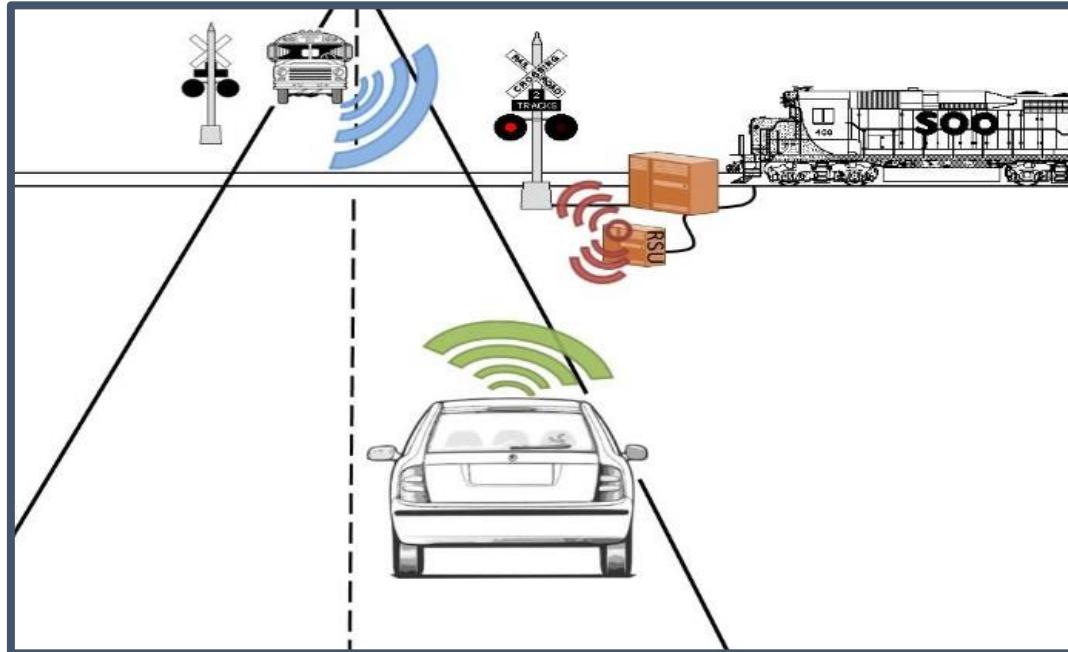


Rail Crossing Violation Warning (RCVW) System Prototype Development



*Jeff Utterback
Battelle*

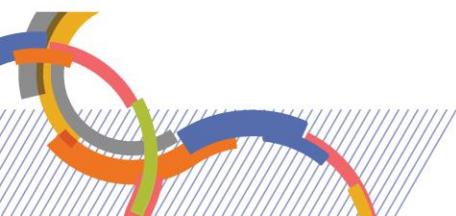
*Adrian Hellman
Volpe*

RAIL CONFERENCE



Key Presentation Take-Aways

- An urgent need exists for protecting vehicle drivers at Highway Rail Grade Crossings (HRGCs) – also known as Highway Rail Intersections (HRIs) - beyond traditional active warning devices.
- Federal Railroad Administration (FRA) is researching whether the application of connected vehicle (CV) concepts and services may help.
- FRA previously funded the development and testing of a proof-of-concept prototype Rail Crossing Violation Warning (RCVW) system and is now focused on improving upon that initial prototype.



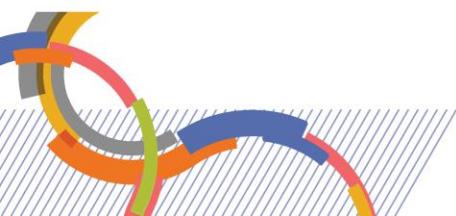
RCVW Background

- FRA statistics found at <https://safetydata.fra.dot.gov/OfficeofSafety/default.aspx> reveal:
 - No appreciable improvement in the frequency of HRGC incidents involving motor vehicles, fatalities, or injuries over the past 8-10 years.
 - HRGCs with traditional active warning devices are no more effective than those with passive crossing devices.
 - Top causes attributed to HRGC crashes includes distracted drivers and driver judgement errors.
- Existing warning devices are limited in effectiveness when a motorist's situational awareness is compromised; they don't communicate with roadway-vehicle systems.

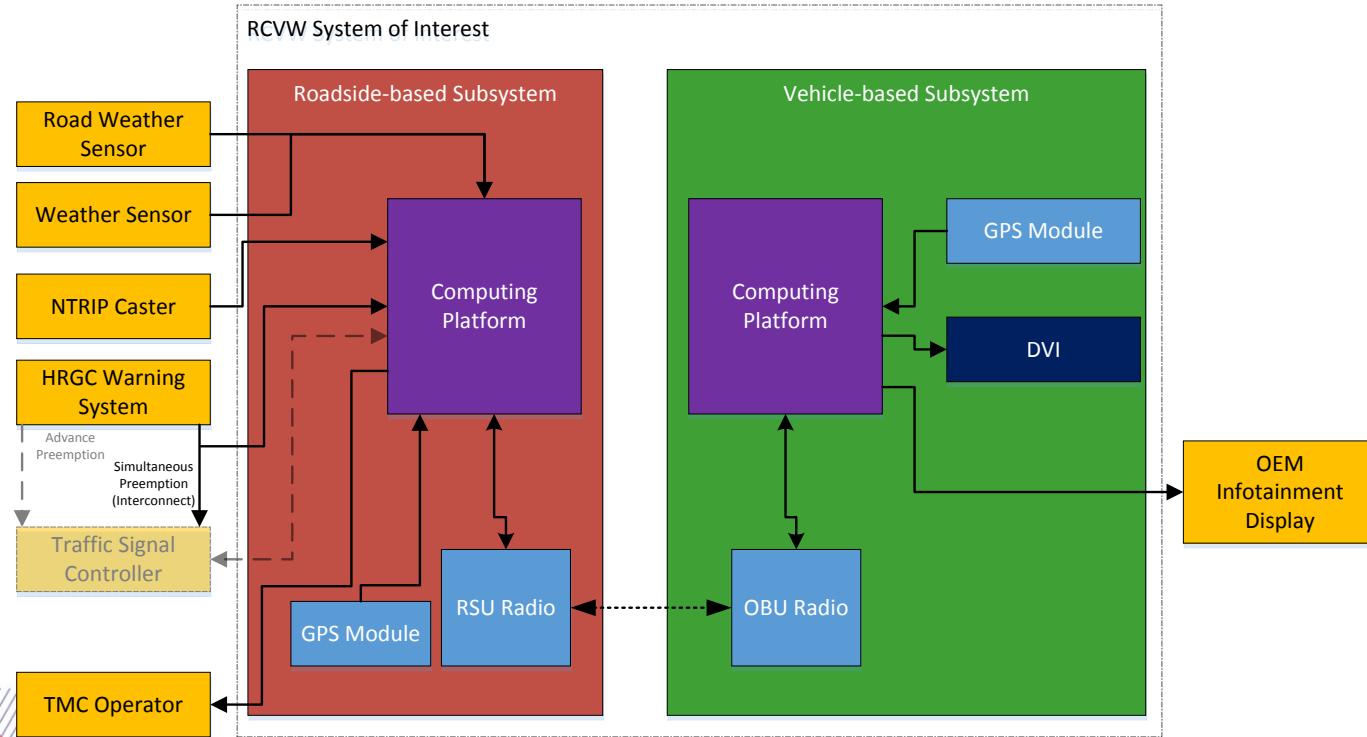


RCVW Phase I Overview

- 24-month project (Oct. 2015 – Sep. 2017) funded by FRA and ITS-JPO in which Battelle, with support from CTC Inc. and Texas Transportation Institute:
 - Applied systems engineering to design, develop, test, and evaluate a prototype RCVW system.
 - Reviewed and revised Volpe-developed ConOps and System Requirements for a Vehicle-to-Infrastructure (V2I) application / system to warn drivers endangered at active rail crossings
 - Demonstrated the potential for leveraging real-time connected vehicle (CV) concepts and services to enhance and transform rail crossing safety.
 - Tested and evaluated the developed prototype RCVW system against requirements
 - Reported project and testing findings (<https://rosap.ntl.bts.gov/view/dot/34852>)



RCVW Phase I Prototype Design

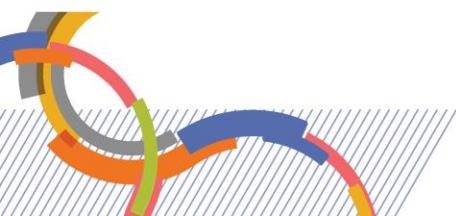


RCVW Phase I Demonstration



RCVW Phase II Overview

- 18-month project phase that began in October 2018, funded by FRA to:
 - Revisit RCVW system needs and design bases
 - Leverage CV technology advances and update to current V2I and ITS standards
 - Base alerting on human factors research
 - Revise RCVW hardware and software to be readily deployable for pilots and demos
 - Rigorously test RCVW II against performance and functionality requirements
- The team for this project is led by Battelle with CTC Inc., Transportation Research Center, Inc. (TRC), and Honda R&D Americas (HRA)



RCVW Phase II Key Focus Areas

- Enhance RCVW functionality
 - Receive preemption via IEEE 1570 interface (supervised) or voltage based simultaneous preempt interconnect
 - Conduct human factors research and create actionable DVI alerts/warnings
- Improve RCVW performance
 - Enhance RCVW positioning
 - Research the use of OBD-II and CAN-based vehicle interface status details
 - Revisit the stopping distance algorithm to reduce complexity and risk of errors
- Evaluate functions & performance (alerts, communication and processing latency)
- Test using more precise vehicle maneuver control, more accurate collection of vehicle performance data, and more test iterations for confidence in results



Project Outreach

- Project will be reviewed and valuable input obtained at the following candidate stakeholder outreach conferences:

Conference	Sponsor	Location	When
Joint Rail Conference on Railroad Engineering	ASME	Snowbird, Utah	April 9-12, 2019
Rail Crossing Committee Meeting	AAR	Columbus, Ohio	June 19-21, 2019
Rail Conference	APTA	Toronto, Ontario (Canada)	June 23-26, 2019
Railway Interchange	AREMA	Minneapolis, Minnesota	September 22-25, 2019

