Smart Roadside Initiative (SRI)

Smart Roadside Initiative
USDOT ITS Connected Vehicle Workshop

Kate Hartman
September 26, 2012
Agenda

• SRI Background and Governing Efforts
• SRI Vision and Goals
• Project Team
• Technical Approach
• SRI Concept
• Task Detail: Task 5.1-5.2
• High-Level Project Schedule
• Completed, Current and Upcoming Activities
SRI Background

• What is Smart Roadside?
  – A joint modal initiative between Federal Highway Administration (FHWA) and Federal Motor Carrier Administration (FMCSA).
  – Focus: the development of roadside infrastructure for commercial vehicle operations that employs technologies for information sharing.
  – USDOT vision: demonstrate, evaluate, and deploy interoperable technology and improved data sharing to improve safety, security, operational efficiency, and mobility on the Nation's freight transportation system.

• Related Research:
  – Wireless Roadside Inspection Program
  – Universal Identification for CMVs
  – Electronic Screening/Virtual Weigh Stations
  – Truck Parking Program
SRI – USDOT Governing Efforts

- USDOT ITS Strategic Research Plan, 2010-2014; defines the strategic direction for the USDOT's ITS research program for the next five years.
  - Emphasis: connected vehicle technologies and applications that uses wireless communications to provide connectivity with and between vehicles; between vehicles and roadway infrastructure; and among vehicles, infrastructure and wireless consumer devices.
  - Areas: safety, mobility, environment
  - SRI represents research to improve safety and mobility of commercial vehicle operations.

- V2I:
  - Investigate key questions such as are vehicle based safety applications using V2I communications effective and do they have benefits
  - SRI represents mode-specific research in this area with regards to commercial vehicles.
SRI Vision and Goals

• Vision:
  – Commercial vehicles, motor carriers, enforcement resources, highway facilities, intermodal facilities, toll facilities, and other nodes on the transportation system collect data for their own purposes and share the data seamlessly with the relevant parties, in order to improve motor carrier safety, security, operational efficiency, and freight mobility.

• Goals:
  – Build, install and test prototype of Smart Roadside Application(s)
  – Enable data exchange between vehicle and roadside infrastructures which connect to authoritative databases for information and relevant data.

KEYS TO SUCCESS:

- Interoperable technologies
- Information sharing between vehicle-roadside-freight facility systems
- Leveraging current technology investments and existing partnerships
- Validating prototype needs, requirements and design with key stakeholders
Project Team

• **USDOT: ITS JPO, FHWA, FMCSA:**
  – Project Sponsor

• **SAIC**
  – Prime Contractor
  – Lead: project management, systems engineering, and prototype design, development, build, install and test

• **North Dakota State’s Upper Great Plains Transportation Institute (UGPTI)**
  – Led applications analysis of deployed systems
  – Subject Matter Expertise for design

• **American Transportation Research Institute (ATRI)**
  – Led applications analysis of research projects
  – Technical advisor to project team representing the trucking industry

• **Delcan Corporation**
  – Led the development of the SRI Concept of Operations

• **Commercial Vehicle Safety Alliance (CVSA)**
  – Technical advisor to project team representing the commercial vehicle enforcement community
SRI Framework

SRI System Components:
* Local Data Buffer
* Enterprise Portal
* Customized User Interface

User Interface Applications:
- Carrier User
- Driver User
- Enforcement User
- Agency User
- Other Users

User Community

Smart Roadside Initiative

Business Systems

Other Systems

Roadside Facilities

Commercial Vehicles

WIM, Roadway & Roadside Systems

Truck Parking Systems

Government Systems
SRI Overview

Elements

• **Users**: Industry and government users that would access the various capabilities delivered through the system

• **User Interface Applications**: Mechanisms by which users would request and receive information and forward instructions

• **External System Interfaces**: Linkages with the business and government systems that are needed to gain access to data and disseminate information
## Task 2-3 Results: User Needs

<table>
<thead>
<tr>
<th>ID #</th>
<th>User Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN01</td>
<td>The system needs to be able to identify Commercial Vehicle (CV) power units uniquely</td>
</tr>
<tr>
<td>UN02</td>
<td>The system must support the exchange of data between the CV and the roadside without requiring the vehicle to stop</td>
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<tr>
<td>UN03</td>
<td>The system must provide the ability to pass data collected from CV to external systems</td>
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<tr>
<td>UN04</td>
<td>The system must provide the ability to receive data from external systems</td>
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<tr>
<td>UN05</td>
<td>The system must provide the ability to efficiently and effectively exchange data between external systems and local users at the roadside or in the CV</td>
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<tr>
<td>UN06</td>
<td>The system must provide protection against unauthorized access to and use of data</td>
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<td>UN07</td>
<td>The system must allow a vehicle operator to interact with it in a safe manner during vehicle operation</td>
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<tr>
<td>UN08</td>
<td>The system must be consistent with the ITS National Architecture and associated standards</td>
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<td>UN09</td>
<td>The system must facilitate the integration of data from multiple sources into one or more cohesive, reusable datasets</td>
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<td>UN010</td>
<td>The system must include functionality that meets specific CV operations needs (truck parking and enforcement screening applications)</td>
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<tr>
<td>UN011</td>
<td>The system must provide applications data in sufficient time to support decision making at the roadside</td>
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<tr>
<td>UN012</td>
<td>The system must be able to uniquely and reliably identify which commercial vehicle driver is actually operating a commercial vehicle</td>
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<tr>
<td>UN013</td>
<td>The system must be able to support the identification of trailing equipment pulled by uniquely identifiable CV power units</td>
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<tr>
<td>UN014</td>
<td>The system must operate in a V2X cooperative systems environment</td>
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Task 4 Concept of Operations
May 2012

- Identifies current system and shortcomings
- Future system concept and capabilities:
  - Identifying Entities on the Road
  - Sharing Information—establishing a common framework
  - Enhanced Electronic Screening—attended and unattended
  - Integrating Public- and Private-Sector Data
  - Streamlined/Accelerated Inspections—Wireless Roadside Inspections and traditional inspections
  - Performance-Based Standards and an Architecture
- Scenarios:
  - Compliant CMV ("Green Light")
  - Compliant CMV – Os/Ow permit verification
  - Non-compliant CMV ("Red Light")
  - Non-compliant CMV – illegal bypass
  - Real-time truck parking information system
Task 5 Overview

- Kickoff in May 2012
- Prototype Design, Build and Install:
  - System Requirements
    - Site Selection
  - Architecture
  - Component Level Design
  - Prototype Development and Test
  - Build and Install Prototype
  - Prototype Field Testing
  - Documentation
Task 5.1 System Requirements: Site Selections

- **Process**
  - Survey Distribution (50 states)
  - Inventory of current physical infrastructure, IT tools, communications infrastructure, physical layout and hardware.
  - Evaluation of available infrastructure, availability for participation

- **Candidates**
  - Alberta, Canada
  - Colorado
  - Maine
  - Michigan
    - Connected Vehicle Test Bed
  - Minnesota
  - North Dakota
  - New Jersey
  - Pennsylvania
  - Tennessee
  - Florida
Task 5.1 – System Requirements

• Draft submission to USDOT – 8/10/12
  – USDOT comments: 8/31/12
  – Revision: 9/18/12
  – Walkthrough: tentative early October
  – Final SyRS: 10/29/12 or sooner

• IEEE 1233 compliant
Task 5.1 System Requirements - Details

• Categories:
  – System
  – Interface
  – Application
  – Performance
  – Security

• Additional Content:
  – Physical Requirements:
    • Environmental
    • Construction
    • Durability/Adaptability
  – Data Requirements
  – System Operations Specifications

• Traceability:
  – Unique identifier
  – Source
  – Verification method:
    • Test
    • Analysis
    • Demonstration
    • Inspection
  – Demonstration Location:
    • Michigan and/or Colorado
    • Future Site
Task 5.2 System Architecture

• Draft submission to USDOT – 8/10/12
  – USDOT comments: 8/31/12
  – Revision: 9/18/12
  – Walkthrough: tentative early October
  – Final SAD: 10/29/12 or sooner

• Sources:
  – Architecture Description Document, Version 1.1, 11/26/07 (Software Engineering Institute)
Task 5.2 System Architecture - Details

- Architecture decisions
- Operational and logical views
  - Operational elements
  - Software components
  - Information exchanges
- System views:
  - Components and relationships
- Technical views and technologies
Task 5.2 – Functional Architecture

- CAN (SAE J1939, 7pin, ...)
- Satellite, CMRS, CDPD, SAE J2735, IEEE P1609
- Serial (USB, RS232, RS485, ...), Bluetooth, Wi-Fi
- RGB, VGA, USB, HDMI, Bluetooth, Wi-Fi
- Ethernet, HTML, SOAP, Web-Services
- Wi-Fi, DSRC, Barcode, RFID, CAN, IR, OCR, Audio
- RGB, VGA, USB, HDMI, Bluetooth, Wi-Fi
- Serial, Ethernet, Bluetooth, Wi-Fi
- Serial, Ethernet, Bluetooth, Wi-Fi, DSRC
- Serial, USB, Ethernet, Bluetooth, Wi-Fi
- Serial, Ethernet, Bluetooth, Wi-Fi, I²C
- Ethernet, HTML, SOAP, Web-Services
- SQL, Oracle
- Ethernet, HTML, SOAP, Web-Services, Browser
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<table>
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<tr>
<th>Activity</th>
<th>Completion Date</th>
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<tr>
<td>Project and Systems Engineering Management</td>
<td>Ongoing</td>
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<td>Stakeholder Outreach</td>
<td>Ongoing</td>
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<tr>
<td>Applications Assessment of Deployed Systems</td>
<td>October 2011</td>
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<tr>
<td>Applications Assessment of Research Projects</td>
<td>October 2011</td>
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<tr>
<td>SRI Concept of Operations</td>
<td>May 2012</td>
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<td>SRI System Requirements</td>
<td>October 2012</td>
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<td>SRI System Architecture</td>
<td>October 2012</td>
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<tr>
<td>SRI Component-Level Design</td>
<td>February 2013</td>
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<tr>
<td>SRI Development and Testing</td>
<td>April – June 2013</td>
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<tr>
<td>SRI Build and Install</td>
<td>June 2013</td>
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<tr>
<td>SRI Prototype Testing</td>
<td>August - September 2013</td>
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<tr>
<td>SRI Final Documentation</td>
<td>December 2013</td>
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Completed Activities

- Project Management Plan
- Systems Engineering Master Schedule
- Systems Engineering Management Plan
- Configuration Management Plan
- Task 2-3 Tech Memo 1: Documentation Review
- Task 2-3 Tech Memo 2: User Needs
- Task 2-3 Tech Memo 3: Prioritization of Applications
- Task 4: Draft ConOps
- Task 4: ConOps Walkthroughs
- Stakeholder Engagement:
  - Reviews of user needs, operational policies, operational constraints
Current and Upcoming Activities

• Current Activities
  • Scheduling and preparing SyRS and SAD walkthroughs

• Upcoming Activities:
  • SyRS and SAD walkthroughs
  • SyRS and SAD Final versions
  • Kickoff SRI system design
Points of Contact

SAIC PI:
Ron Schaefer
618-567-0309
schaeferrl@saic.com

Kate Hartman
202-366-2742
kate.hartman@dot.gov

USDOT:
Tom Kearney, FHWA
518-431-8890
tom.kearney@dot.gov

Chris Flanigan
202-385-2384
chris.flanigan@dot.gov