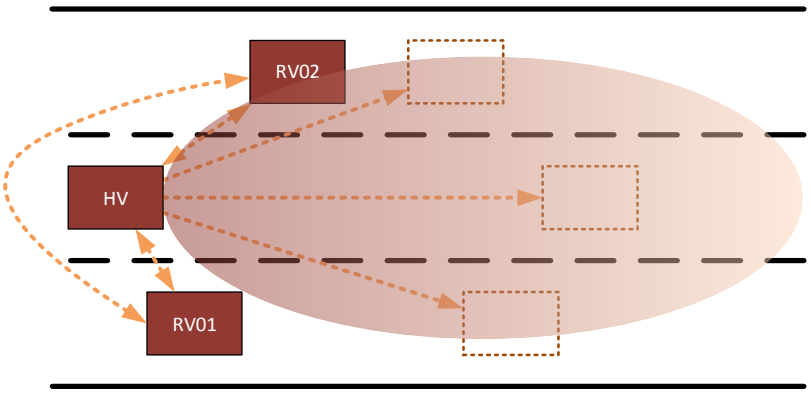
UTC Project Information	
Project Title	Vehicle Based BSM Generator for Accelerating Deployment
University	Virginia Tech Transportation Institute
Principal Investigator	Reg Viray Zac Doerzaph
PI Contact Information	rviray@vtti.vt.edu zdoerzaph@vtti.vt.edu
Funding Agencies	CVI-UTC (Tier 1 UTC)
Agency ID or Contract Number	RITA Grant Number: DTRT12-G-UTC20
Project Cost	$150,495
Start and End Dates	11/17/14 – 12/31/15
Project Duration	13.5 Months
Brief Description of Research Project	Upon initial deployment of V2X connected vehicle systems, the benefits are not readily available on day-one. Considering that the average survivability of vehicles in the United States is approximately 15 years, the market penetration needed for the benefits associated with connected vehicle systems won't be fully realized for some time. Even if all new vehicles are mandated to include such systems in addition to aftermarket devices, a disproportionate amount of non-connected vehicles to connected vehicles will continue to exist for some time. Since there will be very few connected vehicles deployed initially, the environment will be incomplete in terms of data available for connected vehicle applications. To overcome this problem, it is proposed to use ranging sensors that are now becoming increasingly common in new vehicles. By accessing this sensor, relative distances and speeds of other vehicles can be determined. This information can then be packaged into a Basic Safety Message (BSM) and transmitted over-the-air (OTA) by a Generating Host Vehicle (GHV) for use by other connected vehicles or infrastructure applications. By utilizing ranging sensors and connected vehicle systems, early deployment benefits for both drivers and infrastructure are increased. In order to facilitate this proof-of-concept, a series of tasks will be executed. These tasks include algorithm development, vehicle system development, integration & testing, experimental test development, test execution, and performance analysis. The series of tasks will facilitate development and integration of hardware and software systems to satisfy this algorithmic implementation.

	The proposed research project focuses on development of a BSM generating algorithm implemented to expedite the benefits of connected vehicle systems. If positive performance results are gained, the proof of concept can then be leveraged to support: • NHTSA V2V decision • Connected-automation information sharing (i.e. Cooperative Active Cruise Control in the presence of non-connected traffic) • Enhancement to current V2X messages • Creation of new V2X messages • New application development • Connected vehicle misbehavior detection • CVI-UTC research capabilities
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The primary outcome of this research is an algorithm that leverages Radar, GPS and IMU sensors to generate and transmit BSM Elements. By generating BSMs for non-DSRC connected vehicles, data is generated to describe the dynamic roadway environment for the benefit of other connected vehicles and/or infrastructure as depicted below.  The algorithm will calculate the BSM elements annotated in the table below. Based on these elements, applications can utilize to address crash avoidance and mobility concerns.

	<table><tr><th>BSM Data Element</th><th>Source</th></tr><tr><td>DSRCmsgID</td><td>OBE</td></tr><tr><td>MsgCount</td><td>OBE</td></tr><tr><td>TemporaryID</td><td>Algorithm</td></tr><tr><td>Dsecond</td><td>OBE (GPS)</td></tr><tr><td>Latitude</td><td>Algorithm</td></tr><tr><td>Longitude</td><td>Algorithm</td></tr><tr><td>Elevation</td><td>OBE (GPS)</td></tr><tr><td>PositionalAccuracy</td><td>OBE (GPS)</td></tr><tr><td>TransmissionAndSpeed</td><td>Algorithm</td></tr><tr><td>Heading</td><td>Algorithm</td></tr><tr><td>SteeringWheelAngle</td><td>Empty</td></tr><tr><td>AccelerationSet4Way</td><td>Empty</td></tr><tr><td>BrakeSystemStatus</td><td>Empty</td></tr><tr><td>VehicleSize</td><td>Empty</td></tr></table> Although this research focuses on generating BSM specific elements, other data elements such as Radar Target Ahead and Across ranges are available. Such data elements can be utilized in other connected vehicle messages.
Impacts/Benefits of Implementation (actual, not anticipated)	This study is still in progress, actual impacts and benefits of implementation will be determined in December 2015 when the study is completed. This page will be resubmitted in the next round of reporting to state these actual impacts and benefits.
Web Links • Reports • Project Website	