Commercial Vehicle Infrastructure Integration (CVII) Program

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Connected Vehicle/CVII

Background

- Dedicated Short Range Communication
- 5.9 GHz (FCC)
- Extremely high speed, high capacity, low latency, highly secure data transmission
- “Smart vehicles, smart highways”
- “Internet” model for the highway/transportation system
- Vehicle crash avoidance capabilities
- NHSTA Rulemaking 2013
Communication Technologies

Active Safety Latency Requirements (secs)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Signal Violation Warning</td>
<td>0.1</td>
</tr>
<tr>
<td>Curve Speed Warning</td>
<td>1.0</td>
</tr>
<tr>
<td>Emergency Electronic Brake Lights</td>
<td>0.1</td>
</tr>
<tr>
<td>Pre-Crash Sensing</td>
<td>0.02</td>
</tr>
<tr>
<td>Cooperative Forward Collision Warning</td>
<td>0.1</td>
</tr>
<tr>
<td>Left Turn Assistant</td>
<td>0.1</td>
</tr>
<tr>
<td>Lane Change Warning</td>
<td>0.1</td>
</tr>
<tr>
<td>Stop Sign Movement Assistance</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Least stringent latency requirement for Active Safety (1 sec)

Most Stringent latency requirement for Active Safety (.02 sec)

Communications Technologies

5.9 GHz DSRC (0.0002 secs)

Latency (in seconds)

- Two-Way Satellite (60+ secs)
- Terrestrial Digital Radio & Satellite Digital Audio Radio (10 - 20 secs)
- WiFi 802.11 (3 - 5 secs)
- Cellular (1.5 - 3.5 secs)
- WiMax (1.5 - 3.5 secs)
- Bluetooth (3 - 4 secs)

IntelliDrive™
Concept of VII W/CVII!

Vehicle to Vehicle (V2V)

Carriers, Fleet managers, OEMs, Private Companies, Service & Telematics Providers, etc.

OBE – On Board Equipment
RSE – Road Side Equipment

Network Management Center

OBE – On Board Equipment
RSE – Road Side Equipment

OBE – On Board Equipment

DSRC @ 5.9 GHZ
CVII Program

Background

- Funded by I-95 Corridor Coalition
- Integrate heavy vehicles w/past 5.9 GHz DSRC research & development for passenger vehicles
- Started program May, 2009
- 3 Year Schedule (Phase I & II)
- $1.45 Million (1-95 CC)
- Additional $500K possibly available for Phase III
CVII Program

Requirements

- Complete system interoperability!
- Compliant with existing and emerging standards
- Communicate with *any* 5.9 GHz DSRC compliant vehicle or infrastructure
- Non-proprietary core system design capable of duplication/scalable!
- Integrate VII communications device w/ SAE J1708 commercial vehicle databus using SAE J2735 & J1939
CVII Project Team

CVII team led by Volvo Technology of America
CVII Program
Advisory Team

- I-95 Corridor Coalition
- FHWA
- ITS JPO/RITA
- FMCSA
- NYS Thruway Authority
- NYS Bridge Authority
- Washington State DOT
- Commercial Vehicle Safety Alliance
- AASHTO
- NYS Energy Research and Development Authority

- NYS Motor Truck Association
- American Transportation Research Institute
- VII Consortium (Auto OEM)
- Michigan DOT
- Intelligent Transportation Systems of America
- U. of North Carolina Highway Systems Research Center
- American Trucking Association
CVII Program

Commercial Vehicle Data Bus
CVII Program Status

- Develop/Install/Test CV VII compliant 5.9 GHz DSRC OBE system including driver interface w/in-vehicle signage & traveler info. - Complete

- Develop/Test CVII DSRC applications:
  - CV driver I.D and verification - Complete
  - Wireless vehicle safety inspection (brake condition, tire pressure, light status, etc.) - Complete
  - CV to maintenance vehicles communication - Complete
CVII Program

Volvo Truck Interior with Card Reader
Vehicle to Infrastructure (V2I)

Task #3 - Wireless Driver Identification & Verification

- Driver inputs ID information; sent to roadside device
- Roadside sends message to driver indicating CDL is valid, inactive, revoked, or suspended
- Driver unable to start vehicle if driver’s CDL is inactive, revoked, or suspended
- Driver ID integrated with existing e-screening information (weight, credentials, etc.) for expanded 5.9 GHz DSRC screening
- Coordinated with FMCSA’s WRI program
Task #4 – Vehicle Safety Data from Databus

- Vehicle Safety Data – from databus via 5.9 GHz DSRC
- Includes brake, lights and tire data
- Data integrated with existing e-screening information (weight, credentials, etc.) for expanded 5.9 GHz DSRC screening
- Coordinated with FMCSA’s WRI program
CVII Program

Wireless Roadside Inspection Operation

- Enhances existing screening information (weight, credentials, etc.) with driver and vehicle level data
- WRI requested by roadside device (RSE)
- Vehicle sends data to RSE
- Validated against network information (NYS CVIEW/SAFER)
- Results sent to driver & enforcement
- Driver follows in-cab instructions based on screening results (pull in/by pass)
- Inspections results sent to carrier, state and federal backhaul systems as appropriate
Detailed OBE/MMC Information
(click on events or truck icons for info)

FAIL!!

Identification Information
Carrier Name: Volvo Truck - North America, Inc.
USDOT#: 335611
Address: 7500 National Service Road
City, State, Zip: Greensboro, NC 27408-9416
Phone Number: 336-393-2000

Screening ID: X123
Location: New York, I-95, Exit 51
VIN: 1VIN2929V112345
License Plate: NC/LX9999
Veh Make/Model/Color: VOLVO/VHD/BLUE

Screening Result: Fail

Vehicle Status
Out-of-Service Order: Pass
IRP: Pass
OS/OW Permit: Pass
Off-Route: Pass
Brake Stroke: Pass

Carrier Status
Out-of-Service Order: Fail
IFTA: Fail
ISS-2: Pass
PRIMS: Pass
URC: Pass
Vehicle Maintenance: Pass
Improper Loading: Pass
Crash Indicator: Pass

Driver Status
CDL Status: Pass
Seat Belt User: Pass
Driver Safety Screening: Fail

(Goto red hyperlinks for more detailed information)
Task #5 – Maintenance Vehicle to Commercial Vehicle Communications (V2V)

- A moving maintenance vehicle (snow plow) broadcasts a heartbeat-like message with its vehicle type, position and heading.
- Vehicles following the snow plow receive and display a warning to the driver about the snow plow operations ahead.
- Broadcasts work zone operations to approaching vehicles.
- 4 retrofitted maintenance plowtrucks.
CVII Program
Vehicle to Vehicle (V2V) Communication

Prototype Design
CVII Program
Additional Scope Items

- Phase 2 – Underway
- Complete December, 2011
- Heavy Vehicle to Light Vehicle Driver Safety Warnings
- Grade Crossing Driver Warnings
CVII Program

Light Vehicle to Heavy Vehicle
Phase 2 - V2V Active Safety Driver Warnings

- Passenger vehicles/CV exchange heartbeat messages
- Warning scenarios:
  - Potential Blind Spot Warnings
  - Hard Braking Events (multiple vehicles ahead)
  - Tailgate Warning
  - Unsafe to Pass/Unsafe to Merge
CVII Program
Phase III

- Phase III – Funding Obtained/Start 2012
- Potential Scope Items
  - Integrate EOBR hours of service w/wireless roadside inspection message set
  - Add buses to Phase I & II applications
  - Routing information & restriction warnings w/vehicle disabling
  - Wrong way driver warnings w/vehicle disabling
  - Add more fleet management/Clarus/AERIS data to V2I
RSEs can be installed at vehicle depots, parking facilities, etc. for fleet management
NYSDOT INFORM I-495
CVII Test Bed
NYS Thruway RSE Sites
Affiliated Interoperable Test Beds

Multiple Locations.. One Connected System

“In the street – running”
NYSERDA/Kapsch Aftermarket Device Development Project

- NYS Energy Research & Development Authority funded
- Kapsch to develop/commercialize aftermarket OBE
- Relatively low cost, simple to install
- Use CVII V2I & I2V applications
- NYSDOT receives 20 devices January, 2012
- $2.3 million project
NYSERDA/Kapsch Aftermarket Device Development Project

- Deploy in vehicles that use CVII corridors:
  - NYSDOT/NYSTA vehicles
  - Trucking company
  - Buses (School, Transit, For Hire)
- NYSDOT provides device and installation
- NYSDOT partnership with operators to evaluate technology
- Operators provide unique opportunity to develop useful applications for both partners
Task # X.
Develop Aftermarket 5.9 GHz DSRC In-Vehicle Systems with Vehicle Databus Integration Using Smart Phones for Driver Communication (Human Machine Interface)
Looking Ahead: Interconnected Communication Layers

Interconnected communication layers will enable the private sector & public interests to co-exist and flourish.
Connected Commercial Vehicles

VISIT THE SAFETY VILLAGE FOR A DEMO!

Commercial Vehicle Infrastructure Integration

Smart Commercial Vehicles  ITS Technologies  Smart Infrastructure

Wireless Communications

Enhancing Safety, Mobility and Operations

Very high speed transactions among vehicles, and between vehicles and infrastructure components

I2V and V2I

- Driver credential verification with vehicle enabling/disabling for security purposes
- Enhanced mainline screening for wireless safety inspections including driver credential information and vehicle safety systems status (brakes, lights, tires)
- Backoffice integration with existing NYS Screening network

Infrastructure-to-Vehicle (I2V)

- In vehicle signage
- Traveler information including traveler advisories
- Backoffice integration with NYS Traffic Management Operations and NYS 511

Vehicle-to-Infrastructure (V2I)

- Vehicle probe data including location, heading, speed and time

Vehicle-to-Vehicle (V2V)

- Maintenance vehicles broadcasting location and plowing/work zone operations to other vehicles

Sponsors:

- Volvo
- Kapsch
- SRTI
To learn more about National Connected Vehicle Program, visit:

http://www.its.dot.gov/connected_vehicle/technology_testbed2.htm
Thank You!

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