CONNECTED VEHICLE
PILOT DEPLOYMENT PROGRAM

August 2, 2016
Presentation

• Concept
• Pilot Location
• Deployment Characteristics
• Use Cases
• Application Overview
Demonstrate and measure the impact of Connected Vehicle technology’s ability to make multi-modal transportation in the Tampa Bay Community safer, smarter and greener.

- Safety
- Mobility
- Connectivity
- Partnerships/Collaboration
- Community
- Innovation
Where will CV be deployed?

- Channelside Drive
- Meridian Avenue
- Twiggs Street
- Kennedy BLVD
- Marion Street
Deployment Characteristics

- THEA Owns and Operates the Leroy Selmon Expressway
- THEA Owns and Operates Meridian Avenue
- Substantial Commuting Into Downtown
- Commuters Through Downtown (MacDill Air Force Base)
- City of Tampa Staff Co-Located at THEA Traffic Management Center
- High Pedestrian Traffic
- Significant Interaction Between Light Vehicles, Transit, and Pedestrians
- Specific Known Problem Areas
Use Cases

3 Categories of 11 Apps to Fulfill 6 Safety and Mobility Needs at 40 Locations
MORNING BACKUPS AND CONGESTION

Intersection of Twiggs Street and Meridian Avenue at Reversible Express Lanes Entrance/Exit

ISSUES AND NEEDS

- Poor traffic flow on signalized arterials
- Back-to-back right turns
- Queue backup on curve
WRONG-WAY INCIDENTS

Entry/Exit Points Along Selmon Expressway and Reversible Express Lanes (REL)

ISSUES AND NEEDS

- Wrong-way REL entry can/does lead to serious incidents
PEDESTRIAN SAFETY
Midblock of Twiggs Street at Hillsborough County Courthouse

ISSUES AND NEEDS
- Pedestrian struck-by incidents
- Midblock crossing with no protected left turn at signal
- Pedestrians crossing at unmarked locations
TRANSIT SIGNAL PRIORITY, OPTIMIZATION AND SAFETY

Express Route through Downtown City Streets to Marion Street Transit Station

ISSUES AND NEEDS

- Poor traffic flow on signalized arterials
- Passenger vehicles blocking access to transit stops
TECO LINE STREETCAR CONFLICTS

ISSUES AND NEEDS

- Safety concerns and incidents due to streetcar, pedestrian, vehicle, cyclist conflicts
  - Afternoon peak alternate routes
  - Planned special events
ENHANCED SIGNAL COORDINATION AND TRAFFIC PROGRESSION

ISSUES AND NEEDS

- Morning backups and congestion
- Planned special events backups and congestion
- MacDill Air Force Base controlled access points congestion
CV Apps Adaptation

- **Forward Collision Warning (FCW)**
  - **Definition** - Warns the driver of the vehicle in case of an impending rear-end collision with another vehicle ahead in traffic in the same lane and direction of travel.
  - **Adaptation** – Used as designed

- **Emergency Electronic Brake Light (EEBL) Warning**
  - **Definition** - Enables a vehicle to broadcast a self-generated emergency brake event to surrounding vehicles. Upon receiving the event information, the receiving vehicle determines the relevance of the event and if appropriate provides a warning to the driver in order to avoid a crash.
  - **Adaptation** – Used as designed

- **Curve Speed Warning (CSW)**
  - **Definition** - Allows connected vehicles to receive information that it is approaching a curve along with the recommended speed for the curve. This capability allows the vehicle to provide a warning to the driver regarding the curve and its recommended speed
  - **Adaptation** – Used as designed, with input scaled to safe stopping distance
CV Apps Adaptation

- Intersection Movement Assist (IMA)
  - Definition - Warns the driver of a vehicle when it is not safe to enter an intersection due to high collision probability with other vehicles at stop sign controlled and uncontrolled intersections.
  - Adaptation – Used as Designed

- Red Light Violation Warning (RLVW)
  - Definition - Enables a connected vehicle approaching an instrumented signalized intersection to receive information from the infrastructure regarding the signal timing and the geometry of the intersection
  - Adaptation – Used as designed to predict violation, plus added TIM warnings:
    - Before vehicle enters a closed ramp
    - To oncoming traffic when vehicle enters closed ramp
    - To Master Server when vehicle enters closed ramp for Law Enforcement
    - Warnings canceled when wrong-way vehicle exits or reverses direction
CV Apps Adaptation

• Intelligent Traffic Signal System (I-SIG)
  – Definition - Uses both vehicle location and movement information from connected vehicles as well as infrastructure measurement of non-equipped vehicles to improve the operations of traffic signal control systems. The application utilizes the vehicle information to adjust signal timing for an intersection or group of intersections in order to improve traffic flow, including allowing platoon flow through the intersection.
  – Adaptation – Used as mathematically designed, plus:
    • Hard-coded site-specific test constants become configurable fields
    • Manufacture-specific constants become configurable fields
    • Generalize the hard-coded, fixed-phase sequences to configurable fields
• Probe Enabled Data Monitoring (PeDM) or Vehicle Data for Traffic Operations (VDTO)
  – Definition - Uses probe data information obtained from vehicles in the network to support traffic operations, including incident detection and the implementation of localized operational strategies.
  – Adaptation – Aggregate incremental BSM movements to travel time, incidents
CV Apps Adaptation

• Pedestrian in signalized crosswalk warning
  – Definition - Provides to the connected vehicle information from the infrastructure that indicates the possible presence of pedestrians in a crosswalk at a signalized intersection.
  – Adaptation – Translate WiFi PSM to DSRC BSM for FCW and IMA

• Mobile Accessible Pedestrian Signal System (PED-SIG)
  – Definition - Integrates traffic and pedestrian information from roadside or intersection detectors and new forms of data from wirelessly connected, pedestrian (or bicyclist) carried mobile devices (nomadic devices) to request dynamic pedestrian signals or to inform pedestrians when to cross and how to remain aligned with the crosswalk based on real-time Signal Phase and Timing (SPaT) and MAP information.
  – Adaptation – Used as designed
CV Apps Adaptation

- Transit Signal Priority (TSP)
  - Definition - Uses transit vehicle to infrastructure communications to allow a transit vehicle to request an priority at one or a series of intersection. The application includes feedback to the transit driver indicating whether the signal priority has been granted or not.
  - Adaptation – Used as designed, plus:
    - Vehicle Identification Number (VIN) authenticated by HART central
    - Priority Request selectively granted or blocked by HART central

- Vehicle Turning Right in Front of Bus (VTRFB)
  - Definition - Determines the movement of vehicles near to a transit vehicle stopped at a transit stop and provides an indication to the transit vehicle operator that a nearby vehicle is pulling in front of the transit vehicle to make a right turn.
  - Adaptation – transit vehicle is a trolley
# Systems Engineering Approach

## Level 6
- **Needs & Feasibility**
- **Operate & Maintain**

## Level 5
- **Concept of Operations**
- **System Validation**

## Level 4
- **Requirements**
- **System Verification**

## Level 3
- **High Level Design**
- **Subsystem LTP**

## Level 2
- **Detailed Design**
- **Units / Devices**

## Level 1
- **Existing Software & Hardware (Available From)**
- **From Other Projects**

**Phase 3**
- **P3 Deliverable**
- **Install & Test 40 Locations**
- **Install & Test in 1500 Cars**

**Phase 1**
- **Install & Test 6 UI Design Test Cases**

**Phase 2A**
- **Integrate & Test Apps into RSU**

**Phase 2B**
- **Integrate & Test Apps into RSU**
- **Integrate & Test Apps into OBU**
- **Integrate & Test Apps into Phone**
- **Integrate & Test Apps into Phone**

**Phases 2C**
- **Infrastructure HW Security & Test**
- **V2I Apps Security & Test**
- **Android Phone Security & Test**
- **V2X Apps Security & Test**
- **V2X & V2I Apps Security & Test**

**Subsystems**
- **Unit Device LTP**

**From Other Projects**
- **V2I Apps (OGADP, CAMF)**
- **Android Phone**
- **V2X Apps (OGADP)**
- **V2X Apps (OGADP)**
- **V2X & V2I Apps (CAMF)**

**Project Stakeholders**
For More Information

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Questions?