Connected Commercial Vehicles—Integrated Truck Project

Summary Report on Demonstration and Program Outreach at the 18th World Congress on Intelligent Transportation Systems

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This work was conducted by the University of Michigan Transportation Research Institute (UMTRI) and Battelle as part of the Connected Commercial Vehicles—Integrated Truck Project. The Connected Commercial Vehicles Team is led and managed by Battelle. The team includes UMTRI, Mercedes-Benz Research and Development North America, Inc. (MBRDNA), DENSO International America, Inc.—North America Research and Development, California Office, Daimler Trucks North America (DTNA), and Meritor WABCO.

16. Abstract

Connected vehicle wireless data communications can enable safety applications that may reduce injuries and fatalities suffered on our roads and highways, as well as enabling reductions in traffic congestion and impacts on the environment. As a critical part of achieving these goals, the USDOT contracted with a Team led by Battelle to integrate and validate connected vehicle on-board equipment (OBE) and safety applications on selected Class 8 commercial vehicles and to support those vehicles in research and testing activities that provide information and data needed to assess their safety benefits and support regulatory decision processes.

An early activity in this project was the 18th World Congress on Intelligent Transportation Systems in Orlando, Florida. A booth on Connected Commercial Vehicles at the demonstration site had posters and handouts to provide valuable outreach to the ITS community. The Daimler Safety Truck had an early implementation of one of the safety applications and was part of the demonstration of V2V technology. The tractor semitrailer combination was highly visible to visitors, and the demonstrations were useful to show that commercial vehicles are part of the connected vehicles program at USDOT.

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Chapter 1 Introduction

An important deliverable in this project is a summary report of the demonstration and program outreach of the Connected Commercial Vehicle (CCV) Safety Applications Development project at the ITS World Congress held October 16-20, 2011, in Orlando, Florida. The World Congress on Intelligent Transport Systems is a major international technology event for transportation professionals interested in safety, policy, convenience, and transport efficiency. This report provides a summary of the event with details on the project's promotional materials. The report also describes how the Daimler Safety Truck was equipped with vehicle-to-vehicle (V2V) Onboard Equipment (OBE) to participate in the Crash Avoidance Metrics Partnership (CAMP) demonstrations at World Congress. Due to scheduling constraints related to contract award, equipment acquisition (both platform and OBE units), and application development, this effort focused on a stationary truck demonstration in conjunction with the dynamic CAMP demonstrations with accompanying material to explain the goals and objective of the program to World Congress visitors.

Chapter 2 Program Outreach Effort and Material

As part of the program outreach, the team prepared three (3) 2x3-foot poster boards that were prominently displayed in the USDOT Safety Pilot Tent. The location of the display is shown in the lower right corner of Figure 2-1, which is the floor plan of the Safety Pilot Exhibit. Figure 2-2 shows the CCV team posters at World Congress, with the tri-fold poster display set up as a triangle on the corner kiosk. An image of the posters themselves is shown in Figure 2-3. The team also produced a two-sided color handout for the event (Figure 2-4). Hundreds of handouts were distributed to attendees at the Safety Pilot exhibit. The CCV project personnel from UMTRI, Battelle, MBRDNA, and DENSO were onsite to answer questions during the vast majority of the World Congress display. Although many attendees interviewed during the event were not directly involved in heavy-truck safety research, they overwhelmingly responded that it is important that commercial vehicles be included in USDOT research of V2V technology.

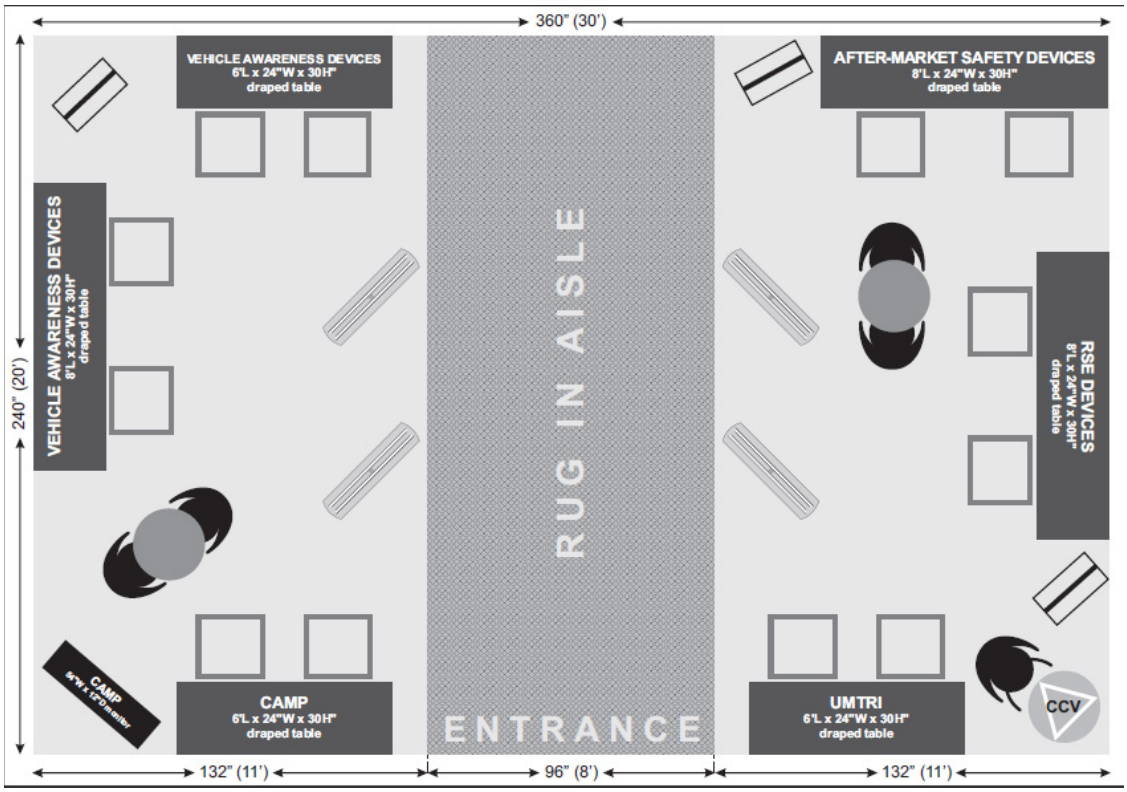

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Figure 2-1. Safety Pilot Exhibit layout for CCV Program Outreach at ITS World Congress.

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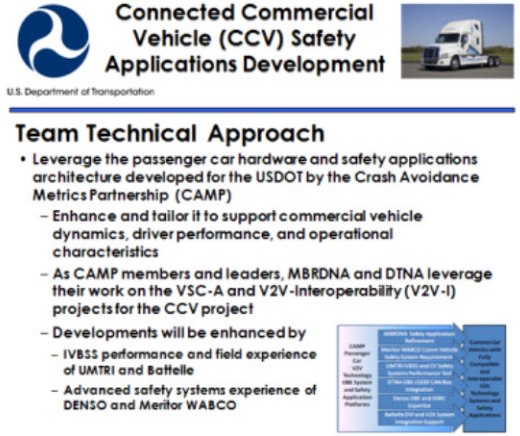
Figure 2-2. Safety Pilot Booth with the CCV Program Outreach Posters and program flyer.



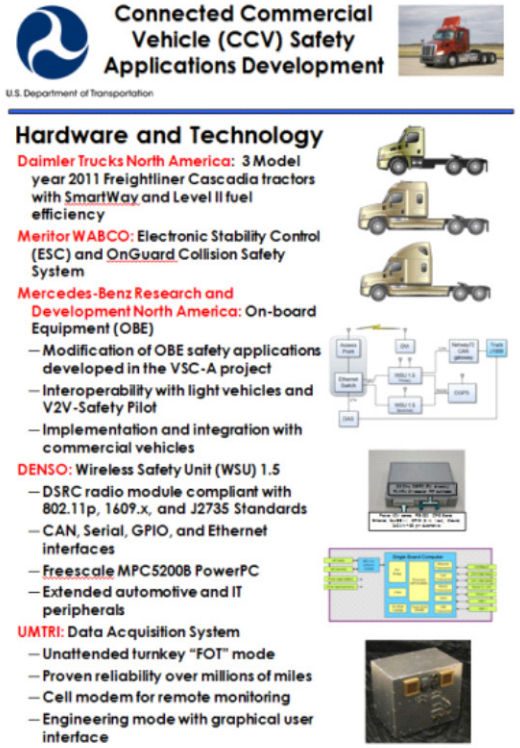


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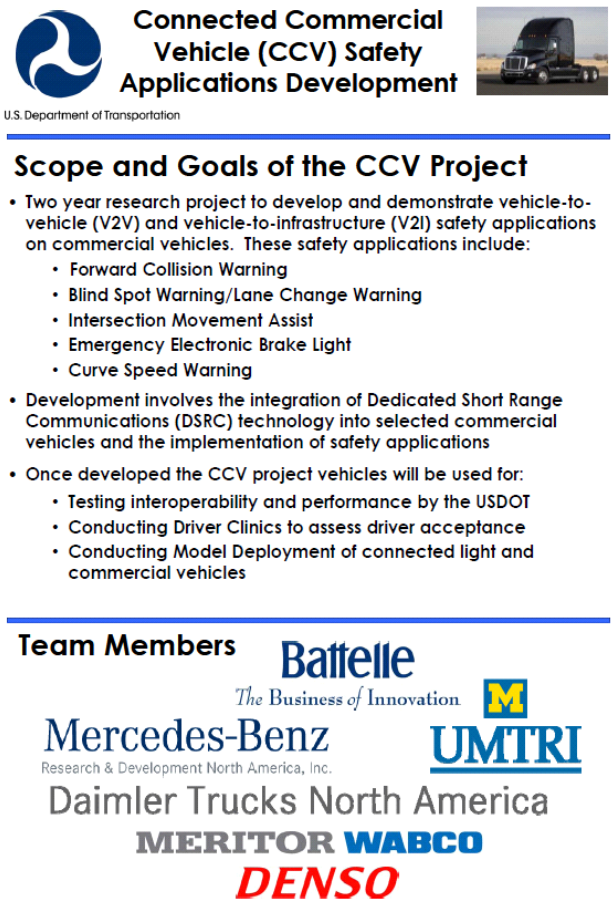
Figure 2-3. Poster Boards for CCV Program Outreach at ITS World Congress.



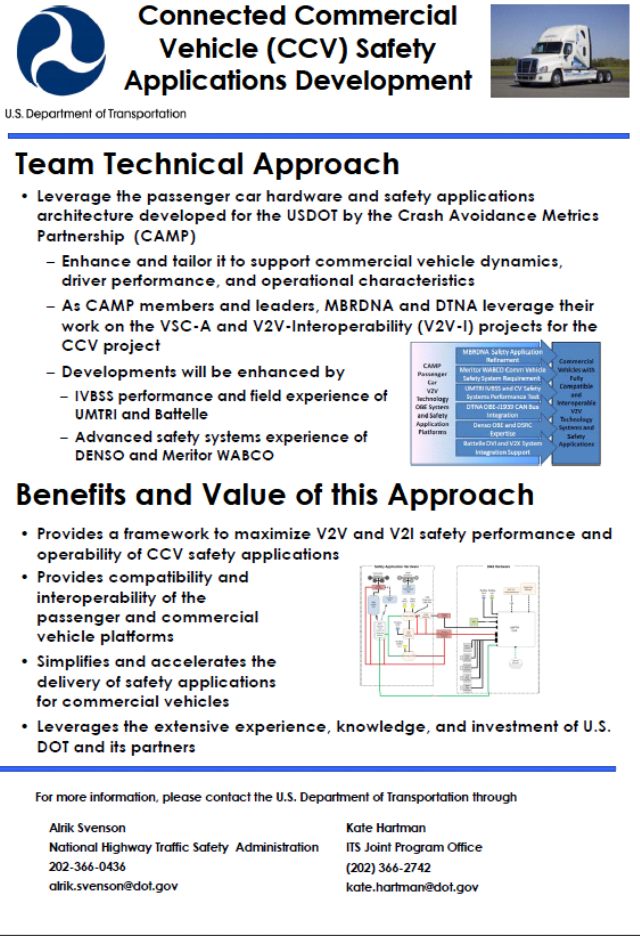


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Figure 2-4. Handout for CCV Program Outreach at ITS World Congress.

Chapter 3 Vehicle-to-vehicle Demonstrations at World Congress

The CCV stationary truck demonstration took place at the Walt Disney World Speedway (WDWS), which is about a 20-minute drive from the Orange County Convention Center (OCCC), the location of the ITS World Congress. An aerial view of the speedway is shown in Figure 3-1. In the week following ITS World Congress, the CAMP – VSC 3 Consortium (the light-vehicle counterpart of this team) conducted a driver acceptance clinic (DAC) at this location. The light-vehicle consortium and USDOT chose WDWS for the following reasons:

- Met the physical requirement necessary to stage driving demonstrations
- Offered proximity to ITS World Congress and the OCCC
- Allowed high exposure to media and stakeholders
- Was an ideal location to publicize the USDOT/OEM efforts in the area of safety application development as it relates to driver acceptance for both light- and commercial-vehicle platforms.

Imagery © 2011 Digital Globe, Lake County, The Florida Department of Environmental Protection, U.S. Geological Survey. Map data © 2011 Google.

Figure 3-1. Walt Disney World Speedway.

As part of the planning for the light-vehicle DAC, the oval and pit area of the speedway were subdivided into eight demonstration areas, which were adjacent to a staging area for ITS World Congress patrons and other transportation and policy professionals. The CCV demonstration tractor-trailer was stationary near the staging area and at the west end of Lane 1 of the DAC layout. The orientation of this tractor-trailer was such that during the evaluation of the light vehicle Forward Collision Warning (FCW) safety application, the Mercedes-Benz DAC light vehicles, heading west, approached the CCV tractor-trailer combination and received a basic safety message from the stationary truck. The FCW application issued an alert to the light

vehicle drivers after the light vehicle had exceeded the warning distance threshold for the given speed. Figure 3-2 shows the DAC layout, the eight designated lanes, the participant staging area, and the location of the CCV tractor-trailer combination. The tractor-trailer was very visible to visitors, and the demonstrations were useful to show that commercial vehicles are part of the connected vehicles program at USDOT.

The tractor-trailer used in the demonstration was provided by Daimler Truck North America (DTNA) and is a Cascadia high-roof sleeper similar to the high-roof sleeper platform currently on order from DTNA for the CCV project. A picture of the DTNA vehicle (called the Daimler Safety Truck) is shown in Figure 3-3.

To conduct the demonstration and elicit an FCW upon approach to the rear of the stationary truck-trailer combination, a set of customized equipment was assembled and temporarily installed in the cab of the Safety Truck. This equipment was assembled and programmed by MBRDNA and consisted of the following V2V components:

- Ruggedized case for mounting and securing the electronics
- 5.9 GHz DSRC Wireless Safety Unit (DENSO WSU 1.5)
- GPS receiver and antenna
- Power supply and power controller circuit
- DSRC antenna and mounting bracket for the side of the vehicle.

The mobile instrumentation package is shown in UMTRI

Figure 3-4. For the demonstration, the case was located on the driver's seat of the tractor and the DSRC antenna was mounted on the side of the tractor above the driver's side door. The antenna and mounting location are shown in
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Figure 3-5.

To broadcast the appropriate safety message for the demonstration, the MBRDNA safety application software was customized by populating the appropriate messages to reflect the state of the tractor-trailer combination including changes to reflect the length of the vehicle and relative location of the antenna. Additional consideration and changes were necessary to the path history elements of the broadcast message by not allowing any recently collected GPS data points to over-write the path that was established only once at the beginning of the day.

Coverage from the DSRC antenna in the area behind the trailer (the approach region of the remote vehicle) was found to be quite good during the preliminary testing of the equipment with the remote demonstration vehicles and throughout the demonstrations.

The FCW demonstrations nominally occurred with a closing speed of 40 mph. However, when time allowed, demonstrations were also performed at 30 and 50 mph closing speeds. In all cases, the host vehicle received basic safety messages from the V2V equipment in the CCV truck and provided FCW at a distance that allowed the host vehicle driver to come to a controlled stop in the space between the remote vehicle and the rear of the trailer. A picture of the CCV truck and an approaching remote vehicle is shown in UMTRI

Figure 3-6.

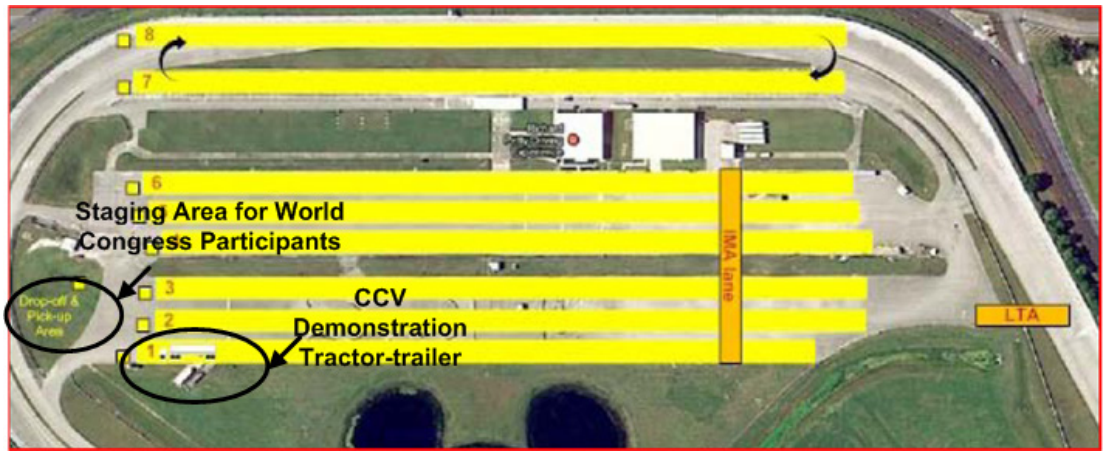

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Figure 3-2. Facility layout for CAMP and CCV demonstration at Walt Disney World Speedway.

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Figure 3-3. Daimler Safety Truck.

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Figure 3-4. DSRC Equipment for the Demonstration of Safety Applications.

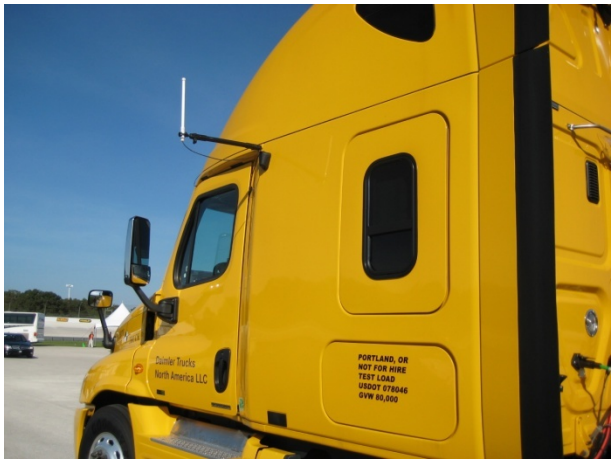

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Figure 3-5. Daimler Safety Truck with DSRC Antenna (shown above the door).

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Figure 3-6. Daimler Safety Truck during a Forward Crash Warning Demonstration.

Chapter 4 Closure

The World Congress on Intelligent Transport Systems is a major international technology event for transportation professionals interested in safety, policy, convenience, and transport efficiency. At this event the Connected Commercial Vehicle project team presented and discussed the project with visitors to the Safety Pilot exhibit booth and distributed hundreds of handouts on the project. The CCV project personnel from UMTRI, Battelle, MBRDNA, and DENSO were onsite to answer questions during the vast majority of the World Congress display. The team also included a stationary tractor-trailer, the Daimler Safety Truck equipped with portable V2V technology, in light vehicle crash avoidance demonstrations led by CAMP. Attendees interviewed during the event overwhelmingly responded that it is important that commercial vehicles be included in USDOT research of V2V technology and were pleased to know that commercial vehicles are an integral part of the program.

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