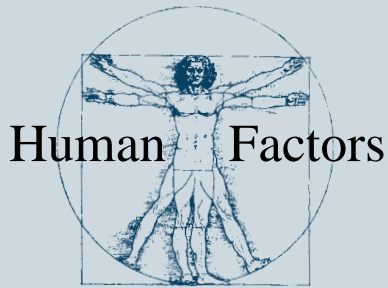


Summary Report



The Human Factors Research Program addresses human performance-related issues that affect highway system design. Current human factors research focuses on Highway Safety and Intelligent Transportation Systems (ITS).

FHWA is placing special emphasis on the trend of the United States to increase numbers of older drivers and implications of this trend on highway safety and ITS design. Human factors research products include highway system design guidelines and handbooks based upon empirical human performance data collected in the laboratory and in controlled, on-the-road tests.



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HUMAN FACTORS RESEARCH NEEDS FOR THE INTELLIGENT VEHICLE INITIATIVE (IVI) PROGRAM

Introduction

This flyer summarizes the activities and results of a preliminary human factors review for the Intelligent Vehicle Initiative (IVI) Program. As part of the IVI program, the Federal Highway Administration funded a project to investigate the human factors issues for an IVI and identify human factors “research needs” that currently exist. The objective of the project was to help the United States Department of Transportation (U.S. DOT) identify human factors work that needs to be done early in the life-cycle of the IVI program to ensure safe and well-engineered vehicles.

The IVI has the potential to provide drivers with useful information for many driving conditions and situations, to improve driving performance, and, ultimately, to increase the mobility and safety of the entire driving public. The IVI clearly represents an increase in the number of displays and controls for the in-vehicle environment, with a concurrent increase in the amount and complexity of information presented to the driver. If human factors integration and design issues are not addressed throughout the development process for the Generation I IVI, there is a risk that this increase in information will lead to information overload, driver confusion, and actual decreases in driver performance and safety.

This project was comprised of two major activities. First, a “Preliminary IVI Human Factors Technology Workshop” to draw together the stakeholders in the IVI program to begin to define the technologies and the human factors issues that need to be considered in developing an IVI. Second, the project team investigated the preliminary infrastructure and human factors in-vehicle requirements for alternative configurations of an IVI. The data collected during the Human Factors IVI Workshop served as a basis for human factors research needs that were identified.

Results

A first step was to assess the functions that could be included under each of the 26 User Services defined in the ongoing U.S. DOT Request for Information (RFI) for the IVI program. Each User Service was decomposed into subfunctions and an assessment was made as to the availability of each (i.e., existing, or available for use on a Generation I, II, or III IVI).

Human factors research to-date summaries and identification of research needs were developed to reflect concise summaries of the current literature as well as the general consensus of human factors professionals’ expert opinions. Current literature was acquired from: (1) the Battelle Human Factors Transportation Center’s collection of literature, including books, journal articles, and conference proceedings, (2) publication lists from the Federal Highway Administration and National Highway Traffic Safety Administration, and (3) literature searches using national databases. Expert opinions from human factors experts and other members of the ITS community were obtained at the Human Factors IVI Workshop.

Key steps and development issues associated with the project are summarized in figure 1 on the following page. To allow analysis of more complex IVI alternatives, the

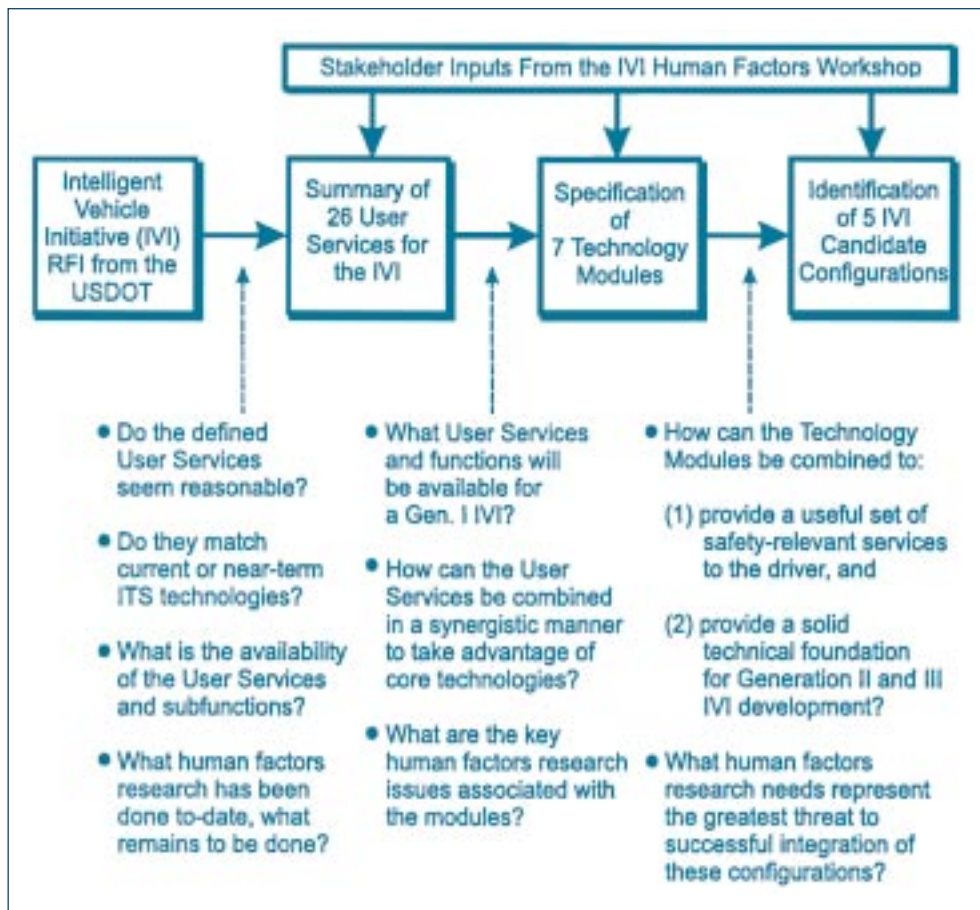


Figure 1. Key steps and development issues in the IVI project.

functional subsystems identified for the 26 User Services were combined into 7 “Technology Modules”:

- 1) Module A. Basic Collision Warning Technologies
- 2) Module B. Advanced Collision Warning Technologies
- 3) Module C. Basic Traveler Information Devices
- 4) Module D. Driver Convenience Devices
- 5) Module E. ITS Collision Warning Systems for Heavy Vehicles
- 6) Module F. ITS Information Systems for Heavy Vehicles

7) Module G. ITS Technologies for Transit

Each module was analyzed to determine high-priority human factors research that was needed to obtain a safe operating IVI. Any human factors work that had already been completed and was applicable to the Technology Module being analyzed was identified. Needed human factors work that could not be found was identified as early human factors research needs for the IVI. Five Candidate IVI Configurations were developed from the Technology Modules. These Candidate Configurations represent configurations of Technology Modules that provide an integrated set of User Services for the Generation I IVI.

Below, we briefly summarize the theme, User Services, and human factors research needs associated with the five IVI candidate configurations developed during this effort. The “themes” identify the overall goals, benefits, and target vehicles associated with the candidate configurations. The human factors research needs were identified through an integration of:

- (1) current research findings for the relevant ITS technologies,
- (2) opinions and judgments regarding research priorities from the more than 70 attendees at the Human Factors IVI Workshop, and
- (3) assessments of the Battelle project team, based on the nature and content of each candidate configuration.

Candidate Configurations for the Generation I IVI

Theme: Provides basic collision warning and driver information capabilities for all vehicles.

Key Human Factors Research Needs:

- The joint use of visual, auditory, and tactile information.
- Driver workload.
- Driver performance.
- Driver acceptance.

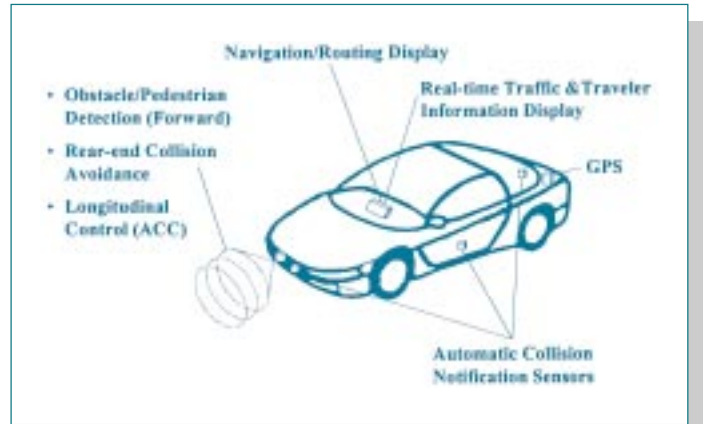


Figure 2. Candidate Configuration #1.

Theme: Promotes synergy among a number of IVI User Services and provides drivers with 360° collision warning coverage for all vehicles.

Key Human Factors Research Needs:

- Human factors design guidelines for multiple CAS devices.
- Integration of ATIS and CAS information.
- Driver tolerance for false alarms.

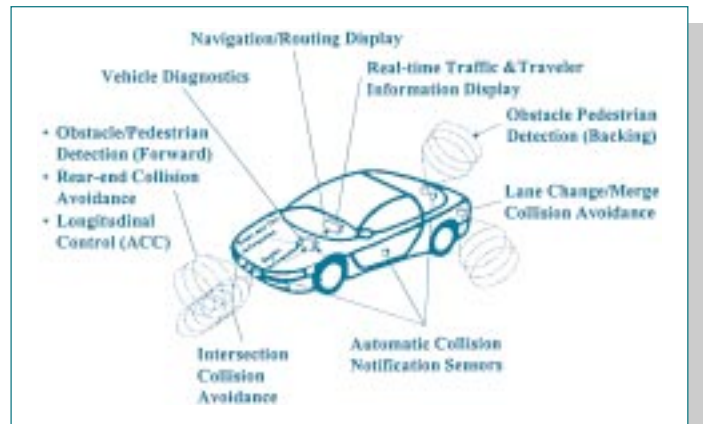


Figure 3. Candidate Configuration #2.

Theme: Promotes synergy among a number of IVI User Services and provides drivers with advanced traveler information system capabilities for all vehicles.

Key Human Factors Research Needs:

- Assess the ways in which an integrated information system with both routing and convenience devices affects performance and behavior of the driver.
- Special design requirements of older drivers.

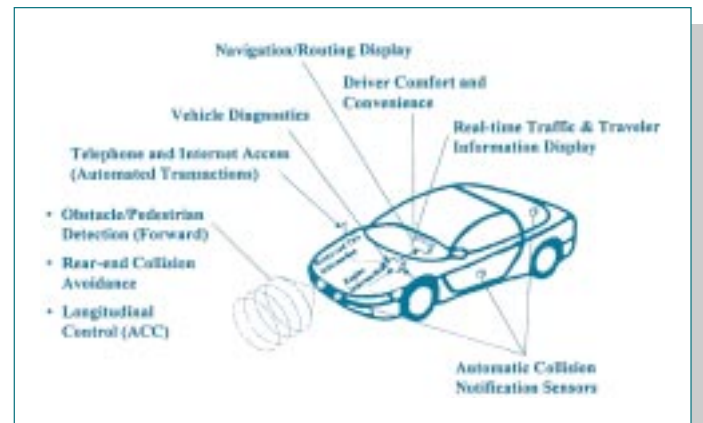


Figure 4. Candidate Configuration #3.

Candidate Configurations for the Generation I IVI (continued)

Theme: Provides an integrated set of ITS capabilities for drivers of heavy vehicles.

Key Human Factors Research Needs:

- Determine the most effective methods of integrating IVI information with existing dashboard displays and roadside signs.
- Determine information priorities within the CVO environment.
- Assess the effectiveness of driver condition warning devices.



Figure 5. Candidate Configuration #4.

Theme: Provides an integrated set of ITS capabilities for drivers of transit vehicles.

Key Human Factors Research Needs:

- Conduct a series of human factors analyses to better understand the transit environment.
- Determine the frequency, density, and timing of IVI information that is presented to the transit driver.

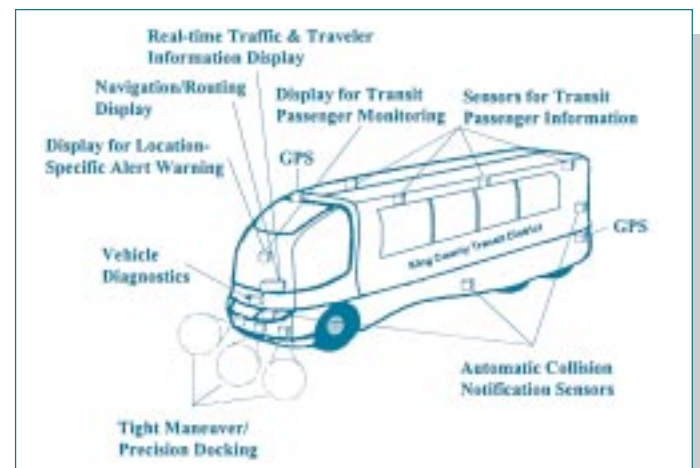


Figure 6. Candidate Configuration #5.

Conclusion

The following conclusions were developed from this project:

- Human factors research needs for the Generation I IVI focus on the need to integrate and manage the information presented to the driver.
- No publicly available human factors research has examined the effects of integrating multiple ITS devices into a vehicle as envisioned by the IVI.
- Considerable human factors research has been conducted to support the development of individual User Services within the IVI.
- A broad range of ITS technologies is available to support the development of a Generation I IVI prototype.
- For the Generation II and III IVI especially, extensive algorithm/software, infrastructure and specific technologies are needed.

For More Information

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