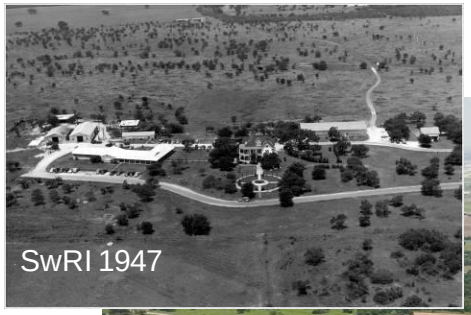
Connected and Automated Vehicle Technology for Trucking Industry

SOUTHWEST RESEARCH INSTITUTE®

Eric Thorn, Ph.D. – Manager R&D

TennSMART Fall Meeting
November 5, 2019

About Southwest Research Institute®



10 Operating Technical Divisions

- Applied Physics
- Applied Power
- Intelligent Systems
- Mechanical Engineering
- Engines, Emissions, and Vehicle Research
- Fluids and Lubricants Research
- Signal Exploitation and Geo-location
- Space Science and Engineering
- Geosciences and Engineering
- Chemistry and Chemical Engineering

Organizational Characteristics

- Independent and nonprofit [501(c)(3)]
- Revenue provided by R&D contracts
- Broad technological and scientific capabilities
- Decentralized organization
- Internal research encouraged
- Unique Client-Oriented intellectual property policy

About SwRI

- ESTABLISHED: 1947
- STAFF: >2,600
- GROSS REVENUE FY2018: >$584M
- FY18 Projects: >5,000
- CAMPUS: ~4.86 km2 (1,200 Acres) in San Antonio, TX
- LABS/OFFICES: > 2.3M ft^2
- Over 1,300 Patents; 43 R&D 100 Awards
- FY18 IR&D: $6.8M, 179 projects

Commercial Vehicle Infrastructure Integration (CVII) Program

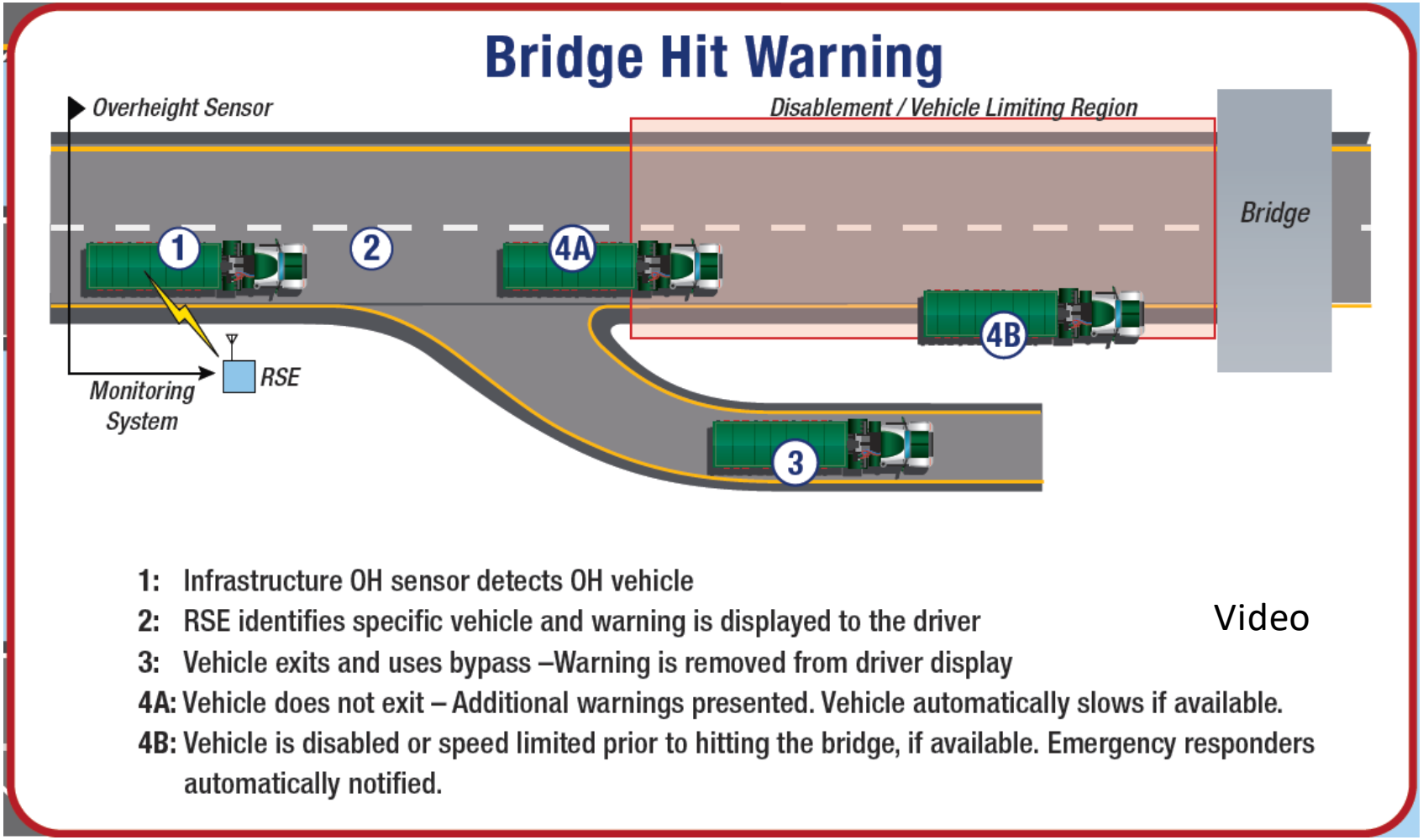
Purpose

- Develop and test Connected Vehicle technologies that will enhance Commercial Vehicle security, mobility, and safety.
  - Wireless Roadside Inspection
  - Traveller Advisories
  - Probe Data
  - Driver Credential Identification
  - Maintenance to Commercial Vehicle Communications
  - Safe-to-Merge, Safe-to-Pass, Blindspot Warning, Tailgate Warning
  - Railroad Grade Crossing Warning

Results

- Team: Volvo, SwRI, Kapsch TrafficCom, Booze Allen Hamilton, Cambridge Systematics, Fitzgerald & Halliday
- Was demonstrated at ITS World Congress in October 2011 in Orlando, FL.
- Recognized as Project of the Year by ITS NY

Over-height Vehicle Detection & Warning



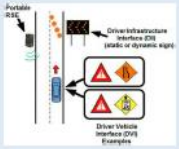
Video

Texas Connected Freight Corridor

Texas Annotated Preliminary Pilot Deployment Site Map

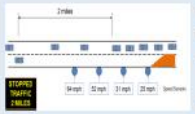
"The Connected Triangle"

Connected Triangle Need: Improve safety of work zones



- Provide work zone alerts to drivers
- Provide better work zone information to freight operators

Connected Triangle Need: Reduce Crashes due to traffic queues



- Q-WARN
- EEBL
- Detect end-of-queue conditions
- Notify upstream traffic

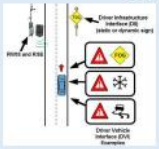
Connected Triangle Need: Reduce Wrong Way Driving Crashes

- Detect Wrong-Way Drivers
- Alert other drivers to warn them
- Notify freight operations dispatch

Connected Triangle Need: Reduce wait-times at border crossings

- Detect border wait times
- Notify drivers prior to decision points
- Notify freight operations

Connected Triangle Need: Reduce crashes due to spot weather conditions



- Spot weather impact warning
- Notify Freight Operations

Entire Triangle

Connected Triangle Need: Provide Higher Quality Advanced Traveler Information & Clearance Info

- Collect vehicle situation data from vehicles
- Provide travelers with higher quality traveler and clearance info

Connected Triangle Need: Reduce Pedestrian / Vehicle Collisions

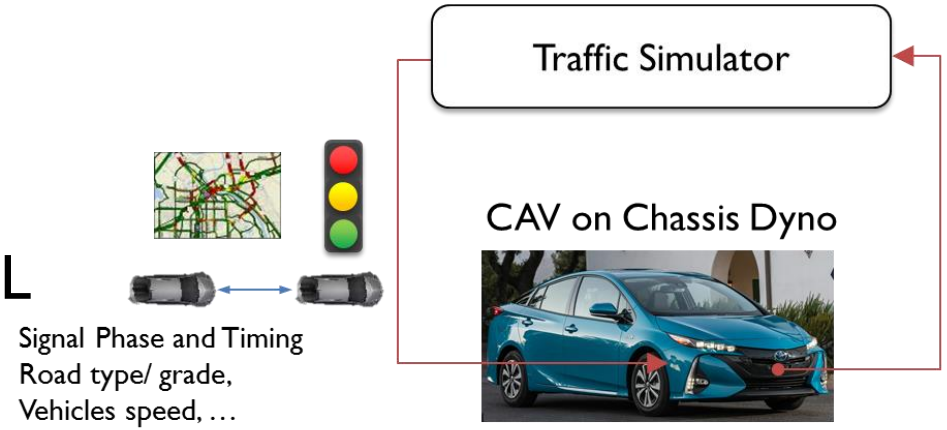
- Detect Pedestrians
- Alert other drivers to warn them
- Notify freight operations dispatch

Connected Triangle Need: Reduce Truck Idle Time Near Distribution Centers

- Implement Freight Signal Priority at critical intersections near distribution centers.

CV Technology for Improved Fuel Efficiency

- Goal of reducing vehicle energy consumption by at least 20%
- Leverage connectivity, automation, and model predictive control
- Traffic simulator feeds HIL simulation



Co-optimized Vehicle & Powertrain Control

Platooning / Cooperative Convoy System

- UGV actively participating in convoy
- Variable lateral offsets and longitudinal spacing
- Vehicle reordering in convoy
- Autonomous UGV lead through urban environment interacting with traffic and pedestrians
- Convoy separation and rejoining

Automated Trailer Docking

Thank You!

SOUTHWEST RESEARCH INSTITUTE®

Eric Thorn, Ph.D.
ethorn@swri.org
+1.210.522.3915