

Advanced Driver Interface Systems for Commercial Vehicle Operations

Foreword—In recent years there have been significant new developments in the area of driver interface systems and software for those systems. The aim of these developments has been to offer the driver better information from a central display or displays, and to take advantage of new developments in personal computing, graphical user interfaces and audio interfaces in order to enhance safety and productivity in a commercial vehicle. These developments are also driven by new Intelligent Transportation System (ITS) technologies, like Global Positioning Satellites, satellite communications, real time traffic information, automated tolls and collections, terrestrial wireless infrastructure, and so on. In addition, the commonality of standardized, on-board digital networks (e.g., SAE J1939) linking vehicle subsystems, also makes a single or limited number of driver interfaces possible, and in most cases preferable.

With professional drivers in commercial vehicle operations the act of driving the vehicle is mixed with the requirements for which the vehicle is employed, such as hauling goods to a designated stop. The delivery process oftentimes requires the driver to be cognizant of customer requirements (e.g., schedules), and may require frequent directions to unfamiliar locations. Among others, these potential distractions include receiving real-time instructions over a radio or cell phone, and glancing at paper maps. Advanced driver interface systems have the capability to remove or mitigate these unavoidable distractions. For example, digital messages stored in a device can replace wireless voice communications, which in many cases, must be committed to memory or written. Also, digital navigation can replace paper maps with commercial vehicle-relevant routes, simplified images, and simple textual or spoken instructions. Non-job related distractions, like adjusting an entertainment system, can be made safer with voice activated commands.

This SAE Recommended Practice does not apply to traditional driver interface technologies, including gauges, gauge clusters or indicator lights.

- 1. Scope**—This SAE Recommended Practice defines an architecture, including operating modes, in which an advanced driver interface system and related software exist. It also provides reference to a set of Federal Highway Administration approved guidelines for human factors characteristics of such systems and related software.
- 1.1 Purpose**—This document is meant to aid the developer of advanced driver interface systems and related software for commercial vehicle operations in understanding the general architecture in which an advanced driver interface system is placed, as well as provide some limited guidance in developing information presentation to the driver. This document has cited specific sections of *The Human Factors Design Guidelines for Advanced Traveler Information Systems (ATIS) and Commercial Vehicle Operations*, published by the United States Department of Transportation's Federal Highway Administration. The specific guidelines cited are those thought to provide the most applicable assistance for developers of advanced driver interface systems and software for professional drivers.

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2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1587—Joint SAE/TMC Electronic Data Interchange Between Microcomputer Systems in Heavy Duty Vehicle Applications

SAEJ1708—Serial Data Communications Between Microcomputer Systems in Heavy Duty Vehicle Applications

SAE J1939—Recommended Practice for a Serial Control and Communication Vehicle Network

SAE J1939/71—Vehicle Application Layer

2.1.2 IEEE PUBLICATIONS—Available from IEEE, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

IEEE 1455—Dedicated Short Range Communications

2.1.3 US DEPT. OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION PUBLICATION—Available from U. S. Department of Transportation, 400 7th Street, S.W., Washington, DC 20590. Telephone: 202-366-4000. Website: www.its.dot.gov

(FHWA-RD-98-057). Human Factors Design Guidelines for Advanced Traveler Information Systems (ATIS) and Commercial Vehicle Operations (CVO)

3. Definitions

CVO	Commercial Vehicle Operations
ITS	Intelligent Transportation Systems
ATIS	Advanced Traveler Information Systems
FHWA	Federal Highway Administration

4. Architecture of Advanced Driver Interface Systems—An advanced driver interface system has the capability to present information to the driver from multiple sources and receive commands from the driver for multiple purposes. An advanced driver interface system can be an autonomous computing device with the capability to run complex software, or can be the combination of a terminal device acting as the front end of a number of autonomous intelligent devices on, or even off of the vehicle. Therefore it is important to acknowledge a structure of which the driver interface system shall be an integral part. Figure 1 illustrates the structure of an advanced driver interface system.



FIGURE 1—STRUCTURE OF ADVANCED DRIVER INTERFACE SYSTEM.

4.1 The Front-End of an advanced driver interface system is that portion available to the driver. It consists of the interfacing hardware, such as the display, keypad, touch-screen, audio circuitry, etc. It also consists of the software applications which present information to the driver, allow the driver to act upon that information, or simply allow the driver to apply commands and messages through the driver interface system to other systems on or off of the vehicle. This document is primarily concerned with the front end. The front end entails the Human Factors elements.

- 4.2** The **Back-End** of an advanced driver interface system is the electronic interface to systems/devices external to the advanced driver interface system. These include the diagnostic and control networks (SAE J1708, SAE J1939), off-board communications networks such as satellite or terrestrial wireless networks, video input or audio input/output, or any of a number of possible electronic interconnections. This document draws the developer's attention to a number of sources of guidelines and recommended practices. These include the SAE J1939, SAE J1708, and SAE J1587. Also included are others such as IEEE 1455 specification for dedicated short range communications. Some electronic interface protocols are proprietary, such as certain wireless data networks. It is important to note that within the advanced driver interface system is included software operating on external devices using the advanced driver interface system for their own driver interface requirements.
- 4.3** The **Information Manager** is at the core of the advanced driver interface system, and includes the message management rules that are applied to the information available to the driver. This document does not outline any rules for the developer other than those required by mode control (see Section 5) or by documents cited as reference material. It is assumed that the developers of advanced driver interface systems or software applications for those systems shall use good judgement in designing their information manager software, and shall use applicable information management rules that might be subsequently developed by SAE.
- 5. Operating Modes**—Two operating modes shall exist for an advanced driver interface system. These two modes are Parked mode and Not-parked mode. Required within the advanced driver interface system is a mechanism for indicating to software applications which of these two operating modes the driver interface system is currently in. This mechanism shall enable software applications to operate in an unlimited or limited fashion, depending on which of the two modes is enabled. Primary responsibility for determining whether a software application can be operated safely during Not-parked mode rests with the software application developer. The software application developer, with input from customers, safety experts, and other responsible parties, shall use the advanced driver interface system's mode indication mechanism to allow full, limited or non-use of the application under Not-parked mode. This document shall not impede a provider of an advanced driver interface system from locking out software applications from operating during Not-parked mode that have not received certification from the advanced driver interface system provider.
- 5.1 Not-Parked Mode**—This is the mode of operation during the time the vehicle is in motion or imminent motion. In this mode, application software running on an advanced driver interface system shall be such that the use of the software shall not detract from the safe operation of the vehicle. The advanced driver interface system shall determine when the vehicle is in Not-parked mode and shall output an indication to software applications that this is the current mode.
- 5.2 Parked Mode**—This is the mode of operation during the time that the vehicle is stopped and not in a state of impending motion, for example, where the operator has placed the vehicle transmission in PARK, or in neutral with the parking brake set, or in gear with the engine off. In this mode, application software running on an advanced driver interface system shall not be required to take into consideration the restrictions of motion or imminent motion of the vehicle.
- 5.3 Optional Modes of Operation**—A provider of an advanced driver interface system may choose to have additional modes of operation. One example would be a Standby mode, where the operator is allowed to stop the vehicle to enable use of the advanced driver interface system beyond that allowed while the vehicle is in motion. Another example would be a Diagnostic/repair mode that enables a service person to operate the vehicle for the purpose of diagnostics and repair. If such modes exist, the advanced driver interface device must indicate to the application software when these optional modes are active. In the case of a diagnostic/repair mode, either the software application or the advanced driver interface system shall provide for a means to allow only authorized service personnel to enter this mode.