



THEA CV PILOT

OVERVIEW, STATUS, CHALLENGES, AND LESSONS LEARNED

Walk. Ride. Drive. *Smarter.*



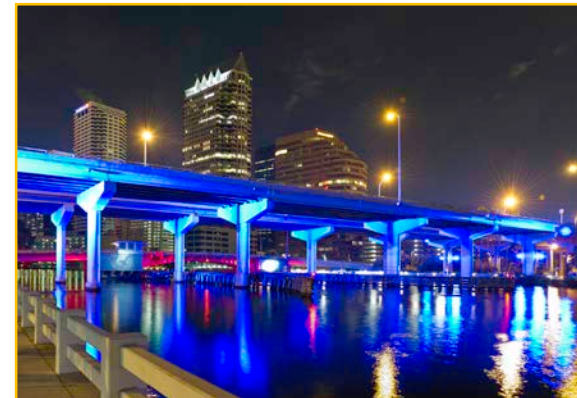
WHAT IS THEA?

INDEPENDENT

Agency of the State



- **A local, user-financed public agency**
 - Financed through revenue bonds
 - Supported by user tolls
 - No tax funding
 - Tolls stay local
- **Seven Member Board**
 - 4 Appointed by Governor
 - Mayor (or Council Chair)
 - Hillsborough County Commissioner
 - FDOT District 7 Secretary



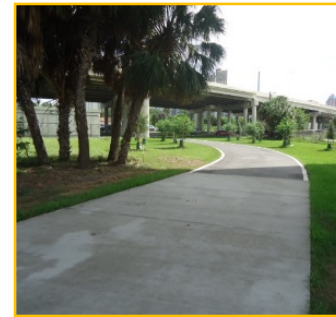
THEA OWNS, OPERATES & MAINTAINS



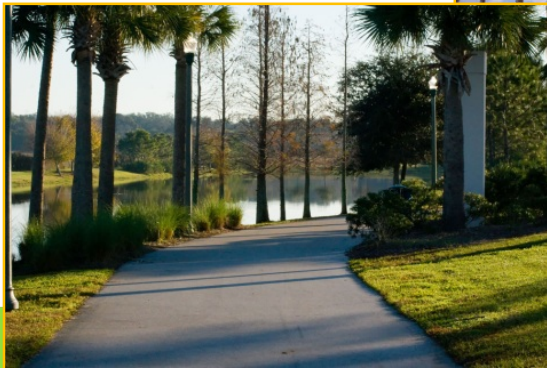
Lee Roy Selmon Expressway



Selmon Greenway



Brandon Parkway



Meridian Avenue



THEA = CREDIBILITY

Innovative

- First Reversible All Electric Toll Road in the World
- First All Electric Toll Road in Florida
- First Florida Expressway to Convert entire system to All Electronic Tolling

Leading Edge

- USDOT \$21 Million Contract for Connected Vehicles Pilot Project (1 of 3 Nationally)



Economic Engine

- Economic Impact – Enabled \$1.4 billion in business sales and the creation of over 10,000 jobs in a variety of industries.
- Smart Funding – THEA revenue and bonds fund roadway construction and improvements, without adding to state, or local government debt.
- Taxpayer Savings – THEA operations are funded by our toll revenue

THEA STRATEGIC OVERVIEW

Mission

Our mission is to provide safe, reliable, and financially-sustainable transportation services to the Tampa Bay region while reinvesting customer-based revenues back into the community.

Vision

Our vision is to lead, partner, and implement safe, economically-sound, and innovative multi-modal transportation solutions for our Tampa Bay community.

Provide THEA customers with the safest, most efficient drive possible.

Advance
Mobility
Technology

Promote Tampa
Bay





CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM

PROGRAM GOALS



PILOT SITES



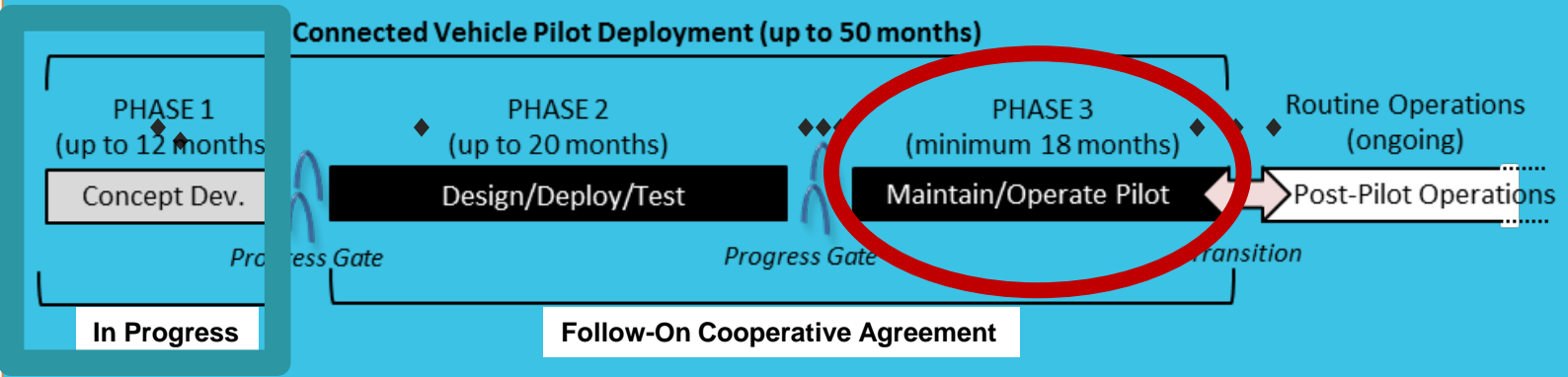
ICF/Wyoming DOT



NYCDOT



Tampa (THEA)



FOCUSED DEPLOYMENT AREA



PARTICIPANTS AND INFRASTRUCTURE



PHOTO: THEA

1,600

**Privately Owned
Vehicles**



PHOTO: THEA

9

**TECO Line
Streetcar Trolleys**



PHOTO: THEA

10

**Hillsborough Area
Regional Transit
(HART) buses**

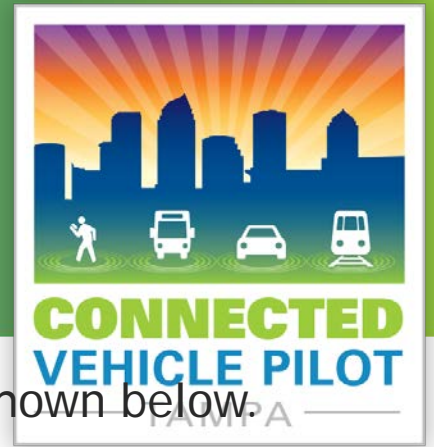


PHOTO: SIEMENS

44

Roadside Units

IN VEHICLE USER INTERFACE



Safety warnings integrated into the rear-view mirror, visual (with auditory alert) examples shown below.



Electronic Brake Lamp Warning



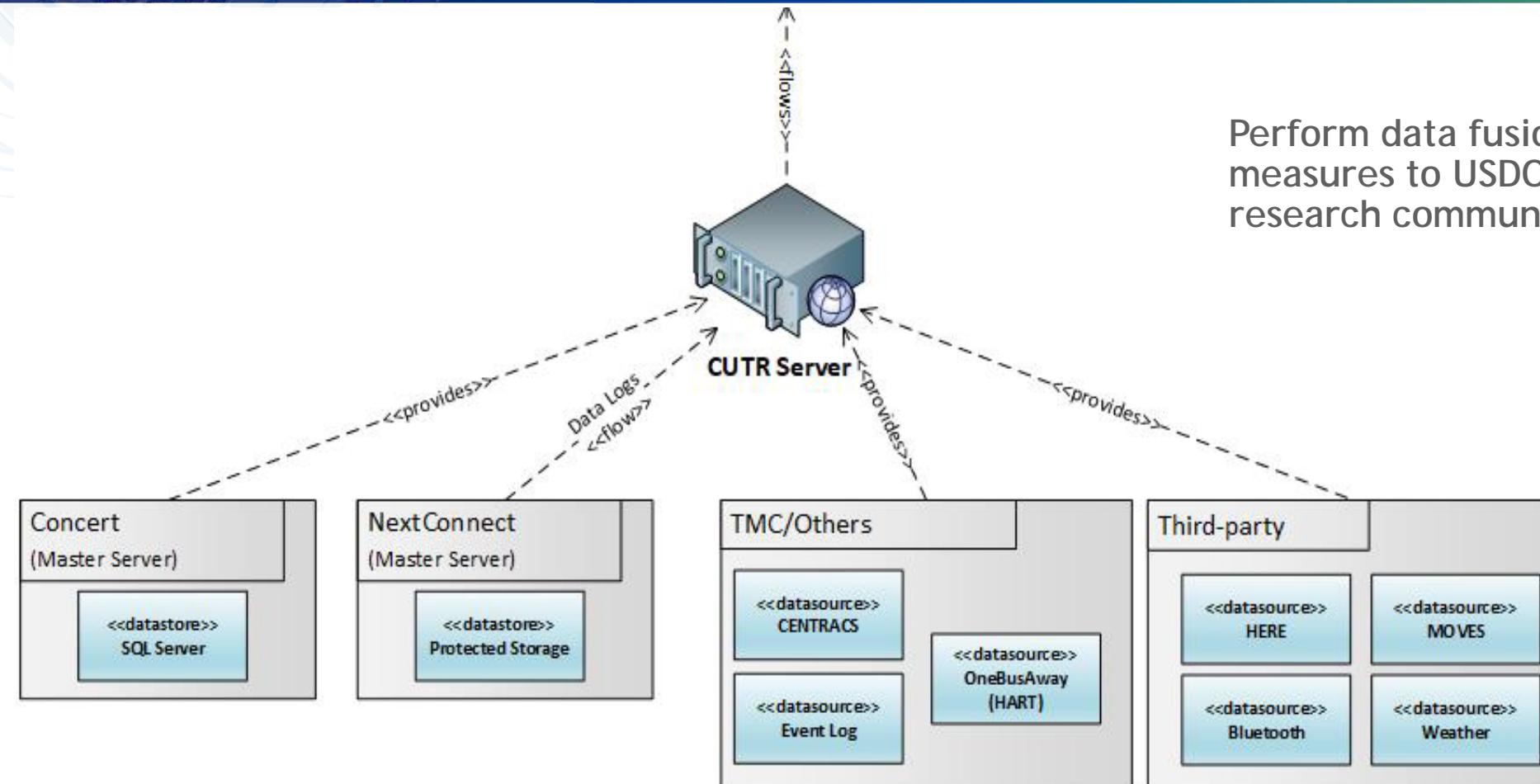
Exit Ramp Deceleration Warning

Source: Brand Motion and Global 5

PHASE 3 - MEASURING PERFORMANCE



Perform data fusion and transmit performance measures to USDOT independent evaluators, research community, and the public at large



Mobility

- Travel time
- Travel time reliability
- Delay
- Throughput

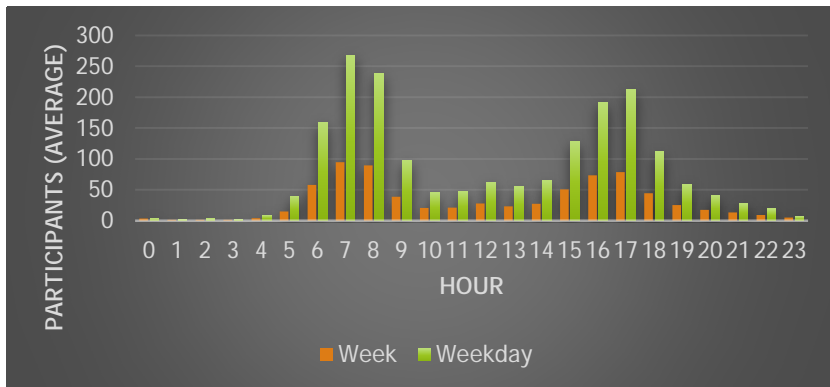
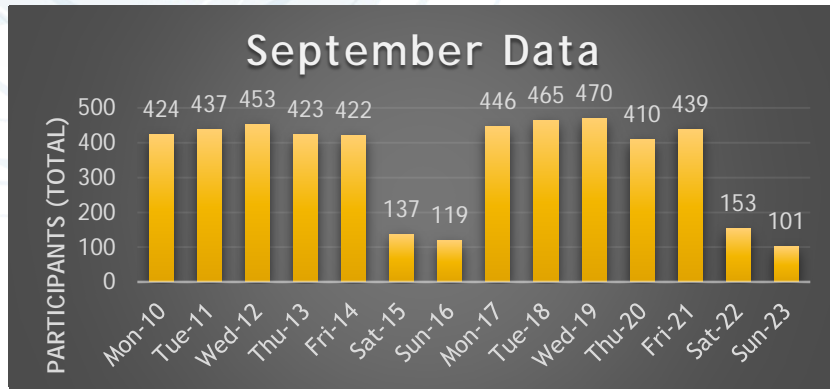
Safety

- Crash rates
- Type of conflicts
- Severity of conflicts

Environment

- Emission analysis

TRAVEL DATA

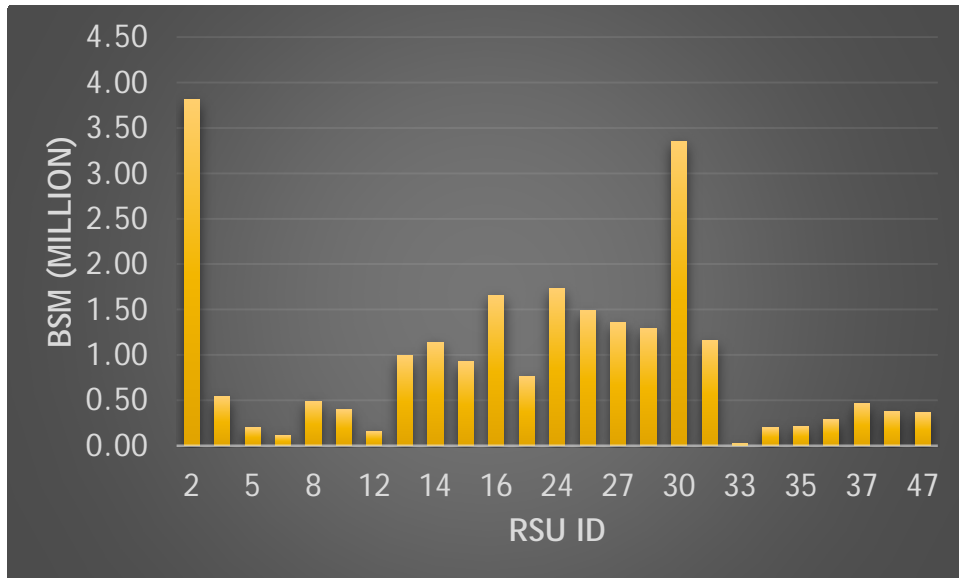


- Average of 1.7 million BSM/day
- About 0.9 million BSM/RSU
- Weekday travel patterns with a.m. and p.m. peak periods
- Up to 270 participants per hour on average at a.m. peak hour

BSM AND RSU: STUDY AREA



- Some RSU receive more BSM than others
- Coverage of entire study area ensured



BSM AND MOBILITY



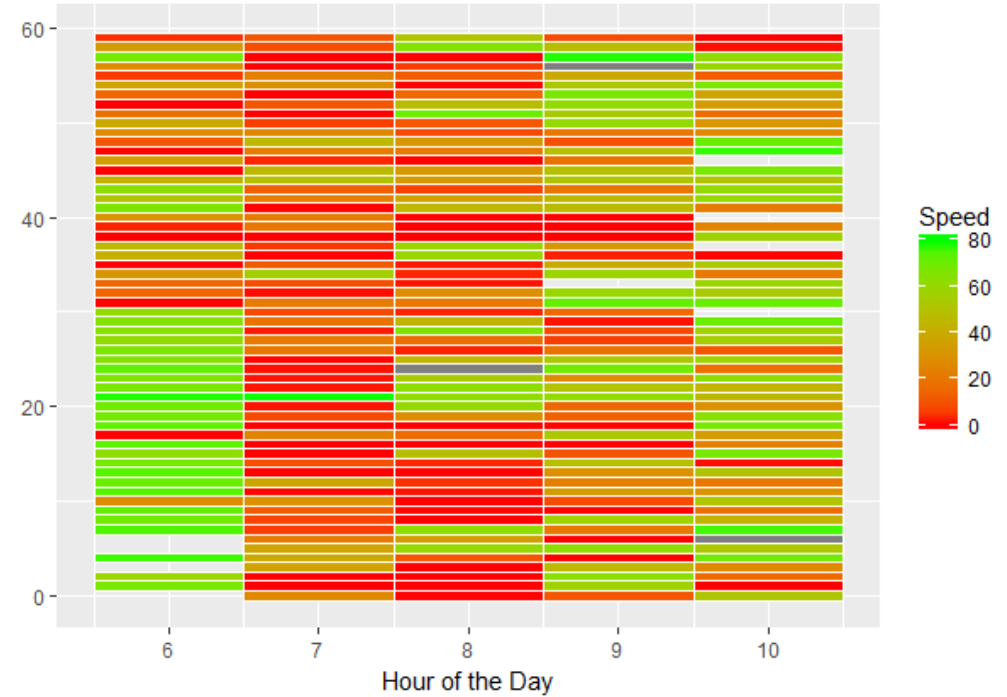
- RSU collected BSM allow generating mobility performance measures by Use Case
- Cluster analysis of events to spot areas prone to accidents



BSM Density

Time-Series Heatmap

One-minute Interval



IF WE COULD DO IT OVER AGAIN: WE WOULD

- Solidified Standards Earlier
- Obtain a Better Understanding of “Available” Applications’ Maturity
- Obtain a Better Understanding of “Available RSU and OBU Hardware
- Obtain a Better Understanding of Vendors’ Depth and Resources
- Like More Transparency in the Device Certification Process From Vendors
- Complete Integration Testing Before Private Vehicle Installs Begin
- Have Shifted the Focus Much Sooner to a Commercial Security Credential Management System
- Identify the Need to Use Traditional ITS Devices as Part of Solution Earlier



LESSONS LEARNED - IN-VEHICLE



- OBUS - DON'T DO IT!!! Hire auto professionals to manage!
- Multiple Technical Scans using RFPs (with on the road testing)
- Early Sourcing of Suppliers to Create a Collaborative Environment
- Early real-life testing with infrastructure in place to verify end-to-end system/application performance
- Distributed Team Across the Country and in Europe, be careful can they support you from overseas?
- New development efforts - OTA and security - need to be piloted, i.e. tested early in the program
- Adequate incentives with community/media support engage the driver/consumer community
- Recognizing the need for a complete and experience project team - systems, infrastructure, vehicle systems, performance measurement, etc.
- DSRC trusted in the Tolling Industry

DEDICATED SHORT RANGE COMMUNICATIONS

- FCC allocated 5,9 Spectrum in 1999
- USDOT initiated research and testing
- Safety Pilot Model Deployment 2011
- ITS America and ITS World Congress Connected Vehicle Demonstrations
- PlugFests
- AASHTO SPaT Challenge
- Colorado DOT RoadX
- USDOT CV Pilot



WHY DSRC CONNECTIVITY? BENEFITS OF CONNECTED VEHICLE COMMUNICATION



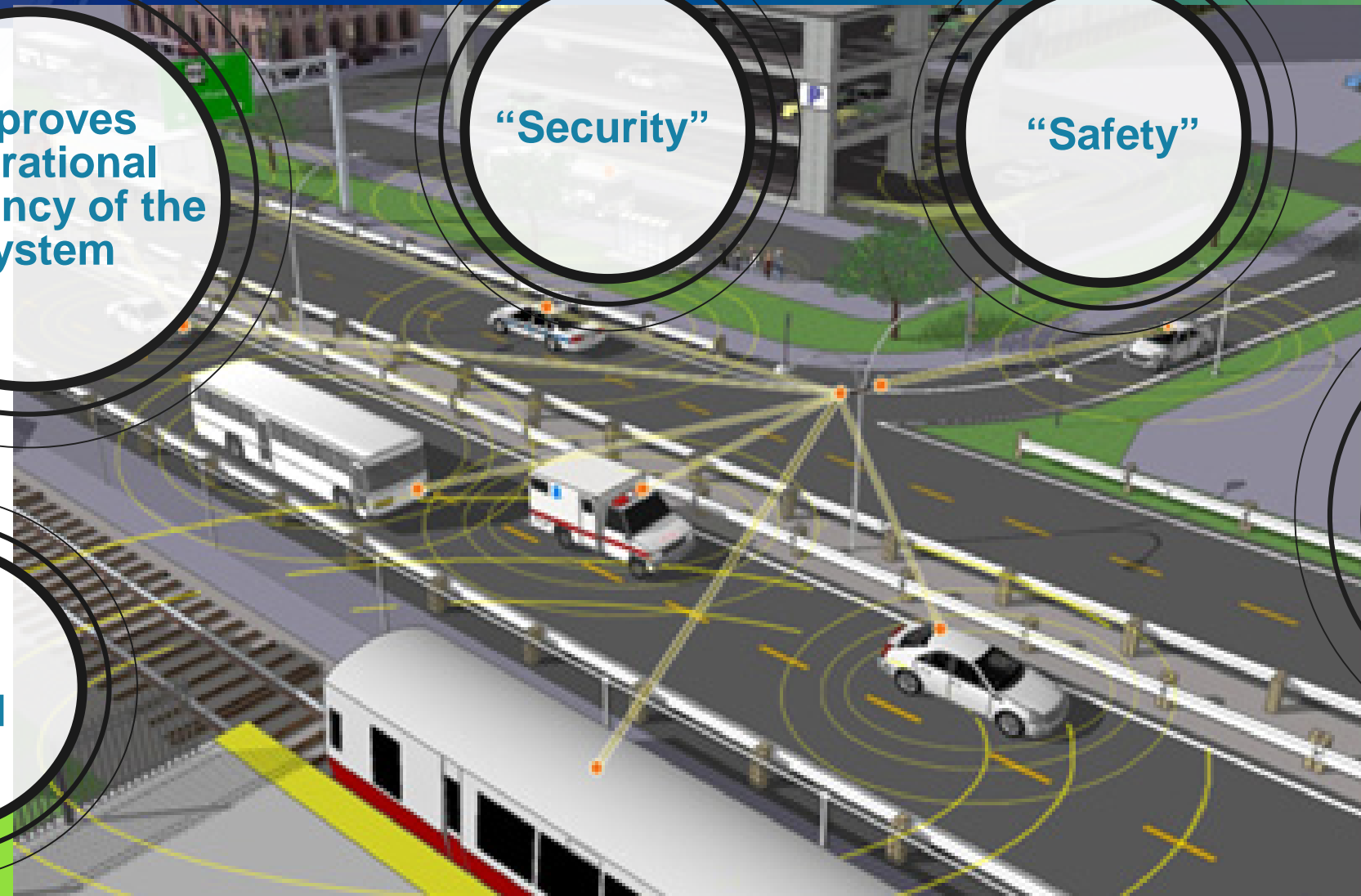
Improves operational efficiency of the system

“Security”

“Safety”

Track Record

Ability for all residents to experience benefits of technology...



DSRC

DEDICATED SHORT RANGE COMMUNICATIONS



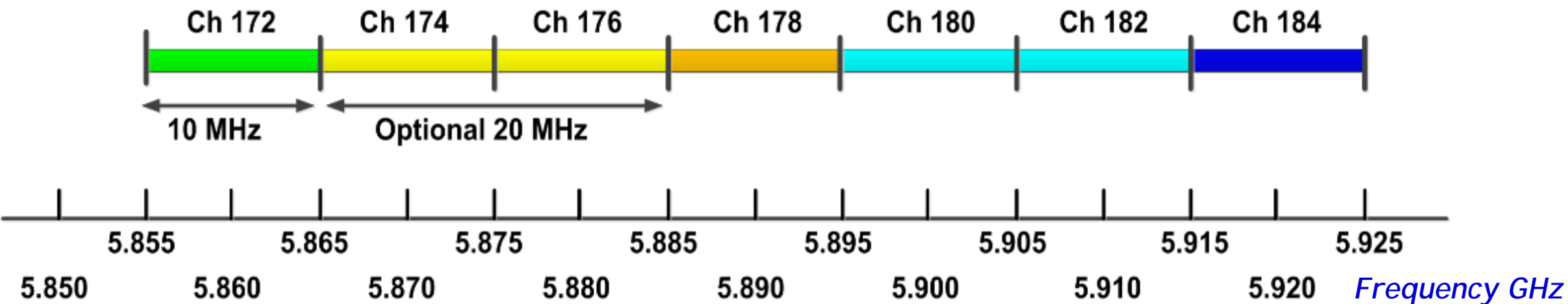
Public Safety V2V Applications Channel (Dedicated)

Control Channel

Emergency Vehicles

Service Channel*
WSMP or IPv6
I→V V→I

Service Channel*
WSMP or IPv6
V→I I→V



Key Benefits:

- 802.11p technology similar to 802.11a
- Low latency communication (<< 50ms)
- High data transfer rates (3 – 27 Mbps)
- Typically 300M and 360 °
- Up to 1000 M for emergency vehicles

**Service Channel: uploading log files; downloading firmware & application parameters and security certificates*

TAMPA CHANNEL ALLOCATION

- 172 - BSM, MAP, SPaT, RTCM
- 176 - PSM, SCMS, SRM, SSM, DataLog
- 178 - WSA, TIM, RSA
- 180 – DataLog
- 182 – Over the Air



DEDICATED SHORT RANGE COMMUNICATIONS CHALLENGES



- Interference (Tampa)
 - 2016 An unknown user
 - 2017 HAMWAN
- C-V2X demonstrations in 5.9 spectrum
- Cable industry petition FCC to open Spectrum
- 5GAA submitted waiver to FCC to operate in 5.9 spectrum
- Opening the Spectrum Economic Impact
 - The 5.9 GHz band's annual potential contribution to U.S. gross domestic product ranges from \$59.8 to \$105.8 billion. ¹
 - Opening the 5.9 GHz band for WiFi could provide gains to economic welfare in the form of consumer and producer surplus of \$82.2 billion to \$189.9 billion. ¹

¹ The Potential Economic Value of Unlicensed Spectrum in the 5.9 GHz Frequency Band; RAND Corporation

STAY CONNECTED



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