



Connected Vehicles -The Basics-

Jim Arnold
OST-R



Transportation Challenges



Safety

33,561 highway deaths in 2012
5,615,000 crashes in 2012
Leading cause of death for ages 4, 11-27



Mobility

5.5 billion hours of travel delay
\$121 billion cost of urban congestion

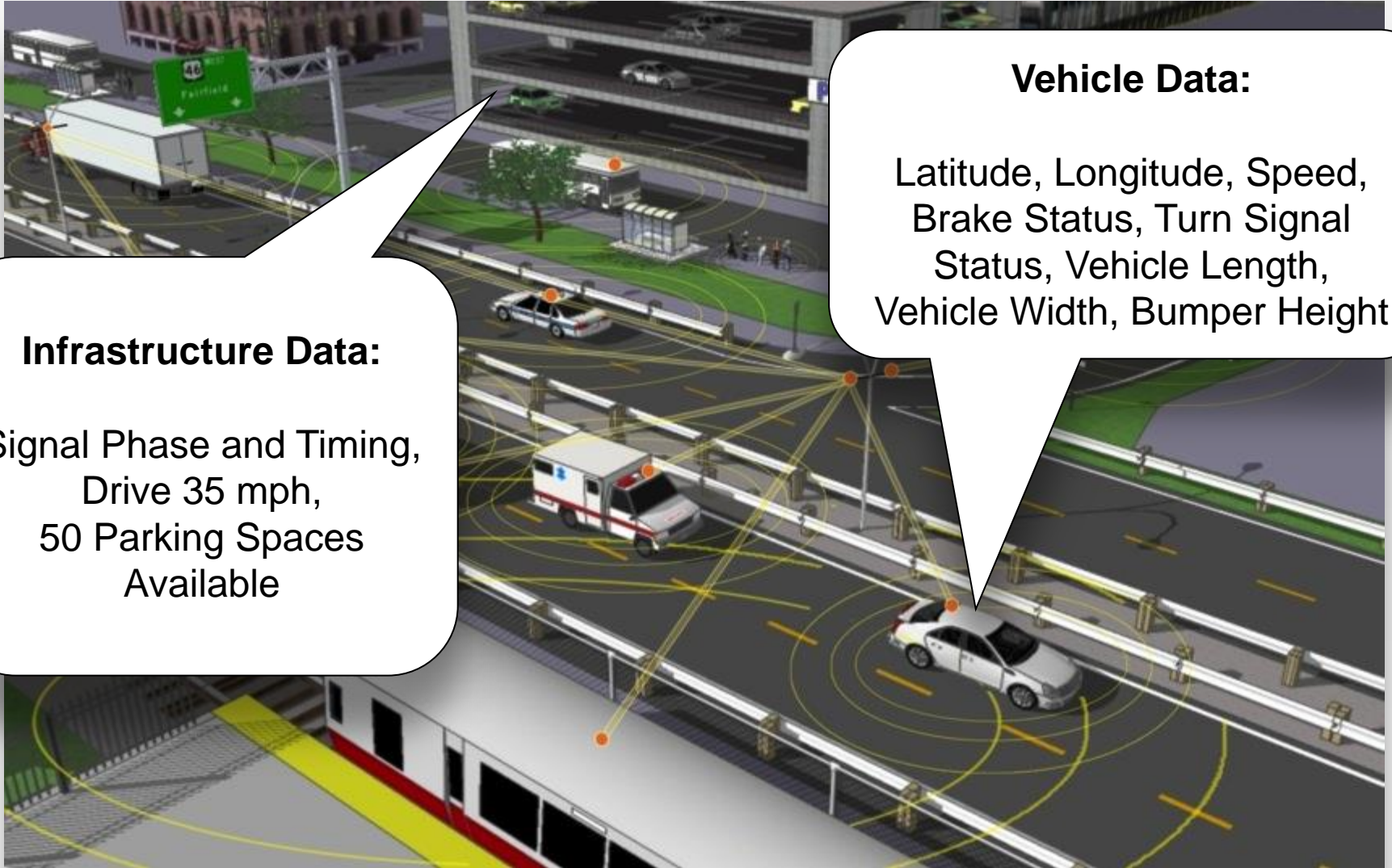


Environment

2.9 billion gallons of wasted fuel
56 billion lbs. of additional CO₂



Fully Connected Vehicles



Infrastructure Data:

Signal Phase and Timing,
Drive 35 mph,
50 Parking Spaces
Available

Vehicle Data:

Latitude, Longitude, Speed,
Brake Status, Turn Signal
Status, Vehicle Length,
Vehicle Width, Bumper Height



Connected Vehicle Communications Technology

- 5.9 GHz Dedicated Short-range Communications (DSRC)
- 4G and older 3G cellular networks provide high-bandwidth data communications
- Other wireless technologies such as Wi-Fi, satellite, and HD radio may have roles to play



DSRC Technology: How it Works

- Data is transmitted 10 times/sec (300m range)
- Privacy is built-in (vehicle location is NOT intended to be recorded or tracked)
- Wi-Fi radio adapted for vehicle environment
- Inexpensive to produce in quantity
- Original FCC spectrum allocation in 1999, revised in 2004 and 2006

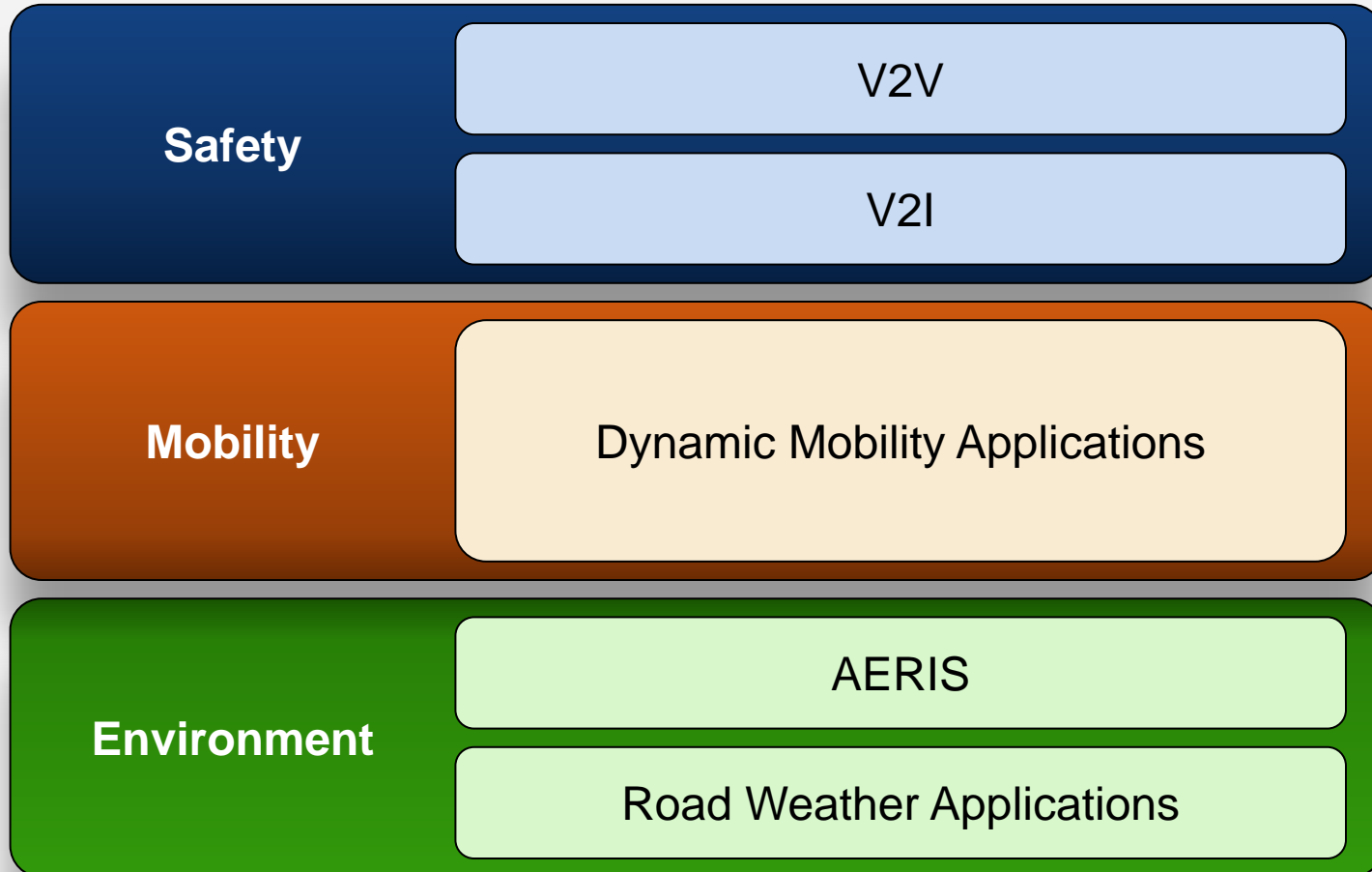


Connected Vehicle Communications Technology: Benefits and Challenges

- Benefits of the DSRC communications technology:
 - Reduced price
 - Improved reliability → fewer false alarms
 - Increased performance → addresses more crash scenarios
- Challenges of the DSRC communications technology:
 - Both parties (vehicle/vehicle or vehicle/infrastructure) need to be equipped to gain benefit
 - Requires security infrastructure



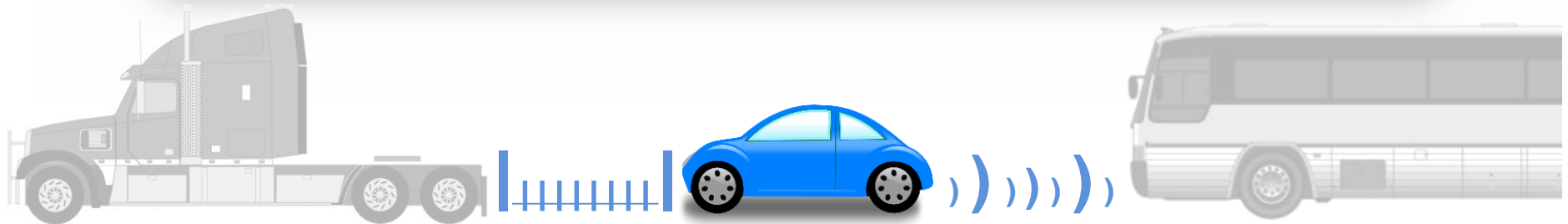
Connected Vehicle Applications



Safety Applications: V2V

V2V Safety Applications

Forward Collision Warning	FCW
Emergency Electronic Brake Light	EEBL
Blind Spot/Lane Change Warning	BSW/LCW
Do Not Pass Warning	DNPW
Intersection Movement Assist	IMA
Left Turn Assist	LTA

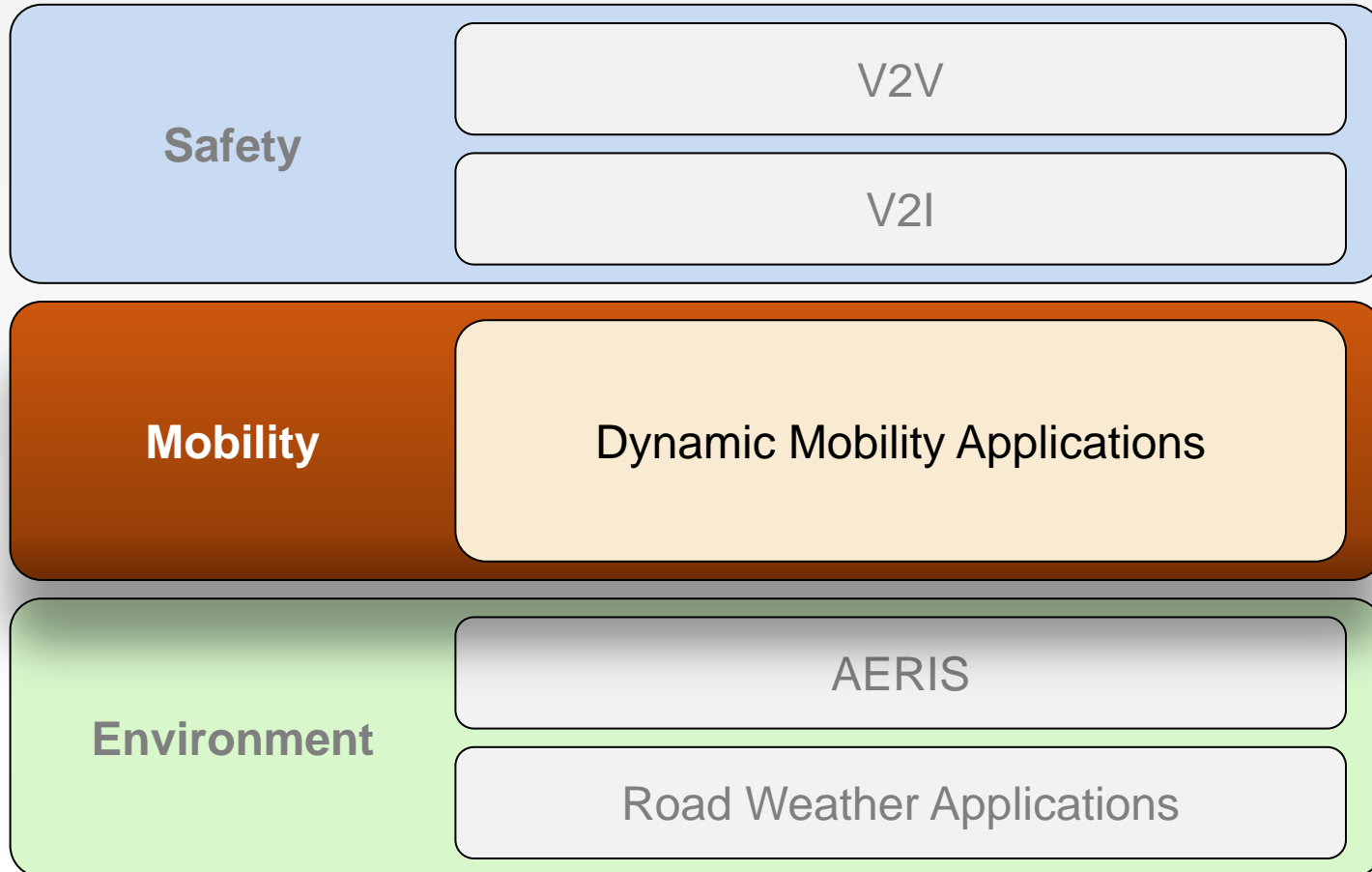


Safety Applications: V2I

V2I Safety Applications	
Curve Speed Warning	CSW
Red Light Violation Warning	RLVW
Spot Weather Information Warning	SWIW
Reduced Speed Zone Warning	RSZW
Stop Sign Gap Assist	SSGA
Smart Roadside	SRI
Transit Pedestrian Warning	



Connected Vehicle Applications: Mobility

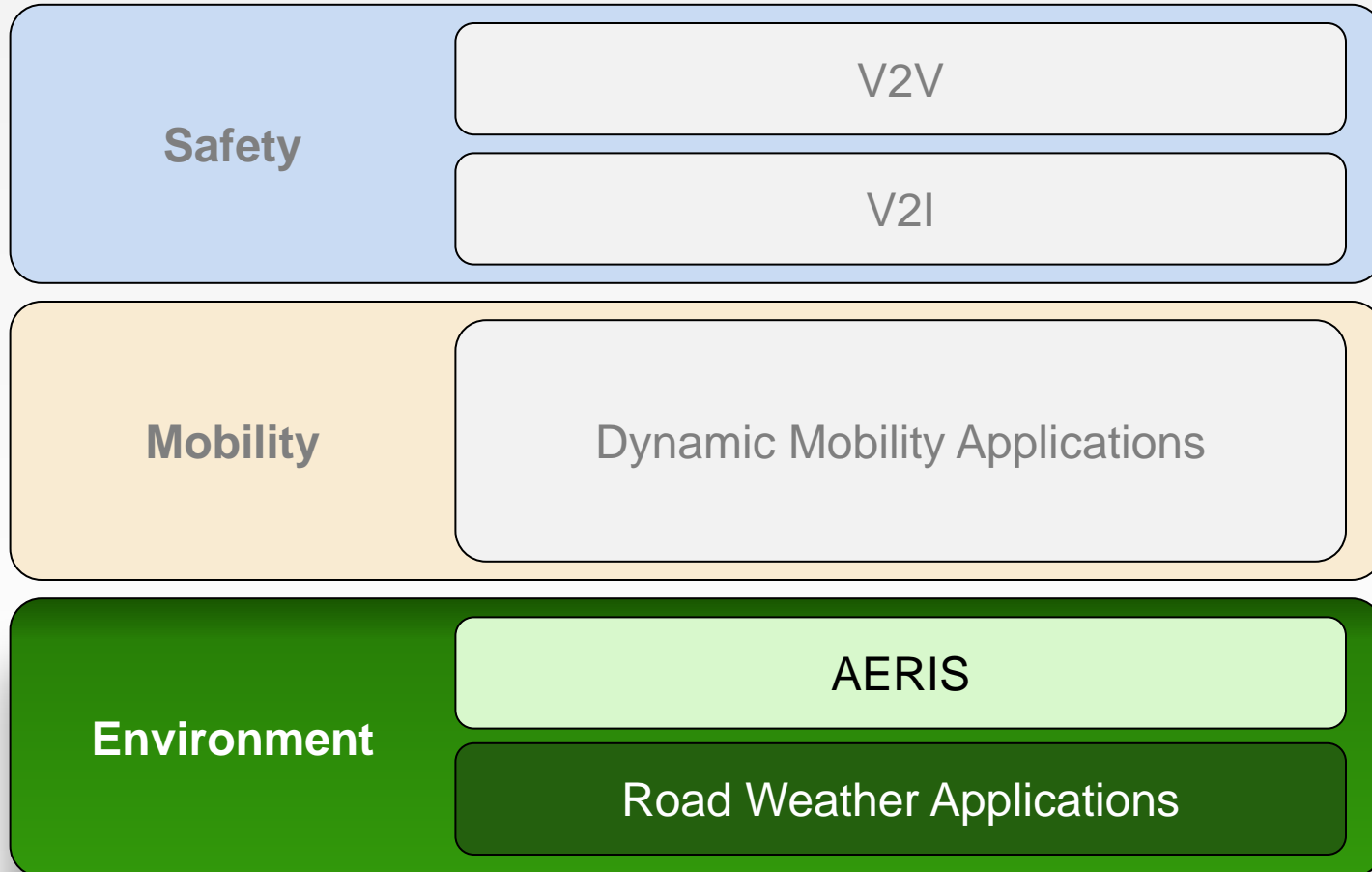


Dynamic Mobility Applications

Multimodal Intelligent Traffic Signal System	MMITSS
Intelligent Network Flow Optimization	INFO
Response, Emergency Staging and Communications, Uniform Management, and Evacuation	R.E.S.C.U.M.E.
Enable Advanced Traveler Information Systems	Enable ATIS
Integrated Dynamic Transit Operations	IDTO
Freight Advanced Traveler Information Systems	FRATIS



Connected Vehicle Applications: Environment



Environment Applications: AERIS

Cleaner Air Through Smarter Transportation

ECO-SIGNAL OPERATIONS

ECO-LANES

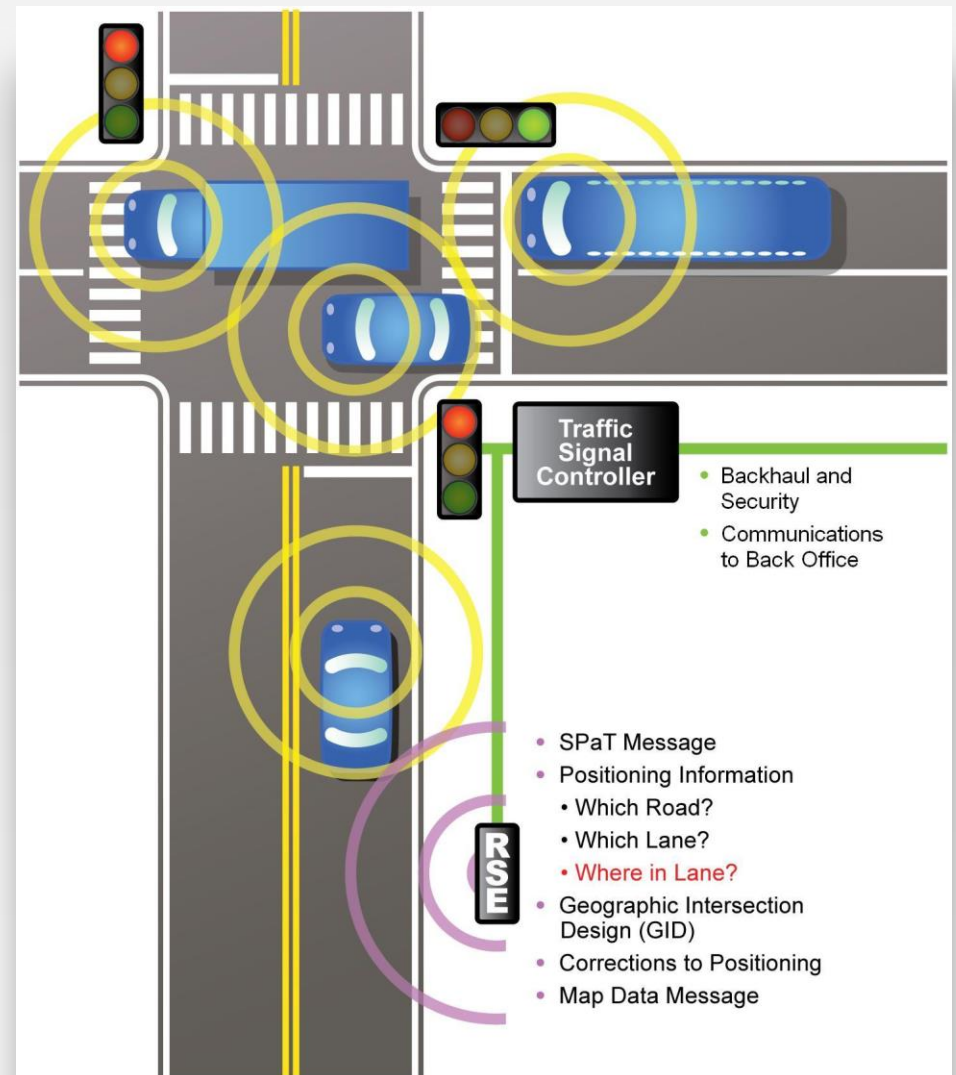
ECO-Traveler Information

ECO-INTEGRATED CORRIDOR MANAGEMENT



V2I Reference Implementation

- A system of specifications and requirements that allow the various components of V2I hardware, software and firmware to work together.
- An agency will be able to select the capabilities and applications desired at a given installation.

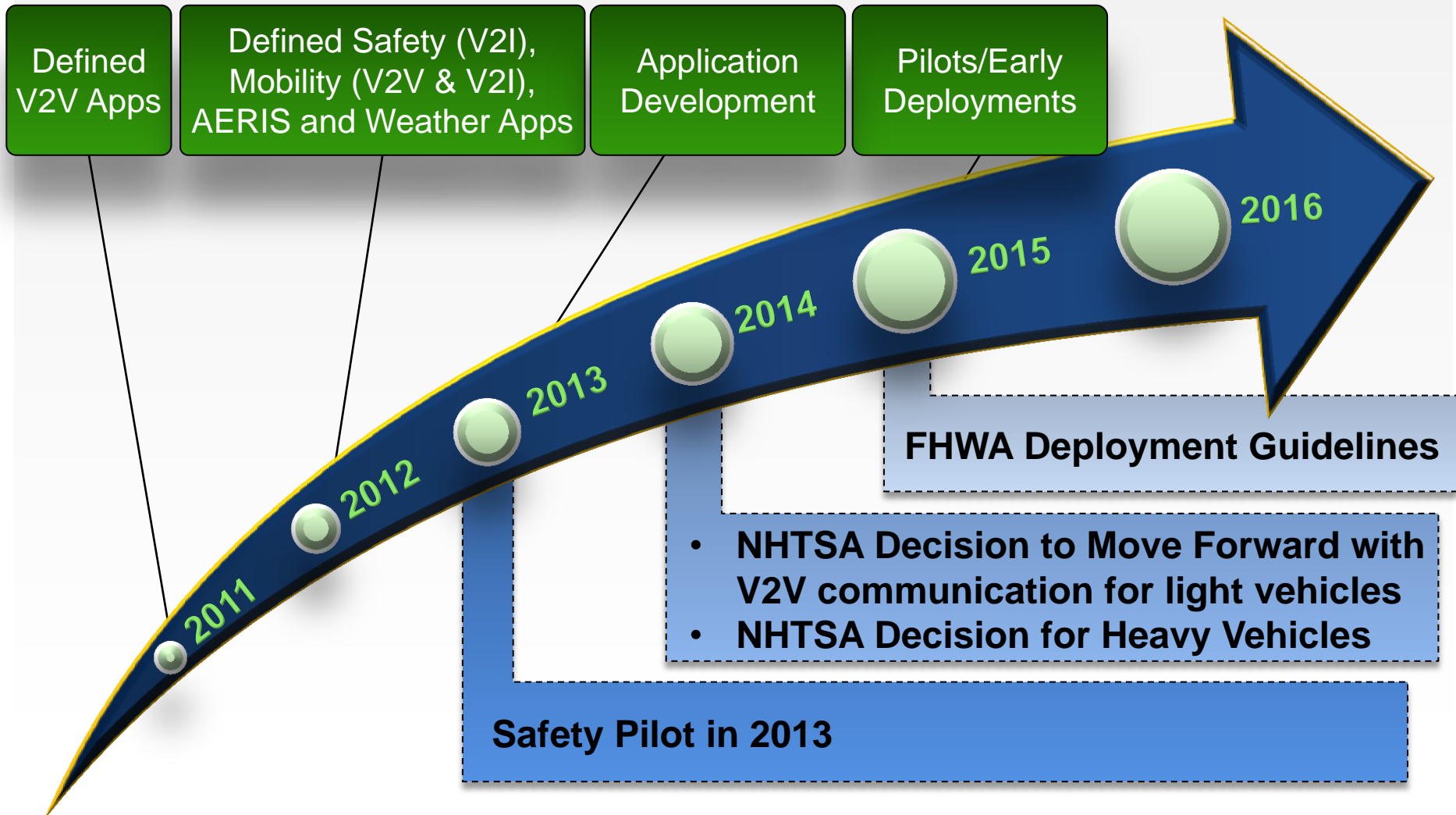


Overview of USDOT Test Bed Resources

- Qualified Product List for RSE
 - 5 vendors
- Qualified Product List for Onboard Equipment (OBE)
 - Vehicle Awareness Devices
 - Aftermarket Safety Devices
- Portable RSE Trailers
- Network Listeners/Sniffers
- Test Bed Operations Staff
- Signal Phase and Timing (SPaT) Resources
 - Listeners
 - Interface standards from FHWA
- Security Credential Management System (SCMS)
 - 1609.2 certificate management system



Path to Deployment



US DOT/NHTSA Decision on V2

- Announced on February 3rd, 2014 for light vehicles; ANPRM issued on August 18, 2014
- Primary purpose: enable collision warnings to drivers prior to a crash
- Based on several years of research including the safety pilot model deployment – 3000 vehicle road test in Ann Arbor, Michigan
 - Report Released 8/20/2014
 - ANPRM Published 8/20/2014
- Security and privacy protections built into contemplated system
 - No exchanging or recording of personal information
 - No tracking of vehicle movements
- After circulating the research report for public comment, NHTSA will then begin working on a regulatory proposal to require V2V devices in new light vehicles in a future year
- Decision on heavy vehicles planned at end of 2014



To Learn More

Connected Vehicle 101 Workshops at ITS
America State Chapter meetings:

- Sept 7 – Detroit, MI (ITS World Congress)
- Sept 30 – Anchorage, AK
- October 15 – Santa Clara, CA
- Nov 12 – Irving, TX



Twitter: [@ITSJPODirector](https://twitter.com/ITSJPODirector)

Facebook: <https://www.facebook.com/DOTRITA>

Website: <http://www.its.dot.gov>

Free ITS Training

- ✓ Increase Your Knowledge of ITS Technologies
- ✓ Excel at Your Career
- ✓ Advance the Mission of Your Organization



Learn more and visit www.its.dot.gov/training

