ITS-Connected Vehicle Technology research initiative

February 6, 2015
Connected Vehicles BAA

• DTFH6115R00003  (Due date 03/16/2015 by 15:00 EST)

https://www.fbo.gov/index?s=opportunity&mode=form&id=4bb6693ac3021c178595d83fab3b5d73&tab=core&cview=1

Phase 1 – Concept Development – award up to 12 months

Phase 2 – Design(Build/Test – up to 20 months

Phase 3 – Operate and Maintain – 18 months
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- DTFH6115R00003 – Phase 1 – **Concept Development** Tasks

- Task 1  Program Management
- Task 2  Pilot Deployment Concept of Operations (ConOps)
- Task 3  Security Management Operating Concept
- Task 4  Safety Management Plan
- Task 5  Performance Measurement and Evaluation Support Plan
- Task 6  Pilot Deployment System Requirements
- Task 7  Application Deployment Plan
- Task 8  Human Use Approval
- Task 9  Participant Training and Stakeholder Education Plan
- Task 10  Partnership Coordination and Finalization
- Task 11  Outreach Plan
- Task 12  Comprehensive Pilot Deployment Plan
- Task 13  Deployment Readiness Summary

- Per PMBOK guidance
- Per IEEE Std 1362-1998
- SCMS, PKI, CVRIA, SET-IT
- Eg, ISO26262 ASIL
- Etc, etc, etc
## Connected Vehicles BAA

- DTFH6115R00003 – Phase 1 – **Concept Development** – Proposal Format

### Volume I - Technical

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### Volume II - Business and Price

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#### Deployment Vision

In this sub-section, at a minimum, the Offeror shall:

- Describe the proposed Pilot Deployment site, including geographic boundaries, topography, and transportation system features.
- Describe the general transportation-related issues and mobility, safety and environmental needs of the site.
- Contain an *Annotated Preliminary Pilot Deployment Site Map*. The map shall identify the specific geographic location being proposed for the Pilot Deployment and shall indicate locations related to key safety, mobility and environmental issues, possible roadside technology locations, and other explanatory features. The map shall be no larger than one page (up to 11 inches by 17 inches is acceptable for this item only) when printed.
- Outline performance measures relevant to identified needs.
- Describe the set of applications proposed, and how they relate to needs and performance goals.
- Illustrate how the proposed concept can synergistically combine to create measurable impact while reducing costs associated with both deployment and operations.
- Outline team partners, key stakeholders, and pilot deployment governance processes expected over all three phases. Note any anticipated change in teaming or team leadership throughout the three-phase deployment life cycle.
- Identify and rate key technical and organizational risks associated with the deployment vision.

- Provide a full three-phase schedule with proposed key milestones, and provide an initial cost estimate that covers all three phases individually and collectively.
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• DTFH6115R00003 – Phase 1 – Concept Development – Questions

All questions concerning the Broad Agency Announcement shall be submitted electronically to Sarah Khan via email at Sarah.Khan@dot.gov, no later than February 20, 2015 by 12:00 PM Eastern Time (EST), in order for responses to all reasonable questions to be conveyed in a timely manner.

L.10 PRE PROPOSAL WEBINAR

A Pre Proposal Webinar will be hosted by the FHWA’s Office of Grants and Acquisition Management for interested parties to ask clarifying questions regarding this Broad Agency Announcement. USDOT officials will present and discuss the procurement process and answer relevant questions from interested parties.

Date/Time: February 27, 2015. 1:00 PM- 2:00 PM Eastern
Please register prior to the web conference time.
Web Conference Site Link: https://connectdot.connectsolutions.com/dtfh6115r00003/event/login.html
Connected Vehicles Applications

http://www.its.dot.gov/pilots/cv_pilot_apps.htm
Connected Vehicles Applications

Potential applications of interest to TDOT

- **EnableATIS (Advanced Traveler Information System 2.0)**
  - Enhanced traveler information services that record or infer user decisions and other contextual trip data that, when suitably processed can improve or transform system management functions

- **Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)**
  - An application that provides input to responder vehicle routing, staging and secondary dispatch decisions

- **Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)**
  - An application that warns on-scene workers of vehicles with trajectories or speeds that pose a high risk to their safety. It also warns drivers passing an incident zone if they need to slow down, stop, or change lanes.

Response, Emergency Staging, Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)
Connected Vehicles Applications

Potential applications of interest to TDOT – Additional Information

Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG) and Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)


Also:

Connected Vehicle Reference Implementation Architecture (CVRIA) for RESP-STG:

Connected Vehicle Reference Implementation Architecture (CVRIA) for INC-ZONE:

Advanced Traveler Information System (ATIS) - not as specific info available at (look for the first item):
http://www.its.dot.gov/pilots/pilots_mobility.htm

Connected Vehicle Reference Implementation Architecture (CVRIA) for ATIS:
Pilot Deployment site: UT is “ideal”

• Geographic boundaries
• Topography—rolling
• Transportation system features:
  – Auto, transit, walk, bike, railroads
• University of Tennessee
  – Diversity of land uses (commercial, residential, & even industrial)
  – High density/alternative mode friendly
  – Easier to recruit students, concentrated, 100% connectivity via internet
  – Easier to design experiments & observe measurable outcomes
• Many similar campuses—results generalizable to other similar campuses
Transportation issues

• Mobility-hampered by signals;
  – students make more trips than general population
  – More alternative modes used
  – Do we have a survey of on-campus travel? Regional plan?

• Safety
  – How many crashes occurred on campus and where?

• Environmental-
  – What do we know about regional conformity?
Annotated Preliminary Pilot Deployment Site Map

• Need to develop this!
Set of applications proposed

• Enable ATIS, given students’ needs
• Incident scene work zone alerts-for Cumberland construction!
• Stopping at signalized intersections
• Curve warnings
• Emissions?
• Alternative modes?
Applications ➔ Performance goals

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<tr>
<th>Perf Goal</th>
<th>Performance Measure</th>
<th>Technology</th>
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<td>Improve safety</td>
<td># of collisions or near misses?</td>
<td></td>
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<tr>
<td>Improve mobility</td>
<td></td>
<td>ATIS &amp; Signal coordination</td>
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V2X technologies...

CV Application Description List

V2X Safety
- Red Light Violation Warning
  - An application that broadcasts signal phase and timing (SPaT) and other data to the in-vehicle device, allowing warnings for impending red light violations
- Curve Speed Warning
  - An application where alerts are provided to the driver who is approaching a curve at a speed that may be too high for safe travel through that curve.
- Stop Sign Gap Assist
  - An application that utilizes traffic information broadcasting from roadside equipment to warn drivers of potential collisions at stop sign intersections
- Spot Weather Impact Warning
  - An application that warns drivers of local hazardous weather conditions by relaying management center and other weather data to roadside equipment, which then re-broadcasts to nearby vehicles
- Reduced Speed/Work Zone Warning
  - An application that utilizes roadside equipment to broadcast alerts to drivers warning them to reduce speed, change lanes, or come to a stop within work zones
- Pedestrian in Signalized Crosswalk Warning (Transit)
  - An application that warns transit bus operators when pedestrians, within the crosswalk of a signalized intersection, are in the intended path of the bus

V2V Safety
- Emergency Electronic Brake Lights (EEBL)
  - An application where the driver is alerted to hard braking in the traffic stream ahead. This provides the driver with additional time to look for, and assess situations developing ahead.
- Forward Collision Warning (FCW)
  - An application where alerts are presented to the driver in order to help avoid or mitigate the severity of crashes into the rear end of other vehicles on the road. Forward crash warning responds to a direct and imminent threat ahead of the host vehicle.
- Intersection Movement Assist (IMA)
  - An application that warns the driver when it is not safe to enter an intersection—for example, when something is blocking the driver’s view of opposing or crossing traffic. This application only functions when the involved vehicles are each V2V-equipped.
- Left Turn Assist (LTA)
  - An application where alerts are given to the driver as they attempt an unprotected left turn across traffic, to help them avoid crashes with opposite direction traffic

CV Application Description

Mobility
- EnableATIS (Advanced Traveler Information System 2.0)
  - Enhanced traveler information services that record or infer user decisions and other contextual trip data that, when suitably processed can improve or transform system management functions
- Intelligent Traffic Signal System (I-TSS)
  - An overarching system optimization application accommodating signal priority, preemption and pedestrian movements
- Transit Signal Priority (TSP) and Freight Signal Priority (FSP)
  - Two applications that provide signal priority to transit at intersections and along arterial corridors as well as signal priority to freight vehicles along an arterial corridor near a freight facility.
- Mobile Accessible Pedestrian Signal System (M-PSS)
  - An application that allows for an automated call from the smart phone of a visually impaired pedestrian to the traffic signal, as well as audio cues to safely navigate the crosswalk.
- Emergency Vehicle Preemption (EVP)
  - An application that provides signal preemption to emergency vehicles, and accommodates multiple emergency requests.
- Dynamic Speed Harmonization (DSP-HARM)
  - An application that aims to recommend target speeds in response to congestion, incidents, and road conditions to maximize throughput and reduce crashes.
- Queue Warning (Q-WARN)
  - An application that aims to provide drivers timely warnings of existing and impending queues.
- Cooperative Adaptive Cruise Control (CACC)
  - An application that aims to dynamically adjust and coordinate cruise control speeds among piloting vehicles to improve traffic flow stability and increase throughput.
V2X

CV Application Description

- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
  - An application that provides input to responder vehicle routing, staging and secondary dispatch decisions
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
  - An application that warns on-scene workers of vehicles with trajectories or speeds that pose a high risk to their safety. It also warns drivers passing an incident zone if they need to slow down, stop, or change lanes.
- Emergency Communications and Evacuation (EVAC)
  - An application that addresses needs of evacuees with and without special needs or their own transportation
- Connection Protection (C-CONNECT)
  - An application that enables coordination among public transportation providers and travelers to improve the probability of successful transit transfers
- Dynamic Transit Operations (D-DISP)
  - An application that links available transportation service resources with travelers through dynamic transit vehicle scheduling, dispatching and routing capabilities
- Dynamic Ride-sharing (D-RIDE)
  - An application that uses dynamic ride-sharing technology, personal mobile devices, and voice activated on-board equipment to match riders and drivers
- Freight-Specific Dynamic Travel Planning and Performance
  - An application that enhances traveler information systems to address specific freight needs. Provides information such as wait times at ports, road closures, work zones, and route restrictions
- Drainage Optimization (DR-OPT)
  - An application that optimizes truck/load movements between freight facilities, balancing early and late arrivals

Environment

- Eco-Approach and Departure at Signalized Intersections
  - A V2I application where intersection traffic signals broadcast the current state of signal phasing (red, yellow, or green) and time remaining in that phase. These data are used by connected vehicles to support eco-friendly speed trajectories as vehicles approach and depart from a signalized intersection.
- Eco-Traffic Signal Timing
  - An application that uses data collected wirelessly from vehicles (and other sources) to optimize the performance of traffic signals, thus reducing fuel consumption and emissions.
- Eco-Traffic Signal Priority
  - An application that allows transit or freight vehicles approaching a signalized intersection to request signal priority, thereby adjusting the signal timing dynamically to improve service for the vehicle. Priority decisions are optimized for the environment by considering vehicle type, passenger count, or adherence to schedule.
- Connected Eco-Driving
  - An application that uses V2I and V2V data to provide customized real-time driving advice to drivers, including recommended driving speeds and optimal acceleration/deceleration profiles, so that drivers can adjust their driving behavior to save fuel and reduce emissions.
- Wireless Inductive/Resonance Charging
  - An infrastructure application that uses magnetic fields embedded in the pavement to wirelessly transmit electric currents between metal coils thus enabling the wireless charging of electric vehicles while the vehicle is stopped or in motion.
- Eco-Lanes Management
  - An application that establishes parameters and defines the operations of eco-lanes. Eco-lanes similar to existing managed lanes, but optimized for the environment.
- Eco-Speed Harmonization
  - An application that determines speed limits optimized for the environment based on traffic conditions, weather information, and GHG and criteria pollutant information, allowing for speed harmonization in appropriate areas.
- Eco-Cooperative Adaptive Cruise Control
  - A V2I application that uses connected vehicle technologies to collect, speed, acceleration, and location information of other vehicles and integrates these data into a vehicle’s adaptive cruise control system, thus allowing for automated longitudinal control capabilities and vehicle platooning that seek to reduce fuel consumption and emissions.
- Eco-Traveller Information Applications
  - A group of applications that disseminate information to support transportation choices that reduce fuel consumption and emissions.
- Eco-Ramp Metering
  - An application that collects traffic and environmental conditions data to determine the most environmentally efficient operation of traffic signals at freeway on-ramps and to manage the rate of entering vehicles.
- Low Emissions Zone Management
  - An application that leverages connected vehicle technologies to enable the operation of low emissions zones. Low Emissions Zones are geographic areas that seek to incentivize green transportation choices and deter high polluting vehicles from entering the zone.
- AVF Charging / Fueling Information
  - An application that informs travelers of locations and availability of alternative fuel vehicle charging and fueling stations and inductive/resonance charging infrastructure, thereby alleviating “range anxiety.”
- Eco-Smart Parking
V2X

CV Application Description

- An application that provides users with real-time location, availability, type, and price of parking, resulting in reduced parking search times and emissions
- Dynamic Eco-Routing (Light Vehicle, Transit, Freight)
  - A navigation routing application that determines the most eco-friendly route, in terms of minimizing fuel consumption or emissions, for individual travelers
- Eco-ICM Decision Support System
  - An application that uses historical, real-time, and predictive traffic and environmental data on arterials, freeways, and transit systems to determine operational decisions by system operators that are environmentally beneficial to the corridor

Road Weather

- Motorist Advisories and Warnings (MAW)
  - An application that will use road-weather data from connected vehicles to provide information to travelers on deteriorating road and weather conditions on specific roadway segments
- Enhanced MIDS
  - An application that will acquire road-weather data from connected and other general public vehicles to recommend treatment plans and weather response plans to snow plow operators, and drivers of maintenance vehicles
- Vehicle Data Translator (VDT)
  - A complementary application that, when installed on road service vehicles such as snowplows, collects road and atmospheric conditions data and transmits them to other portions of the road weather management network
- Weather Response Traffic Information (WRTI)
  - An application that will use connected vehicle data and communications systems to enhance the operation of variable speed limit systems and improve work zone safety during severe weather events

Smart Roadside

- Wireless Inspection
  - An application that will utilize roadside sensors to transit identification, hours of service, and sensor data directly from trucks to carriers and government agencies
- Smart Truck Parking
  - An application that will provide information such as hours of service constraints, location and supply of parking, travel conditions, and loading/unloading scheduling to allow commercial drivers to make advanced route planning decisions

Agency Data

- Probe-based Pavement Maintenance
  - An application that allows vehicle to automatically report potholes or other pavement anomalies
- Probe-enabled Traffic Monitoring
  - An application that utilizes direct short range communication technology to transmit real time traffic data between vehicles
- Vehicle Classification-based Traffic Studies
  - An application that would allow sorting of vehicle behavior data by vehicle type
- CV-enabled Turning Movement & Intersection Analysis
## CV Application Description List

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<th>Industry</th>
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### V2I Safety
- Red Light Violation Warning
- Curve Speed Warning
- Stop Sign Gap Assist
- Spot Weather Impact Warning
- Reduced Speed/Work Zone Warning
- Pedestrian in Signalized Crosswalk Warning (Transit)

### V2V Safety
- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Assist (LTA)
- Blind Spot/Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Vehicle Turning Right in Front of Bus Warning

### Mobility
- EnableATIS (Advanced Traveler Information System 2.0)
- Intelligent Traffic Signal System (I-SIG)
- Transit Signal Priority (TSP) and Freight Signal Priority (FSP)
- Mobile Accessible Pedestrian Signal System (PED-SIG)
- Emergency Vehicle Preemption (PREEMPT)
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Cooperative Adaptive Cruise Control (CACC)
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
- Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
- Emergency Communications and Evacuation (EVAC)
- Connection Protection (T-CONNECT)
- Dynamic Transit Operations (T-DISP)
- Dynamic Ridesharing (D-RIDE)
- Freight-Specific Dynamic Travel Planning and Performance
- Drayage Optimization (DR-OPT)
Environment
- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority
- Connected Eco-Driving
- Wireless Inductive/Resonance Charging
- Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Traveler Information Applications
- Eco-Ramp Metering
- Low Emissions Zone Management
- AFV Charging / Fueling Information
- Eco-Smart Parking
- Dynamic Eco-Routing (Light Vehicle, Transit, Freight)
- Eco-ICM Decision Support System

Road Weather
- Motorist Advisories and Warnings (MAW)
- Enhanced MDSS
- Vehicle Data Translator (VDT)
- Weather Response Traffic Information (WxTINFO)

Agency Data
- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- Vehicle Classification-based Traffic Studies
- CV-enabled Turning Movement & Intersection Analysis
- CV-enabled Origin-Destination Studies
- Work Zone Traveler Information

Smart Roadside
- Wireless Inspection
- Smart Truck Parking
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Areas of potential focus for pilots

- Incident management/emergency vehicle management
- Freight mobility/commercial vehicles
- En-route driver information
- Disaster response and evacuation
- Archived “big data”
- Environmental/eco-friendly applications

Federal guidance: Carefully designed experiments which have a measurable impact