



## Commercial Vehicle Infrastructure Integration for Wireless Roadside Inspections

### Introduction

The Commercial Vehicle Infrastructure Integration (CVII) demonstration of inspection technologies for [Commercial Motor Vehicles \(CMV\)](#) was developed from discussions within The Federal Motor Carrier Association (FMCSA) and US Department of Transportation (US DOT). The US DOT's safety mission is to deliver a targeted research and technology program with the primary objective to reduce crashes, injuries and fatalities involving large trucks and motor coaches. The FMCSA VII research and test program supports the US DOT safety mission and evaluates the potential benefits of current and prototype inspection technologies for the motor carrier industry and government. The FMCSA's 5-Year Strategic Plan (2005-2009) promotes roadside technology to improve safety in commercial motor vehicle transportation.

[TechnoCom](#) Corporation is the leading supplier of [5.9 GHz Dedicated Short Range Communications \(DSRC\)](#) technology and a leading provider of WiFi and VII 5.9 GHz DSRC platforms, software solutions, and professional services for the transportation and automotive industries, systems integrators and federal, state and local government agencies. TechnoCom's 5.9 GHz DSRC and WiFi /4.9 GHz Multiband Configurable Networking Unit (MCNU), R1500S, provides a secure wireless interface used to support cooperative safety and other VII applications based on FCC Report & Order guidelines Feb. 2004 (75 MHz of spectrum)<sup>1</sup>, IEEE 802.11 and IEEE 1609 Standards<sup>2</sup> in the US, and TechnoCom's internally developed best practices.

Collaboration between TechnoCom, The FMCSA, Oakridge National Lab, the University of Tennessee and the state of Tennessee produced the first CVII [Wireless Roadside Inspection \(WRI\)](#) Technology Showcase highlighting 5.9 GHz DSRC prototype technologies

TechnoCom was selected as a CVII WRI partner because of its MCNU platform, systems engineering expertise and software development services. These WRI demonstrations are the basis for developing VII 5.9 GHz DSRC "proof-of-concept" applications using standard inspection technology.

### Problem Statement

Currently, a roadside inspection occurs when a Motor Carrier Safety Assistance Program (MCSAP) inspector conducts a manual examination on individual commercial motor vehicles and drivers to determine if they are in compliance with the FMCSA regulations and or Hazardous Material Regulations. Serious violations result in the issuance of driver or vehicle out-of-service orders. This means that each violation must be corrected before the affected driver and/or vehicle is allowed to return to service. Moving violations also may be recorded in conjunction with a roadside inspection.

According to the FMCSA, Vehicle Infrastructure Integration (VII) technology, if deployed at all 1,400 inspections and weigh stations in the United States and installed on all CMVs, could increase the number of commercial vehicle safety inspections – three million in 2006 to a level on par with commercial vehicle weights inspections, about 177 million in 2006.

The US DOT FMCSA sponsored VII 5.9 GHz DSRC program has the potential to collect significant amounts of on-road performance data for drivers, vehicles and motor carriers in real time. The primary objective is to leverage, expand and supplement ongoing research, development and testing of 5.9 GHz DSRC VII program to be compatible with heavy commercial vehicles to improve safety, security, mobility and carrier operational benefits.

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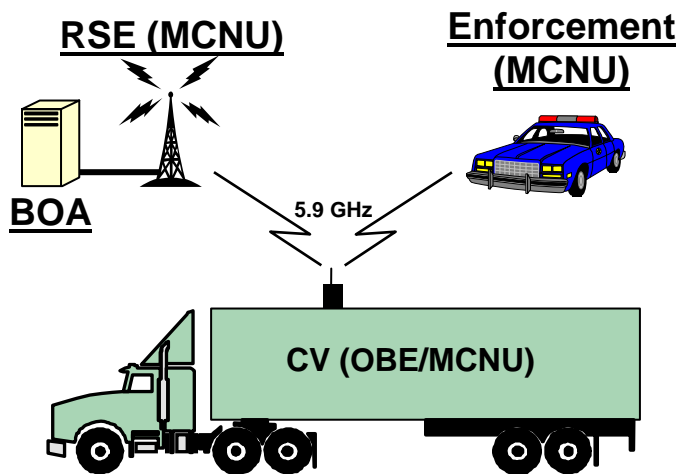
<sup>1</sup> See FCC Report and Order Feb. 2004

<sup>2</sup> See IEEE 802.11 and IEEE 1609

## TechnoCom Technology as Tested

TechnoCom's MCNU platform was used to test the communications of a number of commercial motor vehicle applications including, but not limited to, driver identification and validation, Vehicle Identification Number (VIN), US DOT number, vehicle position, brake status, light status, tire pressure, or any other desirable safety based information such as CMV traffic speeds and travel times, incident detection and location verification, queue length and proximity to weigh stations, global origin and destination data, etc.

The WRI application utilized a network configuration that consisted of On Board Equipment (OBE), Roadside Equipment (RSE) and a "back office application" (BOA) server. The OBE within the Commercial Vehicle (CV) consisted of a MCNU connected to in-vehicle computing systems that collected and stored the inspection data. The OBE periodically retrieved the inspection log and transferred it using 5.9 GHz DSRC to the MCNU configured as the RSE. The RSE subsequently transferred the data to the back office application server for processing and display. In addition the system supported querying the CV by an enforcement vehicle that also contained an OBE (MCNU connected to a laptop or PDA). The WRI demonstration system is illustrated below.



The uploading of the inspection data was triggered by defining geo zones based on GPS. The geo zone information was transmitted by the RSE to the OBE to indicate where data upload should be triggered. Once a CV entered the geo zone associated with the RSE it transferred the data to from the OBE to the RSE and subsequently the BOA. The enforcement vehicle was able to query a CV within a defined range, also based on current GPS locations.

## Lessons Learned

Overall the demonstration was a success. A few minor obstacles were overcome that ranged from long antenna cables and guaranteeing reliable radio communications. Both problems were solved in time for the demo, with lower loss or shorter antenna cable runs being used as well as the geo zone triggering as described above.

## Future Efforts

Future enhancements of the WRI application and corresponding FMCSA efforts should include the addition of security features to guarantee data integrity as well as integration with the National VII network to provide a nationwide picture of CV traffic and compliance data for the purpose of maintaining roadways and enhancing the throughput of those roadways. These features as well as expanding the application into a larger field trial should be the next steps in deploying VII for commercial vehicle operations.

## Executive Summary

For the last 9 years TechnoCom has been working with integrators and operators of road infrastructure as well as the auto industries and other public and private stakeholders to provide reliable wireless technology for VII. The Mobility Solutions business unit is a pioneer in the development of Vehicle Infrastructure Integration and 5.9 GHz Dedicated Short Range

Communications networking and management protocols. TechnoCom's Mobility Solutions business unit developed the Multiband Configurable Networking Unit (MCNU™) and the Wireless Access in a Vehicular Environment (WAVE) software suite to demonstrate vehicle-to-vehicle and vehicle-to-roadside infrastructure communications.

These solutions enable commercial vehicle and safety applications and make it possible to collect and distribute traffic and road condition information within the transportation network. Additionally, these solutions support standardization of secure, anonymous communications for VII users.

The MCNU is an Institute of Electrical and Electronic Engineers (IEEE) 802.11a/b/g/p and 1609 compliant wireless router and application host platform that supports 4.9 GHz public safety, 2.4 GHz and 5 GHz municipal WiFi and 5.9 GHz Dedicated Short Range Communications (DSRC)/ Wireless Access in a Vehicular Environment (WAVE) networks and applications.

Since 2006, TechnoCom's software and solutions for transportation have been tested to validate the concept of VII operations and VII deployment – revealing that it is possible using our nation's existing roadway infrastructure to deploy systems that will enhance safety, mobility and productivity, and satisfy the majority of the technical deployment questions.

TechnoCom VII demonstrations include several ITS and automotive trade show events:

- AASHTO's Interstate 50<sup>th</sup> Anniversary Tour, 2006
- SAE (Society of Automotive Engineers) Convergence 2007
- Consumer Electronics Show (CES) 2007 in Las Vegas
- ITS America's Annual Meeting 2007 in Palm Springs
- Demonstrations to more than 23 DOT agencies in 18 states.

TechnoCom's MCNU was used for the FMCSA-sponsored Wireless Roadside Inspection (WRI) demo in August 2007. The MCNU platform was also selected for the RSE for the Detroit 2007 VII proof of concept (POC), and it will be used within the demonstration system at the ITS World Congress in New York in 2008.