” on touch screen.	Press “Category” on touch screen.
	
Press “Near current position” on touch screen.	Press “Shopping” on touch screen.
	
Press “Department Store” on touch screen.	Press “Target” on touch screen.
	
Press “Set as Destination” on touch screen.	Press “Start Guidance” on touch screen.

Task end state is reached when the system has accepted the final control input from the driver ("Start Guidance") subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Initiate route guidance to the nearest Target store, by using the *POI category search* method. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2H

Description

In this vehicle, route guidance support can be accessed in a visual-manual mode via a touch screen and hard-buttons along-side the display. As previously described, multiple methods of destination entry may be used to initiate route guidance support and each of these may be tested using a testable task to represent each method. The example below illustrates the method of destination entry using the "POI specific destination entry."

Purpose of Example

This example illustrates:

- **Display of address to be entered.** As in prior navigation examples, to test address entry, the test participant needs to be given addresses to enter. This may be done, for example, by typing each address to be entered on a placard (e.g., 6 inches wide by 8 inches tall) using 36-point font and placing it in the cup holder or taped to the console where it can be easily viewed on each test trial.
- **Importance of pre-storing POI search categories**.

HIGHER-LEVEL GOAL: Initiate Route Guidance to specific destination.

TESTABLE TASK: Initiate Route Guidance to the Target store in Christianburg, Virginia, using the POI method of specific destination entry

Starting Configuration/State of Device: Entertainment system off. Map screen on.

Steps:

	
Primary display screen.	Press “DEST” button.
	
Press “POI Search” on touch screen.	Press “Name” on touch screen.
	
Press “T-A-R-G-E-T” on touch screen.	Press “List” on touch screen.
	
Select “Target (80)” with shopping cart icon on touch screen.	Select “195 Conston Ave Chris” (short for the town of Christianburg) with shopping cart icon on touch screen.
	
Press “Set as Destination” on touch screen.	Press “Start Guidance” on touch screen.

Task end state is reached when the system has accepted the final control input from the driver ("Start Guidance") subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Initiate Route Guidance to the Target store in Christianburg, Virginia, using the POI method of specific destination entry. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2I

Description

This task example involves an iPod connected to the vehicle through an interface. When connected, the vehicle's controls (that utilize a combination of hard-buttons to the side of the main display screen and touch-sensitive areas on the display screen) are used to scroll and select songs.

The interface used for this task does not automatically display artist names or song titles. Rather, the interface displays nonsensical alphanumeric strings for each song. Once a song is playing, the "Info" button will call up a display with artist name and song title.

Within the task itself (at the subtask level), there are alternative ways to accomplish the task. Therefore, a ***specific*** method of accomplishing the task must be selected ahead of time for testing and test participants must be trained to perform the task using that method during the test, to have a testable task.

Purpose of This Example

This task example is useful for illustrating the following topics:

- **Advance setup** of a testable task prior to testing (importance of loading songs on the iPod, connecting the iPod to the vehicle, setting the entertainment function to "radio" or "CD" before test).
- **How to make a general task "testable"** by giving it specificity (e.g., "Play the song 'Oh, Atlanta' on your iPod") not "play a song on your iPod." In this case, the song is half-way down a list of five songs, requiring some visual search; neither the easiest nor the hardest instance of finding a song in the list. The method of "using the touch screen interface" to find the desired song in a list of songs must be identified and trained as the method to be used during a given test. (For completeness in testing the vehicle's system, all testable tasks available within this system for achieving the goal of finding and initiating play of a specific song should be tested, and a separate test of each them should be established and conducted but this example illustrates only one of them.)
- **How to define the "start state" for a testable task.** In this vehicle, the hard buttons along the side of the screen allow drivers to access top-level function screens (e.g., for radio, CD, route, phone, etc.) in a single button press allowing the navigation screen to serve as the home page for all testing.
- **How to define the "end state" for a testable task** (distinct from end of measurement).

HIGHER-LEVEL GOAL: Play a song on iPod.

TESTABLE TASK: Find and initiate play of the song "Oh, Atlanta" on your iPod using the touch screen interface

Starting Configuration/State of Device: Connect iPod to device. Turn Device on, and Audio on, set Audio to another mode (radio). Turn audio off. Go to home screen (map).

Steps:

	
Primary display screen (home).	Press “CD/Aux” hard button on left.
	
Press “CD/Aux” hard button on left again to move from CD to Auxillary.	Press “Info” on touch screen to view song and artist currently playing.
	
If song displayed is not the desired song, press “OK” on touch screen. (Note that if song displayed is the desired song, the task would be finished.)	Press forward arrows on the circular dial that has now appeared on the touch screen (two forward arrows on circular dial).
	
Press “Info” on touch screen to view song and artist currently playing <no picture available for button pressing and obtaining different song titles en route to the desired song>. (Note, again, however, the need to load a CD with multiple song titles in advance of testing.)	This screen comes up after the button press on “Info” (in prior step), for the driver to read. It shows that “Oh Atlanta” is indeed playing. This would verify that the task end state had been successfully reached by the prior touches the “info” button and the correct song has begun to play. If song displayed is not the desired song, repeat steps above and repeat until the desired song is playing <no picture available for additional, repeat steps>

The task end state would be reached when the driver successfully touches the "Info" button on the touch screen after the correct song has begun.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Find and initiate play of the song "Oh, Atlanta" on your iPod using the touch screen controls. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant t by some means indicates the same thing non-verbally.

Entertainment

TESTABLE TASK EXAMPLE 2J

Description

In this vehicle, when entertainment tasks are accessed in a visual-manual mode, a touch screen is used along with hard-buttons along-side the display screen.

Purpose of Example

This example illustrates how to test the task of finding songs on a CD. This is just one example. This vehicle provides multiple ways of accomplishing this task and each of them constitutes a different testable task, which would need to be tested separately. One of them is illustrated here.

HIGHER-LEVEL GOAL: Play a specific song on CD.

TESTABLE TASK GOAL: Find and initiate play of Track 4 on the CD in the player using the forward-arrow method on the touch screen.

Starting Configuration/State of Device: Set CD to be at track 1. Set device to radio mode. Turn entertainment system off. Set display to home (map) screen.

Steps:

	
Primary display screen.	Press “CD/Aux” button on left.
	
Press “forward” button 3 times (sensitive area is the two forward-arrows on round dial on touch screen). (Note that an alternate way of accomplishing this task would be for the user to turn the tuning knob, or press a steering wheel button 3 times to accomplish this – but those would each be separate testable tasks – and would each require separate tests.)	Final screen would show track 4 now playing. This photo is not available.

Task end state is reached when the system has accepted the final control input from the driver (“the third press on arrow,” arriving at the song to be played) subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said “now,” in the request to perform the task as in, “Your task is to: Find and initiate play of Track 4 on the CD in the player using the forward-arrow method on the touch screen. Please begin now.”

End of measurement would occur at the point when the test participant says “Done!” and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2K

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a combination of hard buttons and a touch screen is used.

Purpose of Example

This example illustrates how to set up a testable task for placing a phone call using contacts pre-stored in the address book (of the vehicle). It is particularly useful for showing:

- **Advance setup** of a testable task prior to testing (importance of loading or else importing names of contacts into the vehicle's address book for testing, setting the display to the home screen before test)
- **How to make a general task "testable"** by giving it specificity (e.g., "Place a call to your friend Rich by using the contacts stored in your address book and the scrolling function.") In this case, the contact is toward the middle of a list of contacts, requiring some visual search; neither the easiest nor the most extreme instance of finding a contact in the list. Further, the method of "scrolling" to find the desired contact in a list of names must be identified and trained as the method to be used during a given test.

HIGHER-LEVEL GOAL: Place phone call to a contact.

TASK: Place a phone call to your friend Rich at his work number using contacts stored in your address book and the scrolling function.

Starting Configuration/State of Device: Pair cell phone with system. Import contacts (making sure that X number of contacts exist and contact of interest has X optional contact numbers). Set system to home screen (map).

Steps:

	
Primary display screen.	Press button labeled "Phone". (This is a hard button next to the screen, the lower right button). (Note: An alternative way to perform this task is to press the phone button on the steering wheel; however, using that method would constitute a separate testable task and it should be tested separately.)
	
Press "Contacts" (touch screen lower right).	On the list of contact names that now appears on the screen, search for the desired name. To bring more names into view on the screen, press the down-arrow region of the scroll bar (touch screen lower right).
	
To continue bringing more names onto the screen in search of the desired name, press the scroll down-arrow again (2nd time).	And to continue looking for the desired name, press the scroll down-arrow again (3rd time).

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>This brings the target name into view. Touch the name of the desired contact, “RICH” (this results in a display change, in which the name “Rich” is <u>replaced</u> on the next screen by Rich’s cell phone number).</td><td>Touch the number that has now appeared (it corresponds to a cell phone number for “Rich” (and this touch entry changes it to Rich’s work number).</td></tr>
<tr><td>  </td><td></td></tr>
<tr><td>Press Send (touch screen upper left), to place the phone call.</td><td></td></tr>
</table>

<u>The task end state</u> would be reached when the driver successfully touches the area corresponding to “Send” on the touch screen subsequently indicated by the ring of the phone (indicating that the system has placed the call).

<u>Start of measurement</u> during testing would occur when the experimenter said “now,” in the request to perform the task as in, “Your task is to: Place a phone call to your friend Rich at his work number using contacts stored in your address book and the scrolling function. Please begin <u>now</u>.”

<u>End of measurement</u> would occur at the point when the test participant says “Done!” and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2L

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a combination of hard buttons and a touch screen is used.

Purpose of Example

This example illustrates how to set up a testable task for placing a phone call using contacts pre-stored in the address book (of the vehicle). It is particularly useful for showing:

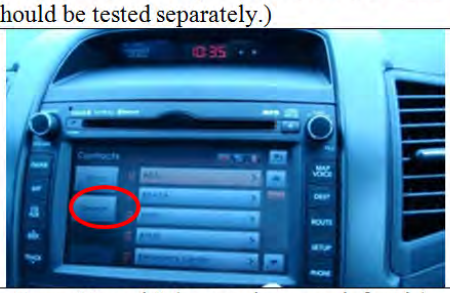
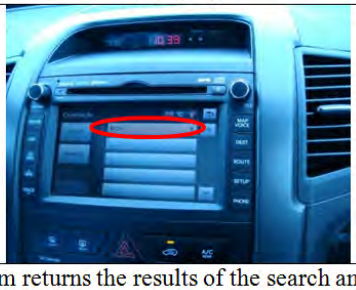
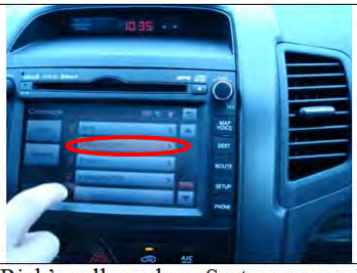
- **Advance setup** of a testable task prior to testing (importance of loading or else importing names of contacts into the vehicle's address book for testing, setting the display to the home screen before test)
- **How to make a general task "testable"** by giving it specificity (e.g., "Place a call to your friend Rich by using the address book and the search method.")

HIGHER-LEVEL GOAL: Place phone call to a contact.

TESTABLE TASK Goal: Place a phone call to your friend Rich at home by using the address book and the search method.

Starting Configuration/State of Device: Pair cell phone with system. Import contacts (making sure that X number of contacts exist and contact of interest has X optional contact numbers). Set system to home screen (map).

Steps:

	
Primary display screen.	Press button labeled "Phone" (This is a hard button next to the screen, the lower right button). (Note: An alternative way to perform this task is to press the phone button on the steering wheel; however, using that method would constitute a separate testable task and it should be tested separately.)
	
Press "Contacts" (on touch screen lower right).	Press "Search" (on touch screen left side).
	
Using keypad on touch screen, enter the letters "R- I- C- H".	Press "Done" (touch screen lower right).
	
System returns the results of the search and displays the match. On the list, press "RICH," which brings up a display of his cell phone number, shown in next cell.	Press Rich's cell number. System responds by displaying Rich's home number.
	
Press "Send" on touch screen upper left.	

The task end state would be reached when the driver successfully touches the area corresponding to "Send" on the touch screen subsequently indicated by the ring of the phone (indicating that the system has placed the call).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Place a phone call to your friend Rich at home using the address book and the search method. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2M

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a touch screen is used in combination with hard buttons along each vertical edge of the display.

Purpose of Example

This example illustrates how to set up a testable dependent task of calling a restaurant selected as a POI during the use of Route Guidance. It, like Example 2D, also illustrates how a dependent task can be enabled by the end state of an antecedent task (see final device state in Example 2B).

HIGHER-LEVEL GOAL: Make reservation at a restaurant along the route.

TESTABLE TASK: Place a call to the nearest Ruth's Chris Steakhouse restaurant along your route to make a reservation, now that you have already located and selected it using the POI function.

Starting Configuration/State of Device: In advance of testing, pair a cell phone with system. The entertainment system should be turned off. Route guidance should be initiated, and in-progress along a route near which the target POI falls. Further, the vehicle must be near this area. (Thus, this task is one that must be done while driving or, if stationary, must be in a vehicle momentarily pulled off route and parked.) Obtain route guidance and begin a route towards the restaurant of interest (listed as a POI). Set device to map screen.

Steps:

	
The task start state corresponds to the state of the system at which acceptance of the touch input occurred on the POI map icon for "Ruth's Chris Steakhouse" restaurant. This represents the end state of an antecedent task (which is shown in TESTABLE TASK EXAMPLE 2A within this section – and which provides the start task for this task. It designates the "Ruth's Chris Steakhouse" POI as the location of interest.	This brings up a display of the restaurant name, address, and phone number. At this screen, a further action must be selected– and, in the case of this task, it would be pressing the phone icon on the touchscreen to place the call. Note: If, after the call, this screen were still up, another separate [dependent] task of "obtaining route directions to the "Ruth's Chris Steakhouse" restaurant" could be initiated – and/or separately tested (Example 2C, previously explained). It could be treated as a "dependent task" in this case because its start state would be made possible by the end state of the "calling restaurant & make reservation" task.

Task end state is reached when the system first accepts the final control input from the driver to "Place Call." This happened in this example on this last screen (when the driver's touch on the "Phone" button was successful). It is then reflected subsequently in system state changes that confirm this (by displaying the route to the POI, and/or by giving voiced guidance instructions to the POI).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Place a call to the nearest Ruth's Chris Steakhouse restaurant along your route to make a reservation, now that you have already located and selected it using the POI function. Please begin now."

End of measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally.

TESTABLE TASK EXAMPLE 2N

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a touch screen is used in combination with hard buttons along each vertical edge of the display.

Purpose of Example

This example illustrates how to set up a testable task for placing a phone call using manual dialing on a keypad displayed on a touch screen.

HIGHER-LEVEL GOAL: Place phone call.

TESTABLE TASK: Place phone call to your co-worker by dialing his 10-digit phone number using manual entry, 555-555-5555.

Starting Configuration/State of Device: In advance of testing, pair phone with system. Set system to home screen (map).

Steps:

	
Primary Screen, "Home".	Press "Phone" (a hard button next to screen, on lower right). (An alternate method is to press the phone button on the steering wheel – but that would be a separate testable task, and should be tested separately.)
	
A keypad appears on the touch screen. Press the numerals in the desired phone number: "5-5-5-5-5-5-5-5-5-5" to manually dial on touch screen.	Press "Send" on touch screen.

The task end state would be reached when the driver successfully touches the "Send" area on the touch screen and the system takes the input subsequently indicated by ringing of the phone (indicating that the system has placed the call).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Place phone call to your co-worker by dialing his 10-digit phone number using manual entry 555-555-5555. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2O

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a touch screen is used.

Purpose of Example

This example illustrates how to set up a testable task for answering an incoming phone call using the touch screen interface. It is particularly useful for showing:

- **Advance setup** of a testable task prior to testing (importance of connecting the phone to the vehicle, having a separate phone ready for the testing staff to use to dial the connected phone in the vehicle, turning the ring volume of the handheld device off, setting the display to the home screen before test)
- **How to make a general task "testable"** by giving it specificity (e.g., "Answer the incoming call using the touch screen interface.") Also, the touch screen method must be identified and trained as the method to be used during a given test.

HIGHER-LEVEL GOAL: Answer incoming call.

TESTABLE TASK: Answer an incoming call when you hear the phone ring.

Starting Configuration/State of Device: Pair a cell phone with the system. Turn cell phone on. Turn volume on cell phone ring tone down, so initial audio tone comes from the system. Turn entertainment off. Make sure the map screen is on (to be used as the "home screen").
Note: At time of test, the testing staff must be ready to place a call to the vehicle to initiate the testable task, and the call must be coordinated to ring upon (or shortly after) the tester's request to the participant, that "Your task is to answer an incoming call on the phone. Please begin now, whenever you hear the phone ring."

Steps:

	
Primary display screen.	When device detects an incoming call, this screen is displayed. Press "Accept" on the touch screen to answer it.
	
Display verifies that call is connected (Task Done).	

The task end state would be reached when the driver successfully touches the "Accept" area on the touch screen and the system takes the input subsequently indicated by the active phone line (indicating that the system has answered the call).

Start of measurement during testing would occur when the device detects an incoming call (after experimenter has delivered instructions): "Your task is to answer an incoming call on the phone. Please begin now, whenever you hear the phone ring."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 2P

Description

In this vehicle, when communication tasks are accessed in a visual-manual mode, a touch screen is used.

Purpose of Example

This example illustrates how to set up a testable task for pairing a handheld phone with the device using the touch screen interface. It is particularly useful for showing:

- **Advance setup** of a testable task prior to testing (having a separate handheld phone ready, training the participant on basic connecting functions of this handheld phone, setting the display to the home screen before test)
- **How to make a general task "testable"**: Train participant on basic connection functions of the handheld phone to be used for this test.

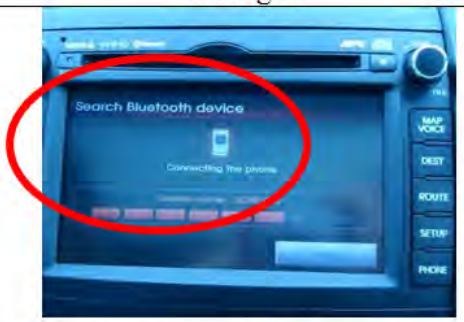
HIGHER-LEVEL GOAL: Pair a cell phone with device.

TESTABLE TASK GOAL: Pair this handheld phone to the in-vehicle system.

Starting Configuration/State of Device: Turn cell phone on in vehicle. Make sure the map display is on the home screen for testing. Turn entertainment system off.

Steps:

	
Primary display screen used as home screen	Push "Phone" button (a hard button next to screen). (Note: An alternate method would be to start the process with a press on the steering wheel button for phone. However, this would constitute a separate, testable task; one that should also be tested.)
	
Press "Settings" on touch screen.	Press "Pairings" on touch screen.
	
Press "Add to" on touch screen.	Read instruction to enter passkey for the vehicle into the cell phone in order to pair it.

 (**Additional steps** take place on the cell phone being paired. This cell phone is just a placeholder picture; no actual pictures or steps are available to show.)	 (**Additional steps** may continue to take place on the cell phone being paired. This cell phone is just a placeholder picture; no actual pictures or steps are available to show.)
Steps on cell phone required for the pairing task (e.g., entering in the passkey) should be included in the task sequence itself, when testing it.	Steps on cell phone required for the pairing task should be included in the task sequence itself, when testing it.
	
Read messages and wait for phone to be connected/paired.	Final screen on device, confirming that phone is now paired with vehicle.

The task end state would be reached when the device successfully accepts connection of the handheld device.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Pair this handheld phone to the in-vehicle system. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TASK EXAMPLES FROM VEHICLE 3

Disclaimer: These task examples were developed in an effort to illustrate real tasks in real vehicles, to provide documentation that could facilitate and support testing efforts. The examples are intended only to illustrate how to set up tasks for testing. They are ***not*** intended to provide an authoritative guide on how any given vehicle, device, or task operates.

TESTABLE TASK EXAMPLE 3A

Description

In this vehicle, the control mechanism is remote from the display on which items are viewed. The primary screen is shown in the first photograph below and the primary controller in the second photograph below. They are used together to accomplish task interactions. In the task sequences for this task, a small photographic inset of the controller is often embedded next to a photo of the display screen. It should be understood, however, that these are separated spatially in the layout of the vehicle's interior.

Purpose of This Example

This example illustrates how to set up a testable task using a system that employs a spatially separate display and controller.

HIGHER-LEVEL GOAL: Ensure that no further navigation instructions are shown on the display, or played over the audio system.

TESTABLE TASK: Cancel route guidance using manual entry starting with navigation hard button.

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • "Select" by pressing the knob down (inward).
	
Press the 'Nav' button on lower center console (Note: An alternate method is to highlight 'Navigation' using the rotary dial, then press in knob – a separate testable task).	Toggle rotary knob to left.
	
Turn rotary knob to highlight guidance icon and then press in knob.	Press in knob to stop guidance. Task is finished at this point.
	
The screen above appears, showing that the system has changed state.	

The task end state would be reached when the device successfully accepts the press of the knob to stop guidance, as indicated by the display in the photo prior to the one above.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Cancel route guidance using manual entry starting with the navigation hard button. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 3B

Description

In this vehicle, the control mechanism is remote from the display on which items are viewed. The primary screen is shown in the first photograph below and the primary controller in the second photograph below. They are used together to accomplish task interactions. In the task sequences for this task, a small photographic inset of the controller is often embedded next to a photo of the display screen. It should be understood, however, that these are separated spatially in the layout of the vehicle's interior.

Purpose of This Example

This example illustrates how to set up a testable task using a system that employs a spatially separate display and controller

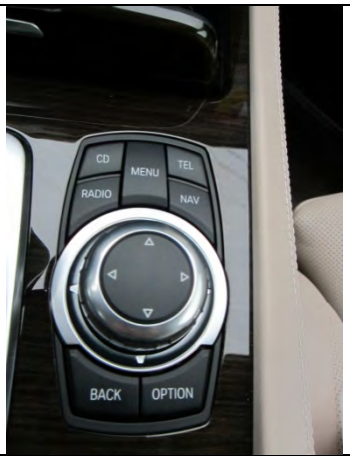
This example illustrates:

- **Display of address to be entered.** As in prior navigation examples, to test address entry, the test participant needs to be given addresses to enter. This may be done, for example, by typing each address to be entered on a placard (e.g., 6 inches wide by 8 inches tall) using 36-point font and placing it in the cup holder or taped to console where it can be easily viewed on each test trial).

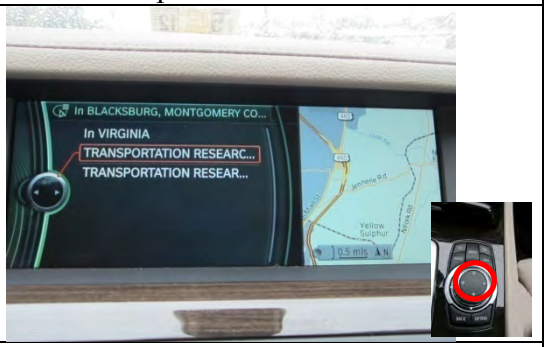
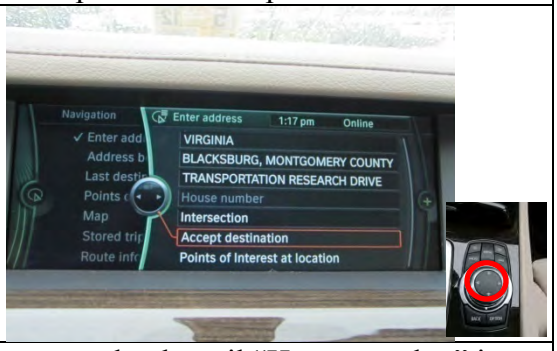
HIGHER-LEVEL GOAL: Initiate route guidance support to target destination.

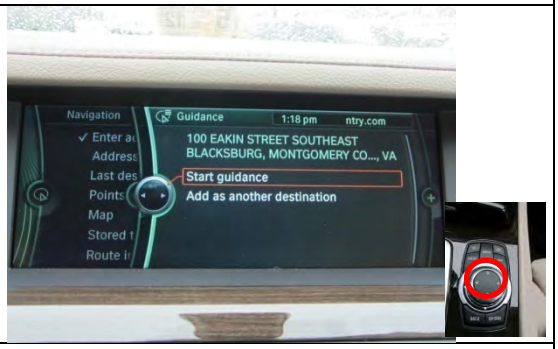
TASK: Initiate route guidance by entering the address for 3500 Transportation Research Plaza, Blacksburg, Virginia (using manual entry)

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward).

	
Press the 'Navigation' button on lower center console. (Again, there is an alternate way to do this, by using the rotary knob to highlight "Navigation" and then pressing in knob; a separate testable task.)	Toggle rotary knob to left twice.
	
First toggle highlights the Navigation toolbar.	Second toggle activates the Navigation menu.
	
Turn rotary knob to highlight "Enter Address" and press knob.	Turn rotary knob to highlight State/Province?" and press knob.
	
Turn rotary knob to highlight exact "State/Province" and press knob to select.	Turn rotary knob to highlight "City?" and press knob.

	
Turn rotary knob to highlight each letter in City Name and press knob. Repeat for each letter.	Turn rotary knob to highlight the city and press knob to select.
	
Turn rotary knob to highlight “Street?” and press knob.	Turn rotary knob to highlight letters in Street name and press knob. Repeat for each letter.
	
Turn rotary knob to highlight the street name (Transportation Research Plaza) and press knob.	Turn rotary knob until “House number” is highlighted and press knob.

	
Turn knob until the correct number is displayed and press knob. Repeat for each number. Press knob again when house number is all entered. ("OK" will be highlighted.)	Turn rotary knob until the correct "house number" is highlighted and press knob.
	
Highlight "Accept destination" and press knob.	Acknowledge Highlight "Start guidance" and press knob. Task is finished at this point.
	
Route guidance then begins.	

Task end state is reached when the system has accepted the final control input from the driver ("Start Guidance"), subsequently reflected by system state changes confirming this.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Initiate route guidance by entering the address for 3500 Transportation Research Plaza, Blacksburg, Virginia (using manual entry). Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

Navigation Task

TESTABLE TASK EXAMPLE 3C

Description

In this vehicle, route guidance support may be accessed in a visual-manual mode through the use of the primary display screen and primary controller (already described). And, as already described, multiple methods of destination entry may be used to initiate route guidance support and each of these should be tested using a testable task to represent each method. The example below illustrates the method of destination entry using POIs.

Purpose of Example

This example illustrates a method of destination entry using POI search. It also illustrates:

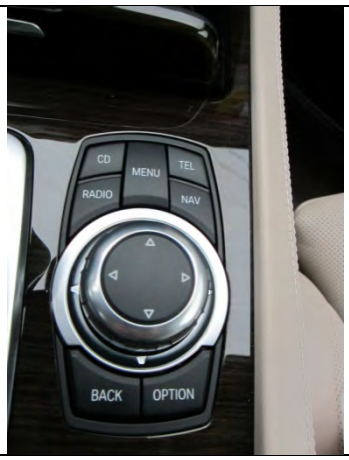
- **Advance setup** of a testable task prior to testing (the need to create a number of "points of interest" within the navigation system in advance of testing to enable the function to be tested to work during testing)
- **How to set up a task that may be tested while driving (rather than in a stationary lab setting).** Some tasks (such as those enabled by navigation functions only become available when a vehicle is in motion and actively following a route). This task is one of those, and thus serves as one example of how to set up such a task for testing.
- **How to make a general task "testable"** by giving it specificity (e.g., "Initiate route guidance to the Roanoke Opera using the POI method.") In this case, because the system is capable of displaying a number of different categories of POIs, it is necessary to load (in advance of testing), instances of each type of POI and to load several instances of each type of POI (so that for any category selected, some reasonable amount of visual search will be needed to perform the task; neither the least nor the most extreme amount of search that might be required).

HIGHER-LEVEL GOAL: Initiate route guidance support to POI.

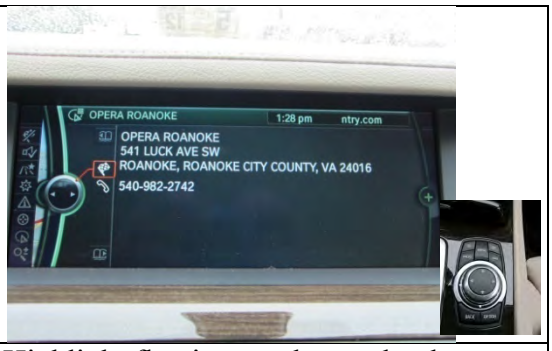
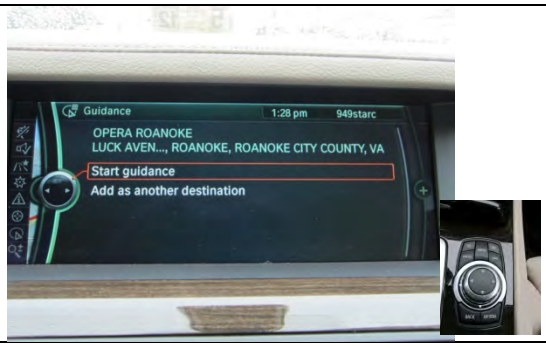
TESTABLE TASK: Initiate route guidance to the Roanoke Opera using the POI method.

Starting Configuration/State of Device: Start screen as shown below. POIs pre-stored.

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center. console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward).
	
Press the “Navigation” button on lower center console. (An alternate method would be to highlight ‘Navigation’ using the rotary dial, then press in knob; a separate testable task).	Toggle left twice.
	
First toggle highlights the Navigation toolbar.	Second toggle activates the Navigation menu.

	
Turn rotary knob to highlight "Points of Interest" and press knob.	Turn rotary knob to highlight "Category search" and press knob.
	
Press knob to select "Town/City."	Press knob to select "Category."
	
Use rotary knob to highlight appropriate category.	Press knob once category is highlighted.
	
*System will return to "Category" search menu once category has been narrowed appropriately.	Press knob to start a search.

	
Use rotary knob to highlight selection and press knob.	Highlight flag icon and press knob.
	
Highlight "Start guidance" and press knob. (Task is finished at this point.)	Route guidance then begins.

Task end state is reached when the system first accepts the final control input from the driver to "Start Guidance." This happened in this example on this next to last screen (with the driver's press on the controller). It is then reflected subsequently in system state changes that confirm this as route guidance begins (final photo).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Initiate route guidance to the Roanoke Opera using the POI method. Please begin now."

End of measurement during testing would occur at the point when the test participant said "Done!" and/or when the participant by some means indicated the same thing non-verbally.

TESTABLE TASK EXAMPLE 3D

Description

In this vehicle, the control mechanism is remote from the display on which items are viewed. The primary screen is shown in the first photograph below and the primary controller in the second photograph below. They are used together to accomplish task interactions. In the task sequences for this task, a small photographic inset of the controller is often embedded next to a photo of the display screen. It should be understood, however, that these are separated spatially in the layout of the vehicle's interior.

Purpose of This Example

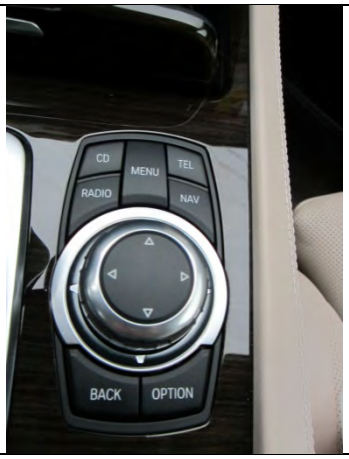
This example illustrates how to set up a testable task using a system that employs a spatially separate display and controller.

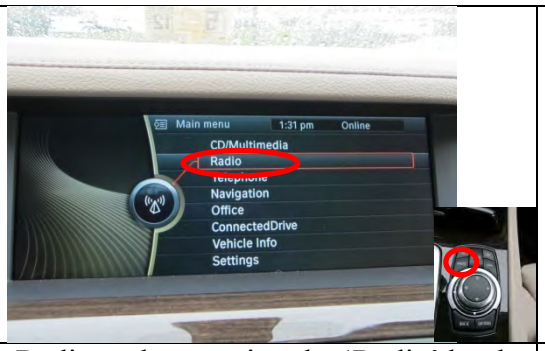
HIGHER-LEVEL GOAL: Turn radio on, change radio band and tune to station (approximately 40 steps away in one direction).

TESTABLE TASK: Turn your radio on, change the band, and tune your radio to 94.9 FM.

Starting Configuration/State of Device: Ahead of time, the radio needs to be preset to a frequency about 40 steps away from the target frequency to be used in the task request. Then the band needs to be changed, and the radio turned off, and left in its "off" state. However, the main infotainment screen should be "on."

Steps:

	
Primary display screen. ("Home") (not a touch screen)	Primary manual controller, which is located on lower center console (between seats). The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward).

	
Turn Radio on by pressing the 'Radio' hard button on lower center console, located in front of the primary controller (Note: An alternate method would to be use the primary controller to highlight 'Radio' on the screen by using the rotary dial and then press in on the knob; but that would be a separate testable task, and should be tested separately).	To change the radio band, toggle rotary knob to left.
	
Highlight FM by turning rotary knob and press in knob.	Highlight Manual by turning rotary knob and press in knob.
	
Turn rotary knob to station requested. (Task is finished when correct radio band and frequency is displayed).	

<u>The task end state</u> would be reached when the device successfully accepts the last control input of the driver to tune the radio to the specified frequency, as indicated by the display in the final photo above.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Turn on the radio, change the radio band, and tune to 94.9FM. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 3E

Description

This task example involves switching from a connected iPod that is playing, and initiating play of a song on a CD (after finding it). As before, the vehicle's interface makes use of a primary display screen in the vehicle's center stack and a primary controller in the center console.

Purpose of This Example

This task example is useful for illustrating the following topics:

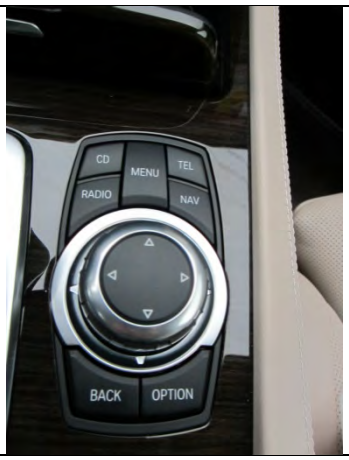
- **Advance setup** of a testable task prior to testing (importance of loading songs on the CD (or else obtaining an appropriate CD in advance of testing and selecting a song that can be found with an appropriate amount of effort, connecting the iPod to the vehicle, setting the entertainment function to iPod before test).
- **How to make a general task "testable"** by giving it specificity (e.g., "Play the song 'Closer to Fine' on the CD"). Choosing a song track half-way through the CD, or at a reasonable position on the display screen requiring some visual search; neither the easiest nor the hardest instance of finding a song in the list is an important element of constructing a fair test. The method of finding the desired song in a list of songs must be identified and trained as the method to be used during a given test. (For completeness in testing the vehicle's system, both testable tasks available within this system for achieving the goal of finding and initiating play of a specific song should be tested, and a separate test of each them should be established and conducted but this example illustrates only one of them.)

HIGHER-LEVEL GOAL: Switch from iPod to CD mode, and play a specific song

TESTABLE TASK: Switch from iPod to CD and initiate play of the song "Closer to Fine."

Starting Configuration/State of Device: Entertainment system on and playing from a connected iPod. This must be connected in advance). A CD should have been inserted in the CD-player. It should contain the target song. Start screen (shown below) should be up.

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward).
	
Press the ‘CD/Multimedia’ button on lower center console. (An alternate path would be to highlight ‘CD/Multimedia’ using the rotary dial, then press in knob; a separate testable task.)	Note: The most recent CD/Multimedia function (e.g., CD or external music player) will be active. Remaining steps are only applicable if CD playback was NOT the most recently used function within the CD/Multimedia menu (e.g., external music player was being used).
	
Toggle left.	Turn knob to highlight CD/DVD.

	
Press knob.	Use rotary knob to highlight song and press knob (Task is finished at this point). Playback begins automatically.

The task end state would be reached when the driver successfully presses the knob after highlighting the correct song selection on the primary display screen (indicated by the system starting to play the song).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Switch from iPod to CD and initiate play of the song "Closer to Fine." Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 3F

Description

This task example involves switching from listening to a CD playing, and initiating play of a playlist stored on an iPod connected to the vehicle via USB. As before, the vehicle's interface makes use of a primary display screen in the vehicle's center stack and a primary controller in the center console.

Purpose of This Example

This task example is useful for illustrating the following topics:

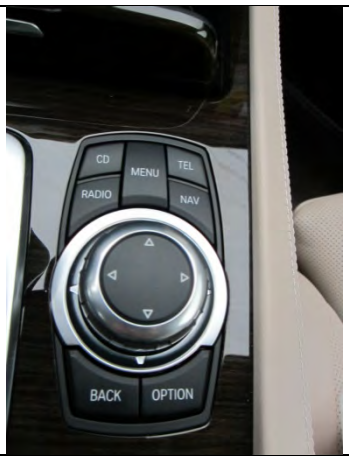
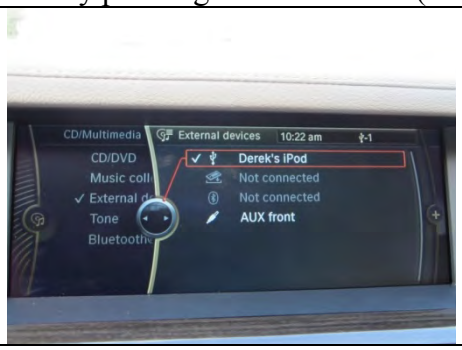
- **Advance setup** of a testable task prior to testing (importance of preparing iPod for use including storing songs and playlists on it: particularly the target playlist, connecting the iPod to the vehicle, setting the entertainment function to 'CD' before test).
- **How to make a general task "testable"** by giving it specificity (e.g., "initiate play of the playlist named 'Bluesville' on your iPod"). Choosing a playlist reasonable to find on the display search screen requiring some visual search; neither the easiest nor the hardest instance of finding an item in the list is an important element of constructing a fair test. The method of switching modes and searching for the playlist in the display screen must be identified and trained as the method to be used during a given test. (For completeness in testing the vehicle's system, both testable tasks that are available within this system for achieving the goal of finding and initiating play of a specific iPod playlist should be tested, and a separate test of each them should be established and conducted but this example illustrates only one of them.)

HIGHER-LEVEL GOAL: Initiate playback of media on iPod Nano.

TASK: Switch from CD to iPod, and initiate playlist named "Bluesville."

Starting Configuration/State of Device: iPod Nano is connected to the vehicle via USB. Numerous songs of different genres and from different artists have been loaded on the iPod in advance of testing, including a playlist named "Bluesville." In advance of the test, the entertainment system has been turned on, and set to a different mode (CD).

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward)
	
Press the “CD/Multimedia” button on lower center console. (An alternative method would be to highlight “CD/Multimedia” using the rotary dial, and then press in knob; a separate testable task.)	Note: The most recent “CD/Multimedia” function (e.g., CD) will be active.
	
Toggle left.	Turn knob to highlight iPod (selection not shown on this screen).

Turn rotary dial to highlight desired or playlist (The target listing should say "Bluesville.") and press knob. Task is finished at this point. Playback begins automatically.

The task end state would be reached when the driver successfully touches the area corresponding to the correct playlist selection on the primary display screen subsequently indicated by the system starting to play the song.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Switch from CD to iPod, and initiate playlist named "Bluesville." Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 3G

Description

In this vehicle, communication tasks are accessed in a visual-manual mode using a primary controller in the center console and a display screen on the center stack.

Purpose of Example

This example illustrates how to set up a testable task for pairing a handheld phone with this vehicle using this vehicle's interface. It is particularly useful for showing:

- **Advance setup** of a testable task prior to testing (having a separate handheld phone ready, training the participant on basic connecting functions of this handheld phone, setting the display to the home screen before test)
- **How to make a general task "testable"**: Train participant on basic connection functions of the handheld phone to be used for this test.

HIGHER-LEVEL GOAL: Use Bluetooth to connect handheld phone to integrated system.

TESTABLE TASK: Pair this handheld phone to the in-vehicle system using Bluetooth.

Starting Configuration/State of Device: Turn cell phone on in vehicle. Make sure the primary display is on the home screen for testing. Turn entertainment system off.

Steps:

<table>
<tr>
<td> 
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<td> 
</td>
</tr>
<tr>
<td>Primary display screen (not a touch screen). (Home Screen)</td>
<td>Primary manual control located on lower center console. The center circle contains the following controls:
• Rotary dial
• 4-directional toggle
• Select by pressing the knob down (inward).</td>
</tr>
</table>

	
Turn the rotary knob to highlight "Telephone" and press in knob.	Turn the rotary knob to highlight "Add new phone" and press in knob.
	 Additional steps take place on the cell phone being paired. This cell phone is just a placeholder picture; no actual pictures or steps are available to show.
Use Bluetooth on handheld phone to connect by identifying vehicle on phone and entering a passkey on phone.	Steps on cell phone that are required for the pairing task (e.g., entering in the passkey) should be included in the task sequence itself, when testing it.
	 (Additional steps may continue to take place on the cell phone being paired. This cell phone is just a placeholder picture; no actual pictures or steps are available to show.)
Enter that same passkey to the vehicle by using rotary dial to highlight the correct number and pressing knob to select correct number. Repeat for each number.	Steps on cell phone required for the pairing task should be included in the task sequence itself, when testing it.

	
Press in knob on controller to select.	Wait for system to check passkey.
	
Highlight correct function and then press knob to select. Then highlight 'OK' and then press knob to select. (Task is finished at this point)	Final screen will appear.

The task end state would be reached when the device successfully accepts connection of the handheld device.

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Pair this handheld phone to the in-vehicle system using Bluetooth. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 3H

Description

In this vehicle, communication tasks are accessed in a visual-manual mode using a primary controller in the center console and a display screen on the center stack.

Purpose of Example

This example illustrates how to set up a testable task for placing a phone call to someone whose phone number is already stored as a contact in the device and doing so using a handheld phone that has been paired to the vehicle using this vehicle's interface. It is particularly useful for showing:

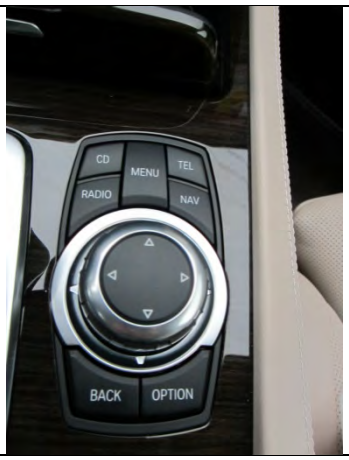
- **Advance setup** of a testable task prior to testing (having a separate handheld phone ready, having paired the phone to the vehicle in advance of testing, having stored contact phone numbers in advance)
- **How to make a general task "testable"**: How to give specificity to the task so that it is testable.

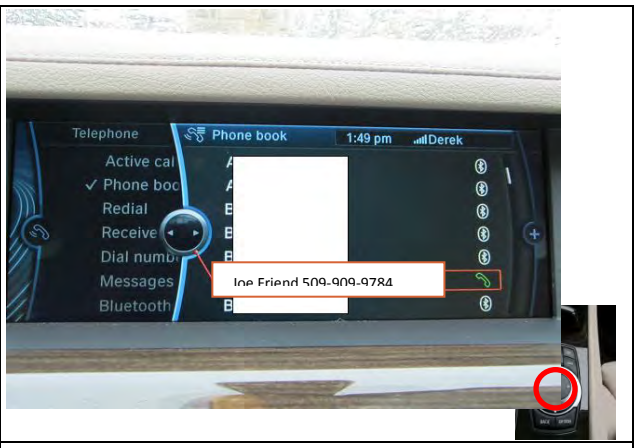
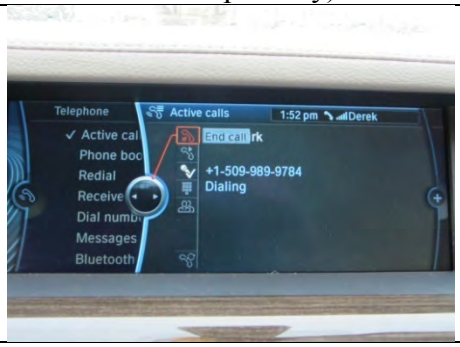
HIGHER-LEVEL GOAL: Make a phone call on a paired phone using a saved number.

TASK: Call your friend Joe on the connected phone by using stored contacts.

Starting Configuration/State of Device: Turn cell phone on in vehicle. Turn entertainment system off. Make sure primary display screen is up.

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward).

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>Press the “Tel” button on lower center console (or an alternate method would be to use the rotary dial to highlight “Tel” and then press in knob; but that would be a separate testable task, and need to be tested separately).</td>
<td>Select a contact using rotary dial and “Select” knob. (Task is finished at this point.)</td>
</tr>
<tr>
<td> 
</td>
<td></td>
</tr>
<tr>
<td colspan="2">System starts to dial phone number.</td>
</tr>
</table>

Task end state is reached when the system has accepted the final control input from the driver on the controller knob (selecting the contact to whom the call should be placed) on the next to last photo subsequently reflected by system state changes confirming this (e.g., audio feedback that the system is dialing the phone number.)

Start of measurement during testing would occur when the experimenter said “now,” in the request to perform the task as in, “Your task is to: Call your friend Joe on the connected phone by using stored contacts. Please begin now.”

End of measurement would occur at the point when the test participant says “Done!” and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 3I

Description

In this vehicle, communication tasks are accessed in a visual-manual mode using a primary controller in the center console and a display screen on the center stack.

Purpose of Example

This example illustrates how to set up a testable task for placing a call to a new phone number (not already saved as a contact) using a handheld phone connected to this vehicle's interface. It is particularly useful for showing:

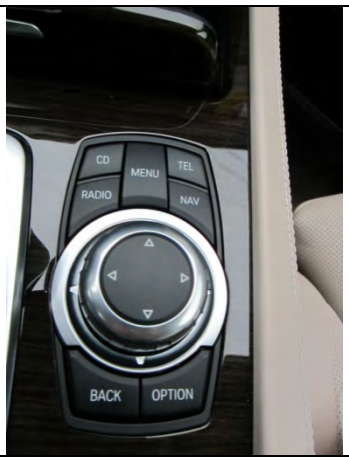
- **Advance setup** of a testable task prior to testing (having a separate handheld phone ready, and having paired the phone to the vehicle in advance of testing).
- **How to make a general task "testable."**

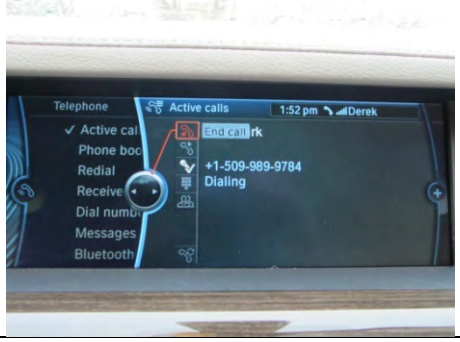
HIGHER-LEVEL GOAL: Make a phone call to a new (unsaved) phone number.

TESTABLE TASK: Place a phone call to the new restaurant by dialing 507-989-9784.

Starting Configuration/State of Device: Turn cell phone on in vehicle. Turn entertainment system off. Make sure home screen is up.

Steps:

	
Primary display screen (not a touch screen).	Primary manual control located on lower center console. The center circle contains the following controls: • Rotary dial • 4-directional toggle • Select by pressing the knob down (inward).

	
Press the "Telephone" button on lower center console (An alternate method is to use the rotary dial to highlight "Telephone" and then to press in knob (a separate testable task.)	Toggle left to access the telephone menu.
	
Press the rotary knob to select "Dial number."	Highlight number and press knob (Repeat these two steps until the entire number appears at the top of the screen.).
	
Press knob (Task is finished at this point.).	This screen appears and the phone begins to dial the number.

Task end state is reached when the driver has pressed the controller knob subsequently reflected by system state changes confirming this (e.g., audio feedback that the system is dialing the phone number.)

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Place a phone call to the new restaurant by dialing 507-989-9784. Please begin now."

End of measurement would occur at the point when the test participant says “Done!” and/or when the participant by some means indicates the same thing non-.

TASK EXAMPLES FROM VEHICLE 4

Disclaimer: These task examples were developed in an effort to illustrate real tasks in real vehicles, to provide documentation that could facilitate and support testing efforts. The examples are intended only to illustrate how to set up tasks for testing. They are ***not*** intended to provide an authoritative guide on how any given vehicle, device, or task operates.

PREFACE on DEPENDENT TASKS for TESTABLE TASKS 4A.1-4A.5

The first five task examples for this vehicle should be considered as a set (A.1-A.5).

They are all ***route-following tasks*** and all **part of the same trip** (a trip lasting over an hour in length in this particular example). As route-following tasks, they do present certain challenges for testing. As mentioned in an earlier chapter, many of these tasks often need to be tested while driving on the road. This is because, in order for the route-following systems to generate instructions, the vehicle's GPS unit must be moving spatially in order to be mapped to the navigation database. When a vehicle is stationary in a test setting (e.g., in a simulator), the GPS unit does not move which is a technical hurdle in getting the navigation unit to generate route guidance instructions for a non-moving vehicle during simulation and, moreover, to have those instructions match the simulated world that a driver is viewing on the simulator screen. A few rare simulators may have a way to trick both the route guidance system to be tested and the simulator into jointly creating the test conditions to make a test of route-following tasks possible but this set of tasks, for the moment, may need to be addressed with some on-road testing. The route-following examples shown here were photographed while driving on a road.

The first task in this string of five tasks is a normal, stand-alone task (that of initiating route guidance) though it is a mixed-mode task consisting of both visual-manual and voice parts (but, as such, the visual-manual portions would be covered under the guidelines, and could be tested).

However, the end state of this first task, (Task A.1) enables the conditions for the start state of the second task, (Task A.2). Task A.1 provides the route instructions for the first maneuver (or turn) in the route, ending with information about the subsequent upcoming turn on the trip. Task A.2 starts when the first alert is then issued to prepare for that next turn in the trip and continues through to the actual making of the turn. It reaches completion (or its task end state) when, immediately upon completion of the turn, information about the very next upcoming turn on the trip is given. That represents the end state for Task A.2. The reasoning is that once a driver has completed a given turn within a trip, and knows what maneuver is going to come up next, then he/she can focus on driving for a while until alerted that the next turn is near. Thus, route following is not one long task but a series of dependent tasks (one after another) with each task structured around a single turn or maneuver within the route. The structure of the task around each turn/maneuver is depicted in Figure 4 below.

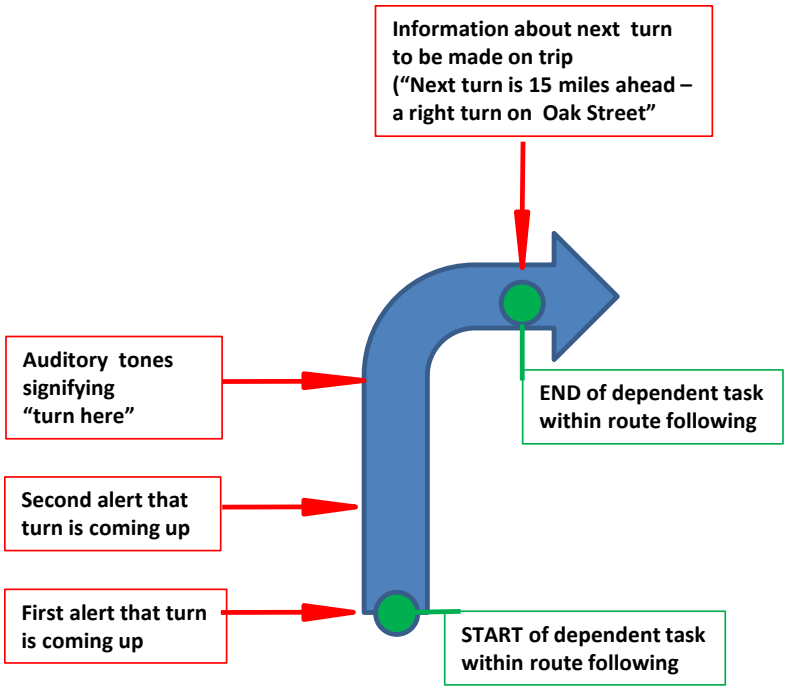


Figure 4. Dependent Task Structure Within Route Following

The start state for Task A.3 thus also depends on the end state of Task A.2 since the instructions for Task A.3 (the next upcoming maneuver or turn in the trip) cannot be issued until Task A.2 is completed. Tasks A.2 through A.5 all follow this same pattern and are part of a set of dependent tasks.

This means that in testing, each of these is a testable task (under the definition of a dependent task) and so data needs to be analyzed for each task separately. However, for testing purposes, it will be easiest to conduct the entire route guidance trip as a single integrated test and, then, after the test, to partition the data into the separate tasks which comprised the data stream.

With dependent tasks, there are *no task requests* that need to be given between the end state of the antecedent task and the start state of the dependent task. This makes it possible to collect data from the beginning of Task A.1 through the end of Task A.5 of this set (starting with the task request, "Your task is to obtain and follow route guidance to the Ikea store in Canton, Michigan. Please begin now"). As mentioned previously, the data can be partitioned into measurements associated with each of the separate tasks afterward. [Each dependent task nonetheless has its own implicit goal, "Your task is to make your next turn and to complete it by understanding what maneuver is coming up next and how long it will be before you approach it."

The next several pages provide concrete illustrations of these dependent tasks, and how they are related.

These interactions all involve mixed-mode interactions (a mixture of both auditory-vocal interactions, as well as visual-manual interactions). Because each task involves some visual-manual interaction, it is appropriate that the visual-manual components meet the proposed NHTSA Phase 1 Guidelines.

TESTABLE TASK EXAMPLE 4A.1

HIGHER-LEVEL GOAL: Obtain and follow route guidance to the Ikea store in Canton, Michigan, using voiced destination entry.

TESTABLE TASK: Enter destination and initiate route guidance support to the Ikea store in Canton, Michigan. (Note: During training, participants are shown that video displays are available to support the voiced route guidance instructions. The purpose of the test is to assess visual demand of the displays which accompany the voiced instructions and also any manual demand associated with the initial button press.)

Starting Configuration/State of Device: Set infotainment system to XM radio setting "2," volume turned down to barely audible (so that voiced route guidance instructions may be heard by the driver).

Steps:

	
Start State is this screen (Entertainment home screen, showing XM radio station and currently playing song).	Press blue OnStar button to request route guidance instructions to the Ikea Store in Canton Township, MI.

 Image from: http://www.interstate-guide.com/i-029.html	
Look ahead at road while waiting for OnStar Advisor to determine route.	OnStar Advisor indicates that route will be downloaded to vehicle; and the (redundant) display just indicates that the vehicle is still connected to the OnStar Advisor.
	
Display indicates that vehicle is receiving route download from OnStar Advisor.	Driver hears voice saying, "Your destination is 45 miles away. Continue driving on I-96 West." This indicates that the destination has been successfully entered and route guidance downloaded/initiated.

The task end state would be reached when the driver hears the message indicating how far away the destination is, and giving the first driving instruction. This indicates the destination has been successfully entered and route guidance downloaded/initiated.

Start of measurement during testing would occur when the experimenter says "now" in issuing the instruction to perform the task, as in: "Enter destination and initiate route guidance support to the Ikea store in Canton, Michigan. Please begin now."

End of measurement for this dependent task would end at the point shown in the last cell of the task flow, when the device says "Your destination is 45 miles away. Continue driving on I-96 West." Since the task request for this dependent task remains *implicit* rather than explicit, the test participant will not be instructed to say "Done!" at this point, and will not say it. In fact, measurement may continue through completion of all dependent tasks until the destination of the overall goal is reached and then the data stream can be partitioned after the fact into the elemental tasks that enabled achievement of the overall goal.

Navigation

TESTABLE TASK EXAMPLE 4A.2

HIGHER-LEVEL GOAL: Obtain and follow route guidance to the Ikea store in Canton, Michigan, using voiced destination entry.

TESTABLE (dependent) **TASK: Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.**

Starting Configuration/State of Device: This task is a dependent task and, as such, the conditions of its start state were enabled by the end state of the last task (the antecedent task).

Steps:

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>This task begins with the first alert for the turn coming up and it is issued by voice, “In a mile, bear left to take I-96 Express.”
A redundant visual display of this turn-by-turn instruction comes up on the screen.</td><td>As the turn approaches, OnStar gives another prompt in the “countdown” to the turn, “In half a mile, bear left to take I-96 Express” and the redundant display updates.</td></tr>
<tr><td> 
</td><td>Auditory-Only Indicator To Turn Now
“Ding, ding”
♪ ♪</td></tr>
<tr><td>Closer to the turn, OnStar gives another prompt in the “countdown” to the turn, “Bear left to take I-96 Express” and the redundant display updates.</td><td>At the point where the turn needs to be made, OnStar prompts auditorily with a “ding, ding.”</td></tr>
</table>

Immediately following the turn (just as a driver completes the maneuver), the route guidance system informs the driver that the next turn is 15 miles away and will involve bearing left on M-14. This allows the driver some 'closure' and enables the driver to focus on just driving until the next route guidance instruction is received. It **represents the end state** of this dependent task.

The task end state would be reached when the driver hears the message indicating how far away the next turn is, and explaining what that maneuver is.

Start of measurement during testing would occur at the start state shown in the first cell shown in the photographs for this task flow at the issuance of the first auditory system message/alert for this turn. The conditions for this start state were enabled by the end state of the preceding antecedent task. At the end of the antecedent task, the goal of the dependent task is implicitly invoked (but need **not** be explicitly stated during testing): Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.

End of measurement for this dependent task would end at the point shown in the last cell of the task flow, where the next turn has been announced/shown. Since the task request for this dependent task remains *implicit* rather than explicit, the test participant will not be instructed to say "Done!" at this point, and will not say it. In fact, measurement may continue through completion of all dependent tasks until the destination of the overall goal is reached and then the data stream can be partitioned after the fact into the elemental tasks that enabled achievement of the overall goal.

Navigation

TESTABLE TASK EXAMPLE 4A.3

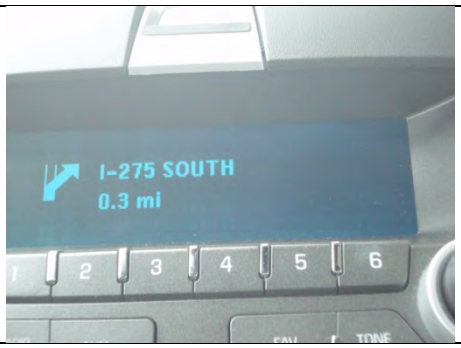
HIGHER-LEVEL GOAL: Obtain and follow route guidance to the Ikea store in Canton, Michigan, using voiced destination entry.

TESTABLE (dependent) **TASK: Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.**

Starting Configuration/State of Device: This task is another dependent task and, as such, its start state was the end state of the last task (the antecedent task).

Steps:

	
As this turn approaches, OnStar gives another prompt in the "countdown" to the turn, "In half a mile, bear left to exit onto M-14" and the redundant display updates.	Drawing even closer to the turn, OnStar gives another prompt in the "countdown" to the turn, "Bear left to exit onto M-14" and the redundant display updates.

Auditory-Only Indicator To Turn Now "Ding, ding" ♪ ♪	
At the point where the turn needs to be made, OnStar prompts auditorily with a "ding, ding."	Immediately following the turn (just as a driver completes the maneuver), the route guidance system informs the driver that the next turn is 0.3 miles away and will involve exiting onto I-275. This allows the driver some 'closure' and enables the driver to focus on just driving until the next route guidance instruction is received. This instruction (and redundant visual display) represents **the end state** of this dependent task.

The task end state would be reached when the driver hears the message indicating how far away the next turn is, and explaining what that maneuver is.

Start of measurement during testing would occur at the start state shown in the first cell shown in the photographs for this task flow at the issuance of the first auditory system message/alert for this turn. Note that the conditions for this start state were enabled by the end state of the preceding antecedent task. At the end of the antecedent task, the goal of the dependent task is implicitly invoked (but need **not** be explicitly stated during testing): Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.

End of measurement for this dependent task would end at the point shown in the last cell of the task flow, where the next turn has been announced/shown. Since the task request for this dependent task remains *implicit* rather than explicit, the test participant will not be instructed to say "Done!" at this point, and will not say it. In fact, measurement may continue through completion of all dependent tasks until the destination of the overall goal is reached and then the data stream can be partitioned after the fact into the elemental tasks that enabled achievement of the overall goal.

TESTABLE TASK EXAMPLE 4A.4

HIGHER-LEVEL GOAL: Obtain and follow route guidance to the Ikea store in Canton, Michigan, using voiced destination entry.

TESTABLE (dependent) **TASK: Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.**

Starting Configuration/State of Device: This task is another dependent task and, as such, its start state was the end state of the last task (the antecedent task).

Steps:

	
As the turn approaches, OnStar alerts the driver (first at a half-mile before the turn; photo not available), "In half a mile, exit right onto I-275" and then again as the vehicle gets closer (e.g., at 250-300 yards (shown here), and the redundant display updates.	Drawing even closer to the turn, OnStar gives another prompt in the "countdown" to the turn, "Exit right onto I-275" and the redundant display updates.

Auditory-Only Indicator To Turn Now "Ding, ding" ♪ ♪	
At the point where the turn needs to be made, OnStar prompts auditorily with a "ding, ding."	Immediately following the turn (just as a driver completes the maneuver), the route guidance system informs the driver that the next turn is 4.2 miles away and will involve exiting onto M-153. This allows the driver some 'closure' and enables the driver to focus on just driving until the next route guidance instruction is received. This instruction (and redundant visual display) represents **the end state** of this dependent task.

The task end state would be reached when the driver hears the message indicating how far away the next turn is, and explaining what that maneuver is.

Start of measurement during testing would occur at the start state shown in the first cell shown in the photographs for this task flow at the issuance of the first auditory system message/alert for this turn. The conditions for this start state were enabled by the end state of the preceding antecedent task. At the end of the antecedent task, the goal of the dependent task is implicitly invoked (but need **not** be explicitly stated during testing): Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.

End of measurement for this dependent task would end at the point shown in the last cell of the task flow, where the next turn has been announced/shown. Since the task request for this dependent task remains *implicit* rather than explicit, the test participant will not be instructed to say "Done!" at this point, and will not say it. In fact, measurement may continue through completion of all dependent tasks until the destination of the overall goal is reached and then the data stream can be partitioned after the fact into the elemental tasks that enabled achievement of the overall goal.

TESTABLE TASK EXAMPLE 4A.4

HIGHER-LEVEL GOAL: Obtain and follow route guidance to the Ikea store in Canton, Michigan, using voiced destination entry.

TESTABLE (dependent) **TASK: Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.**

Starting Configuration/State of Device: This task is another dependent task and, as such, its start state was the end state of the last task (the antecedent task).

Steps:

	
As the turn approaches, OnStar begins to alert the driver auditorily, "In 1.4 miles, exit right onto M-153," and the redundant display updates.	OnStar gives further auditory prompts as the vehicle gets closer (shown here), and the redundant display updates.
	Auditory-Only Indicator To Turn Now "Ding, ding" ♪ ♪
Drawing even closer to the turn, OnStar gives another prompt in the "countdown" to the turn, "Exit right onto I-275" and the redundant display updates.	At the point where the turn needs to be made, OnStar prompts auditorily with a "ding, ding" completing the instructions for that turn.

Immediately following the turn (just as a driver completes the maneuver), the route guidance system informs the driver auditorily that the next turn is 0.4 miles away and will involve turning right onto Ford Road. The redundant visual display updates as well. This information allows the driver some 'closure' and enables the driver to focus on the driving until the next route guidance instruction is received. This instruction (and redundant visual display) represents **the end state** of this dependent task.

The task end state would be reached when the driver hears the message indicating how far away the next turn is, and explaining what that maneuver is.

Start of measurement during testing would occur at the start state shown in the first cell shown in the photographs for this task flow at the issuance of the first auditory system message/alert for this turn. The conditions for this start state were enabled by the end state of the preceding antecedent task. At the end of the antecedent task, the goal of the dependent task is implicitly invoked (but need **not** be explicitly stated during testing): Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.

End of measurement for this dependent task would end at the point shown in the last cell of the task flow, where the next turn has been announced/shown. Since the task request for this dependent task remains *implicit* rather than explicit, the test participant will not be instructed to say "Done!" at this point, and will not say it. In fact, measurement may continue through completion of all dependent tasks until the destination of the overall goal is reached and then the data stream can be partitioned after-the-fact into the elemental tasks that enabled achievement of the overall goal.

TESTABLE TASK EXAMPLE 4A.5

HIGHER-LEVEL GOAL: Obtain and follow route guidance to the Ikea store in Canton, Michigan, using voiced destination entry.

TESTABLE (dependent) **TASK: Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.**

Starting Configuration/State of Device: This task is another dependent task and, as such, its start state was the end state of the last task (the antecedent task).

Steps:

	
As the turn approaches, OnStar begins to alert the driver auditorily, "Turn right onto Ford Road," and the redundant display updates.	Immediately after the final turn on the route, OnStar says auditorily, "Your destination is 0.2 miles ahead on the right. 41640 Ford Road." And provides a redundant screen to display the key information.
OnStar audio says: "You are arriving at your destination on the right. Route guidance will now end."	
This represents **the <u>end state</u> of this dependent task**.The prior display often persists through the message, or sometimes updates to the display shown in the next cell.	The main screen returns to its home state **<u>after</u>** the end of the task.

<u>The task end state</u> would be reached when the driver hears the message indicating that the destination has been reached.

Start of measurement during testing would occur at the start state shown in the first cell shown in the photographs for this task flow at the issuance of the first auditory system message/alert for this turn. Note that the conditions for this start state were enabled by the end state of the preceding antecedent task. At the end of the antecedent task, the goal of the dependent task is implicitly invoked (but need **not** be explicitly stated during testing): Make your next turn on the route, completing it by understanding what maneuver will be coming up next and how long it will be before you approach it.

End of measurement for this dependent task, the last one in the task, which achieves the overall goal, would end at the point shown in the last cell of the task flow, where arrival at the destination has been reached. Since the task request for this dependent task remained *implicit* rather than explicit, the test participant would not have been instructed to say "Done!" at this point, and thus would not say it. Thus, measurement can continue through completion of all dependent tasks until the destination of the overall goal is reached and then the data stream can be partitioned after the fact into the elemental tasks that enabled achievement of the overall goal.

TESTABLE TASK EXAMPLE 4B

Description
In this vehicle, adjustment of the entertainment system functions may be made using hard buttons under the main display screen, as well as soft buttons on the screen.

Purpose of Example
This example illustrates how to set up a testable task using the hard buttons.

HIGHER-LEVEL GOAL for this example: Change the radio to a favorite pre-set.

TESTABLE TASK: Change the XM station that is playing to the first preset station.

Starting Configuration/State of Device: Radio should be set to "on." The Home screen should be showing on the main display screen.

Steps:

	
Start state: XM station playing.	Press the hard button labeled "1" underneath the screen.

Task end state is reached when the system has accepted the final control input from the driver to "change the station that is playing to the first preset station" subsequently reflected by system state changes confirming this (different station playing).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Change the XM station that is playing to the first preset station. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 4C

Description

In this vehicle, adjustment of the entertainment system functions may be made using hard buttons under the main display screen, as well as by rotary knobs to either side.

Purpose of Example

This example illustrates how to set up a testable task using the hard buttons and rotary knobs.

HIGHER-LEVEL GOAL for this example: Fade audio to front speakers by a noticeable amount.

TESTABLE TASK: Fade audio to front speakers by a noticeable amount.

Starting Configuration/State of Device: Radio or CD should be set to "on." The Home screen should be showing on the main display screen.

Steps:

	
Push the "CONFIG" hard button under the screen.	This brings up the "system configuration" screen. Rotate the rotary knob on the right to move the highlighted bard downward in the list of choices on the screen until "Radio Settings" is selected.

<table>
<tr>
<td> 
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<td> 
</td>
</tr>
<tr>
<td>When “Radio Settings” is highlighted, PUSH in on center of knob.</td>
<td>Again, using the same rotary knob, rotate it to move the highlighted bar downward through choices.</td>
</tr>
<tr>
<td> 
</td>
<td></td>
</tr>
<tr>
<td>Continue to rotate the right knob, until “Fader” comes into view. Then PUSH the knob to select it.</td>
<td></td>
</tr>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>The screen shows the audio is balanced between front and back. Push on knob.</td>
<td>Then rotate to move the fader position toward the “F” for “front” by a noticeable amount</td>
</tr>
</table>

Task end state is reached when the system has moved the "fader" indicator to the front of the cross-hairs indicating "front of vehicle" subsequently reflected by system state changes confirming this (sound level is shifted to front).

Start of measurement during testing would occur when the experimenter said "now," in the request to perform the task as in, "Your task is to: Fade audio to front speakers. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally.

TESTABLE TASK EXAMPLE 4D

Description

In this vehicle, when communication tasks are accessed, it involves a mixed-mode process, of touching one OnStar button, and then speaking commands. Although a display is provided, it is redundant with information that is available in an auditory mode.

Purpose of Example

This example illustrates how to set up a testable task for dialing a 10-digit phone number using a mixed-mode method. This is just one example of how a mixed-mode task can be set up for testing under the NHTSA Guidelines. Testing can begin at the start state and proceed to the end state, to evaluate the needed metrics for visual-manual demand (glance metrics).

HIGHER-LEVEL GOAL: Place phone call.

TESTABLE TASK: Call the school using OnStar to dial 313-881-2488.

Starting Configuration/State of Device: Any. The task start depends only on access to the OnStar mirror, and it is always in the same state.

Steps:

	
Push the "Phone" button on the OnStar mirror.	Say "Dial 313-881-2488." (The OnStar system responds auditorily with confirming messages, ending with "Dialing" and displays the redundant visual screen shown above.)

After hearing the phone ringing, when the call is connected, this screen appears (again, as a redundant indicator that the call has been connected).

The task end state would be reached when the system accepts the dial control input from the driver, as indicated by the system's auditory confirming messages, ending with "dialing." The actual call connection is subsequently indicated by the ringing of the phone (the connection, and the redundant visual display saying "connected" but these come after the end of the task).

Start of measurement during testing would occur when the tester says "now" in the task instruction as in, "Your task is: Call the school using OnStar to dial 313-881-2488. Please begin now."

End of measurement would occur at the point when the test participant says "Done!" and/or when the participant by some means indicates the same thing non-verbally

.

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