Rear-End Collision Warning System Field Operational Test - Status Report

Presented by:

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Presentation Outline

- **Field Operational Test Overview**
- **Collision Warning System Overview**
- **Program Information**

Program Team

- **General Motors**
  - Delphi Delco Electronics Systems
  - Delphi Chassis Systems
  - Hughes Research Laboratories (HRL)
  - University of Michigan Transportation Research Institute (UMTRI)
- **National Highway Traffic Safety Administration (NHTSA) - Office of Vehicle Safety Research**
- **Volpe National Transportation Systems Center**

Program Goals

- Deploy and test a state-of-the-art rear-end collision warning system
- Measure system performance
- Estimate real-world safety benefits
- Obtain information about user acceptance

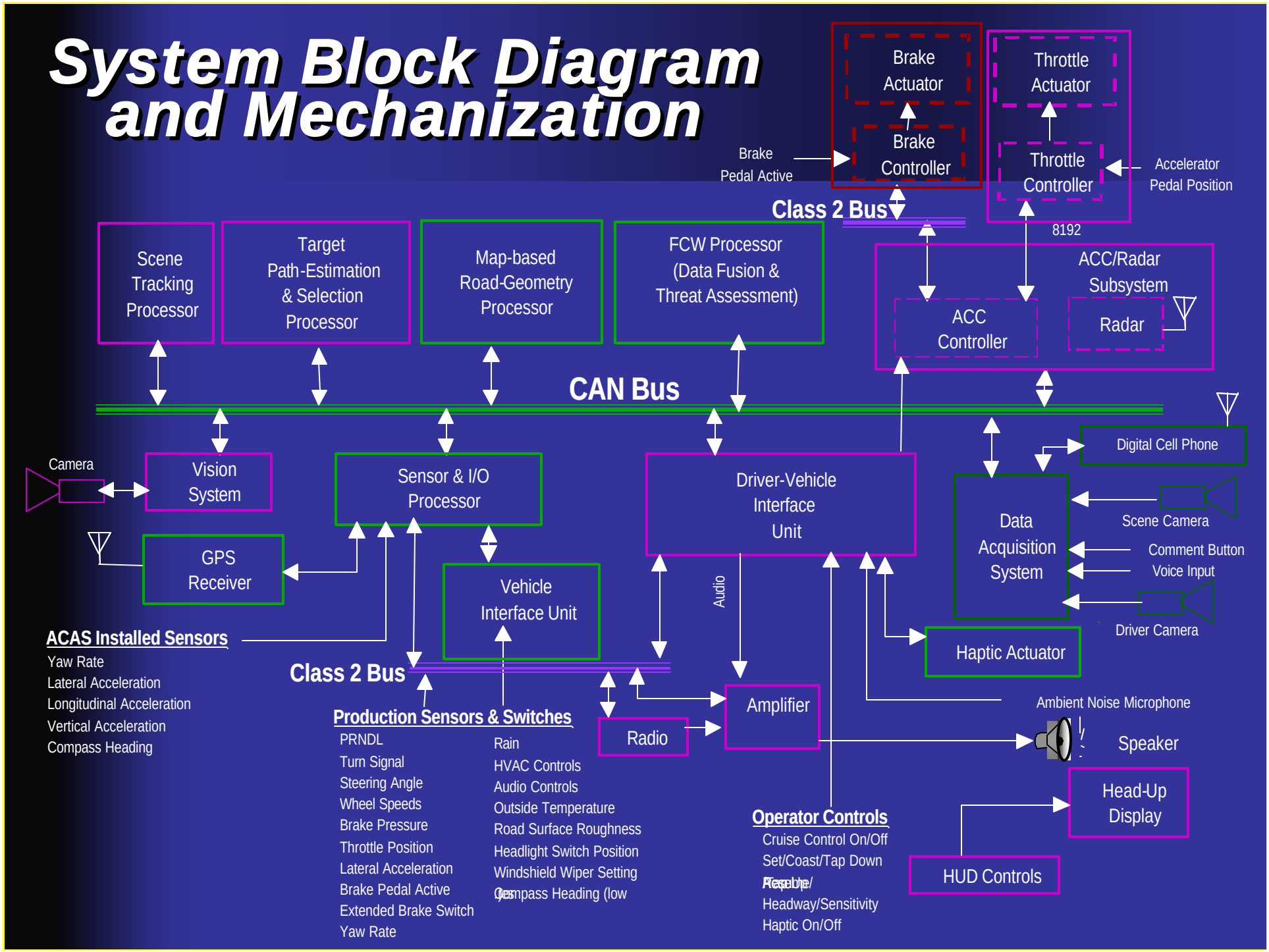
Program Schedule

June '99 | Mar '01 | Dec '01 | Feb '02 | Jan '03 | May '04

Phase I | Phase II

Engineering Development Vehicles → Prototype Vehicle → Pilot Vehicles → Deploy Vehicles → FOT

System Block Diagram and Mechanization



Forward Vision System

- **Estimate road shape, lane width, vehicle heading, and vehicle lateral position within the lane using a video camera.**
- **Three university teams support Delphi Delco Electronics:**
  - University of Pennsylvania
  - Ohio State University
  - University of Michigan-Dearborn

Map-Based Road Geometry Processor

- **Predict upcoming road geometry:**
  - Differential GPS
  - Digital road maps
  - Dead reckoning
- **Dead reckoning from accelerometers augments DGPS during signal outages to update host vehicle position and speed.**

Scene Tracking Processor

- **Utilize the trajectories of the preceding vehicles and roadside objects as measured by the radar to:**
  - Estimate the upcoming road curvature
  - Distinguish between in-lane and adjacent lane vehicles
  - Determine the heading of the host vehicle in its lane

Forward-Looking Radar

- **Millimeter-wave Monolithic Integrated Circuit (MMIC) Design**
  - Used for both Adaptive Cruise Control and Forward Crash Warning
- **Determines kinematic variables of visible targets**
  - Range (measured), Range-rate (measured), Deceleration (computed)
- **Key Technical Challenges:**
  - In-Lane Threats on Curved, Multi-Lane Roadways
  - False Alarms from Overhead Signs/Bridges

Path Estimation and Target Selection

- **Uses the Data Fusion outputs for host path**
- **Predicts path trajectories for host and targets**
- **Selects the in-path vehicle of interest, either stationary or moving:**
  - Accounts for in-lane weaving and drift.
  - Accounts for lane change maneuvers.

Data Fusion and Threat Assessment

- **Fusion of data to estimate host lane geometry, host kinematics, driver distraction, and environment:**
  - On-board yaw rate estimator
  - Forward vision system
  - Map-based road geometry processor
  - Scene tracking processor
  - Driver distraction estimator
  - Environmental sensors
- **Crash threat assessment**
  - Driver warning algorithm to energize displays

Driver-Vehicle Interface

- **Interface Hardware:**
  - Visual Full-Color Head-Up Display
  - Tonal Alert Delivered over Vehicle Sound System
- **Candidate Visual Display Formats:**
  - Single-Stage Imminent Crash Alert
  - Graded Multi-Stage Warning
  - Continuous Display of Safe Following Information

FOT Data Acquisition System

- **Support Field Operational Test Objectives**
  - Crash avoidance estimations
  - User acceptance determinations
- **Present State of Development Includes:**
  - System Conceptual Design
  - List of Recorded Variables
  - Strategies to Recognize and Capture Critical Events
  - Data Storage and Retrieval Architecture
  - Test and Evaluation of a Rapid Prototype

Program Status

- First Annual Report published Dec 2000
- Prototype vehicle system integration to be completed by end of August
- Verification testing will be conducted this Fall (September-November)
- Interim Report due in January 2002
- Phase II to begin in January 2002

Program Contacts and Information

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