

A VARIABLE DYNAMIC TESTBED VEHICLE

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ABSTRACT

This paper describes the concept of a potential test vehicle for the National Highway Traffic Safety Administration (NHTSA) that is designed to evaluate the dynamics, human factors, and safety aspects of advanced technologies in passenger class automobiles expected to be introduced as a result of the Intelligent Vehicle/Highway System (IVHS) program. The Variable Dynamic Testbed Vehicle (VDTV) requirements were determined from the inputs of anticipated users and possible research needs of NHTSA. Design and implementation approaches are described, the benefits of the vehicle are discussed and costs for several options presented.

INTRODUCTION

The Jet Propulsion Laboratory (JPL) was commissioned by the National Highway Traffic Safety Administration to investigate and assess the need for an instrumented test vehicle to be used by NHTSA in the evaluation of new crash avoidance technologies emerging from the Intelligent Vehicle/Highway System program.

It would also provide a test capability that could support related programs such as the Automated Highway System (AHS) and the National Advanced Driving Simulator (NADS) programs. The concept of a test platform having programmable, variable performance was named the Variable Dynamic Testbed Vehicle. JPL considered three general aspects of the VDTV concept:

- potential uses and users
- need and benefits
- design, cost, and implementation approaches.

The following sections of the paper summarize the program results.

THE VDTV CONCEPT

The need for a VDTV is motivated by the rapid advancement in automotive technology and transportation

infrastructure expected to result from the IVHS program, [Ref. 1] NHTSA has identified the VDTV as one of several test capabilities it may need to evaluate and guide the safe introduction of these technologies into the public sector. [Ref. 2.] The part of the test spectrum that VDTV could uniquely fill is that for which an integrated, systematic approach to acquiring high-fidelity data concerning the interaction of advanced vehicle technologies, new collision avoidance systems, and the driver is of paramount importance.

The underlying concept of variable performance in a test bed vehicle has its roots in the aircraft industry where variable stability airplanes have been used extensively in research, and more recently in practice. The ability to quickly and easily change the dynamic response characteristics of a vehicle gives the investigator a powerful tool to conduct systematic testing of a broad range of research topics, including vehicle, driver-vehicle, and vehicle-environment areas of interest. Additionally, and equally important, the simulation attributes of a VDTV would assist NHTSA in conducting an integrated test program in which the needs and results of collision avoidance, vehicle technology, and simulator testing, as well as the support of other IVHS programs, can be coordinated and validated using a common test platform.

Features that make the VDTV a unique and versatile test tool are:

- On-board computer-controlled variable performance subsystems that allow rapid emulation of a range of automobile classes over a large envelope of test conditions.
- Complete instrumentation system package for both human factors and vehicle performance testing.
- Designed-in capability to accept a variety of collision avoidance technologies as they become available in future years for testing.

Figure 1 illustrates the main functions of the VDTV. In addition to those shown, the system includes an off-board data processing capability,