REGIONAL TRANSIT SIGNAL PRIORITY
INTEROPERABILITY

Mark Pitstick, Ph. D.
Chicago Regional Transportation Authority (RTA)

24th Annual Transportation Research Conference
May 22nd, 2013
Presentation Overview

- Introduction / Background
- Who? – Participants & Roles
- What? – Interoperable TSP Program
- When? – 5 Year Program
- Where? – 30 Arterial Corridors
- Closing Comments
RTA Transit System

• 2 million trips per day
• 3rd largest system
• 6 counties
• 8 million people

Agencies
• CTA – Urban Bus & Rail
• Metra – Commuter Rail
• Pace – Suburban Bus
• RTA – Funding/Oversight
Who? – Participants and Roles

**Agencies**
- Regional Transportation Authority
- Chicago Transit Authority
- Pace Suburban Bus Company
- Illinois DOT
- City of Chicago DOT
- Local DOTs

**TSP Working Group**
All agencies listed above, plus:
- Lake County DOT
- Federal Transit Administration
- Chicago Metropolitan Agency for Planning (CMAP)
Who? – Participants and Roles

Program Managers – RTA (supported by URS Team)

TSP Implementers
• Primary – CTA and Pace
• Secondary – DOT’s

Engineering Consultants
• URS Team – Program Management & Systems Eng.
• Traffic Engineers
• TSP Design Engineers

TSP System Vendors/Installers/Systems Integrators
Who? – Participants and Roles

Federal Funding (FTA / CMAP)
- Review / Comment on Program Documentation
- Program Documentation
- Approvals and Concurrences

Program Manager and Local Match Provider (RTA)
- Concept of Operations
- Technical System Requirements
- Regional TSP Standards and Guidelines
- TSP Implementation Updates
- Program Validation Activities

TSP Implementers (CTA, Pace, IDOT, CDOT, & local DOTs)
- Transit and Traffic Signal Data for Program Validation

Program Management/Systems Engineering Support (URS)
- TSP System Design Plans
- TSP Procurement Reviews
- TSP Installation Reviews
- Acceptance Testing Oversight

TSP Design Engineering Firms (TBD)

TSP Vendors & Installers (TBD)
- Project Management
- TSP System Installation

Project Management
- TSP Corridor Engineering
What? – Regional TSP Implementation Program

What is TSP?

What do we mean by Interoperability?

- Communication Equipment
- Message Sets
Program Goals & Objectives

1. Establish Regional TSP Standards and Implementation Guidelines
   - Operational guidelines for requesting & granting TSP
   - “Open standards” for equipment (non-proprietary)
   - Compatible technology for communications throughout the region
   - Centralized TSP system monitoring
   - Performance measures to assess effectiveness
Program Goals & Objectives (continued)

2. Implement TSP along priority corridors throughout the region
   - 5 year program (2013 – 2017)
   - ~ 30 Arterial Corridors
   - $40 million CMAQ grant to the RTA

3. Reduce travel times, schedule variability and fuel consumption
Why? – Reasons and Anticipated Benefits

• **Improve Transit Performance**

• **Support BRT and ART Corridors**

• **Need for Interoperability**
  – Legacy TSP Systems & Corridors
Legacy TSP Systems

**Pace/CTA Corridor**
- Cermak Road

**CTA Corridor**
- Western Avenue (2 segments)

**Pace Corridors**
- Washington Street
- Harvey Transp. Center
Why? – Reasons and Anticipated Benefits

• **Guiding Principles**
  – Utilize existing on-board AVL systems and vehicle technology to generate TSP requests
  – Utilize readily available off-the-shelf communications technology
  – Leverage TSP communications infrastructure for other transit ITS applications
  – Create standards-based communication protocols between buses and intersections
Why? – Reasons and Anticipated Benefits

- **Anticipated Benefits**
  
  - **Transit**
    - Better transit performance
    - Reduced transit operating cost
    - Minimize vehicle-based TSP equipment (amount & variety)
  
  - **Highways**
    - Optimize and maintain traffic signal coordination
    - Minimize intersection-based TSP equipment (amount & variety)
    - Leverage TSP equipment for interconnecting signals (& central communication?)
How? – Systems Engineering Approach

- **Program Management Plan (PMP)**
- **Systems Engineering Management Plan (SEMP)**
- **Concept of Operations (ConOps)**
  - Centralized versus Distributed approach
How? – Systems Engineering Approach

- Vehicle-to-Intersection Communications

**Wireless Technologies**
- DSSS/FHSS (900 MHz)
- Wi-Fi (2.4 or 5.0 GHz)
- Public Safety (4.9 GHz)
- Cellular (4G LTE)
- DSRC (5.9 GHz)
How? – Systems Engineering Approach

- **Intersection-to-Intersection Communications**
How? – Systems Engineering Approach

- Intersection-to-Center Communications

Or .....
• **Operational Environment - Existing Equipment**
  
  – **CTA Buses**
  
  • Clever Devices AVL System
  • CTA Jeffrey Jump BRT Corridor Demonstration
    – 5.0 GHz communications to intersections
  • Wireless router on new buses

  – **Pace Buses**

  • Trapeze TransitMaster AVL System
  • Previous TSP Demonstrations with several TSP vendors
  • Wireless router on new buses
How? – Systems Engineering Approach

- **Operational Environment - Existing Equipment**
  - **CDOT Traffic Signal Controllers**
    - Peek ATC-1000 Controllers
    - Central communications with MIST Traffic Mgmt. System
    - Communications box (C-box) with router at intersections
  
  - **IDOT / Local DOT Traffic Signal Controllers**
    - Mix of Econolite / Eagle Controllers
    - Many closed-loop signal systems (non-centralized); dial-up communications to master controllers
    - Lots of Emergency Vehicle Preemption (EVP) systems
When? – Five-Year Program

• **2013 Activities**
  - *Program Management Plan (PMP)*
  - *Systems Engineering Management Plan (SEMP)*
  - *Preliminary Engineering for Initial TSP Corridors*
    - Traffic Engineering
    - Communication Assessment
    - Signal Optimization
When? – Five-Year Program

- **Annual Program of Projects (2014-2017)**
  - TSP Preliminary Engineering
  - TSP Design Engineering
  - TSP Implementation
Where?

2013 Preliminary Eng.

- **CTA Corridors**
  - Ashland Ave.
  - Western Ave.

- **Pace Corridors**
  - Grand Ave.
  - Roosevelt Rd.
  - 95th Street
  - 147th Street
  - 159th Street
  - Cicero Ave.
Where?

~30 TSP Corridors

- CTA Corridors
- Pace Corridors
- CTA & Pace
Our Vision

- TSP Corridors
- ART Corridors
- BRT Corridors
Closing Comments

- This is a complicated program
- Lots of participants / agencies
- Lots of moving and stationary parts
- We have been working on this a long time
- We still have a lot of work to do
- We believe that interoperability is the right way to go
Thank You!

Mark E. Pitstick, Ph.D.
Technical Advisor, Planning
Regional Transportation Authority
175 W. Jackson Blvd., Suite 1650
Chicago, IL 60604
Email: pitstickm@rtachicago.org
Program Work Tasks (RTA and URS)

- Program Management
- Systems Engineering
- Implementation Oversight
- Program Validation
How? – Systems Engineering Approach

- Operational Scenarios
  1. TSP Requested and Granted
  2. TSP Requested and Denied
  3. Simultaneous TSP Requests from Buses with the Same Priority Level
  4. Simultaneous TSP Requests from Buses with Different Priority Levels
  5. Simultaneous TSP and EVP Requests
How? – Systems Engineering Approach

• **Operational Scenarios**

  6. Fleet Changes
  7. Service Changes
  8. TSP System Central Monitoring
  9. Planned Event Impacting TSP System Operations
  10. Un-planned Event Impacting TSP System Operations
  11. Loss of Central Communications
How? – Systems Engineering Approach

• **Technical System Requirements**
  – NTCIP / SAE standards
  – Priority Request Generator (PRG)
  – Priority Request Server (PRS)
  – TSP Protocols (PRO)
  – TSP Communications (COM)
  – TSP Central Software (SOFT)