
Applying Systems Engineering to Implementation of Adaptive Signal Control Technology

Jeffrey A. Lindley
Associate Administrator for Operations USDOT,
Federal Highway Administration (FHWA)
jeffrey.lindley@dot.gov

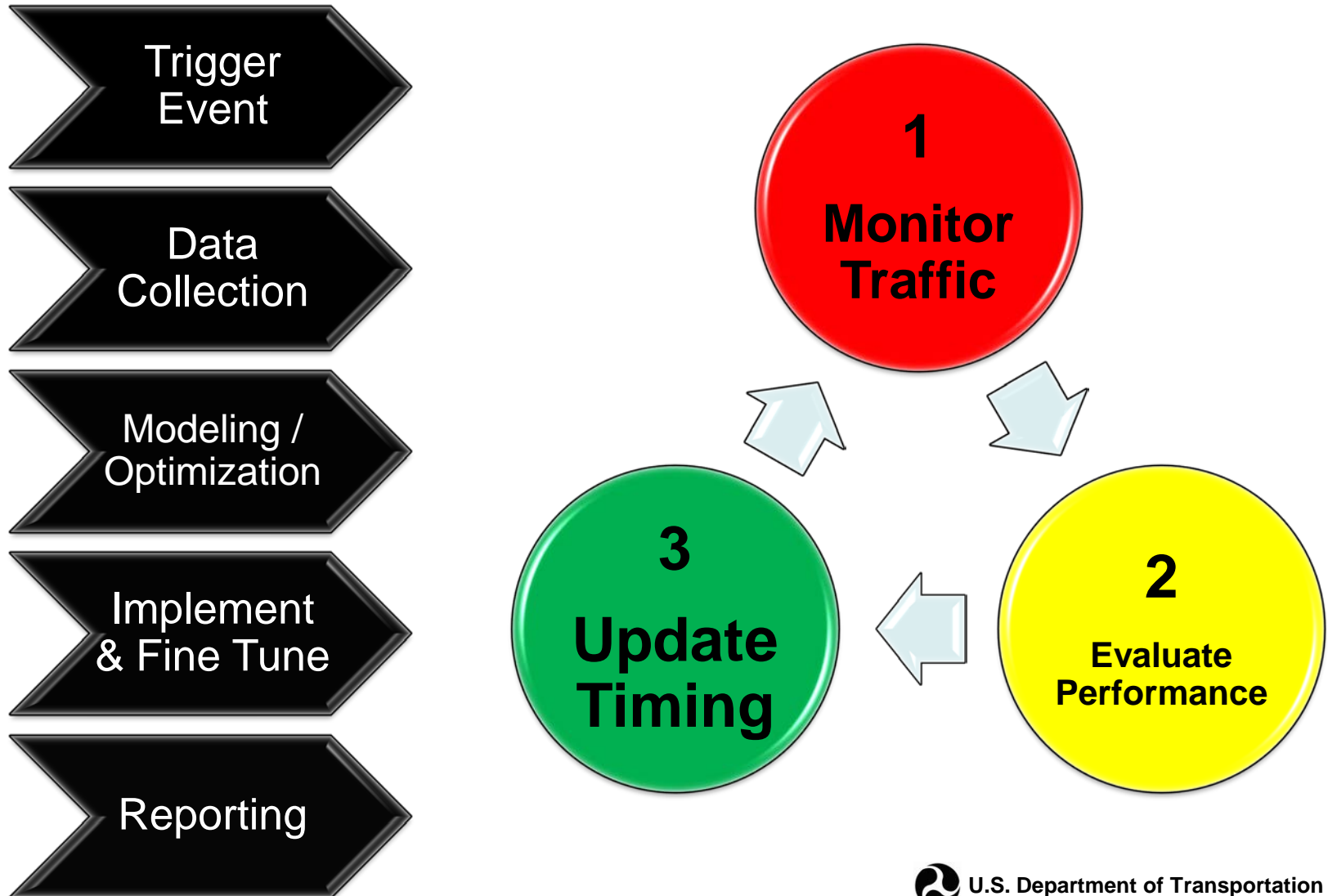
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Outline

- **ASCT Benefits**
- **ASCT Deployment Penetration**
- **Barriers to ASCT Adoption**
- **Overcoming Barriers by Managing Risks**
- **The Role of Systems Engineering**
- **Your Questions**



A daptive Signal Control Technology

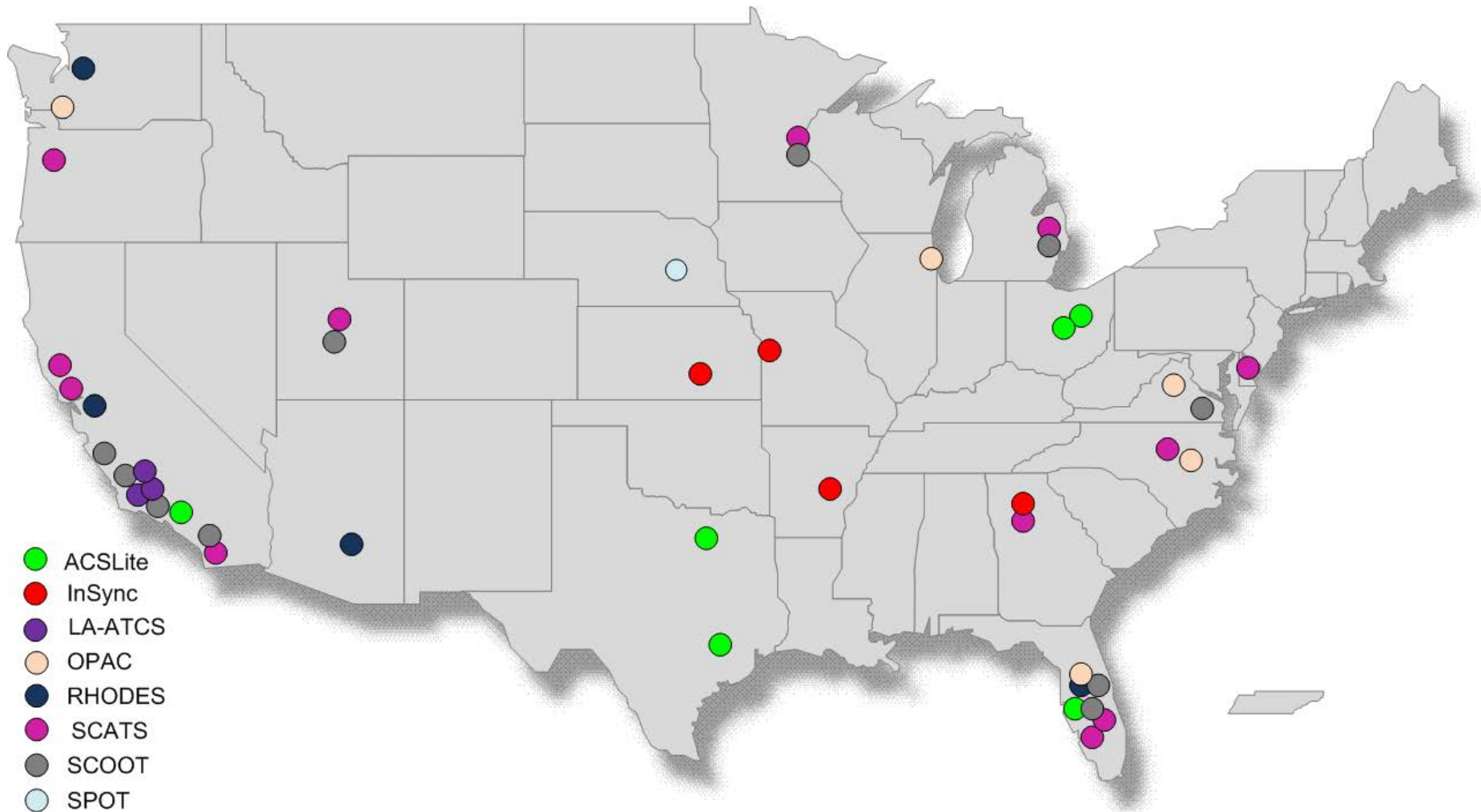


ASCT Benefits

- **Better**
 - **Benefits to both road users & public agencies**
 - **Travel time reduction 13% - 50%**
 - **Fuel Consumption 8% - 38%**
 - **Ongoing performance measurement**
- **Smarter**
 - **Solves problems that are difficult to address with time-of-day and traffic responsive timing**
 - **Saves cost of mundane data collection and retiming**
- **Faster**
 - **Reduces retiming intervals from years to minutes**



US Implementation 1992-2009



Source: NCHRP 403 2010 & FHWA Arterial Management Program

Lessons from ASCT Demonstrations

- **Substantial benefits over coordinated TOD operation**
 - **Travel time, Delay, Emissions,**
 - **Congestion, Safety**
- **Most effective where demand conditions are variable and unpredictable**
- **Most effective on linear arterials, limited success within tight grids**
- **Most effective in under-saturated conditions**



Identified Barriers to ASCT Adoption

- **Complexity**
- **Cost**
- **Uncertainty about Benefits**



Every Day Counts – Better, Faster, Smarter



- **FHWA Initiative focused on Shortening Project Delivery and Deploying Innovative Technology**
- **Two year effort (2011-2012) focused on 5 technologies including ASCT**

Successful Technology Deployment

- **Goals well understood**
- **Agency describes its needs**
- **Positive response to requirements in RFP**
- **Requirements are verified**
- **Performance objectives are validated**
- **System is effective over entire life cycle**



What are the Risks - ASCT?

- **Problem could be solved with other strategies**
- **Functional objectives of the system may not align with agency objectives**
- **Loss of other critical functions / features**
- **Constraints not properly addressed**
- **Cost**
- **Maintenance**



Other ASCT Risk Issues

- **Technology NEW to most**
- **Technology still evolving**
- **Most systems have very limited track record**
- **Documented history of failed ASCT projects (40%+)**
- **Significantly increased complexity**
- **Extremely dependent on infrastructure**
 - **Communications systems**
 - **Detection**
 - **Staff**
- **Not “one size fits all”**
- **Marketing exceeds performance in many cases**



The Role of Systems Engineering

**Understanding
the problem**

Managing risk

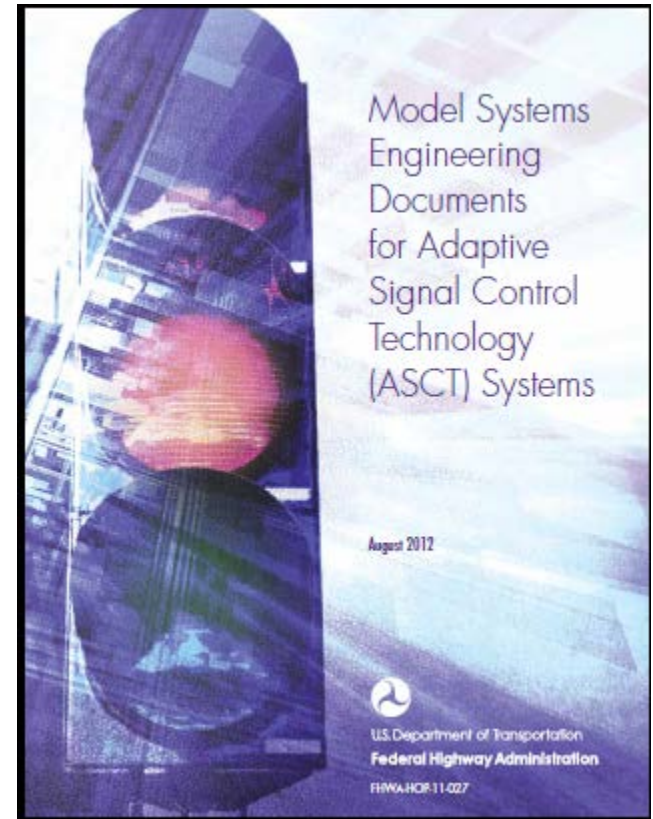
- Projects getting bogged down with shifting requirements
- Acquisitions being challenged by unsuccessful bidders/proposers/vendors
- Projects not meeting agency needs

+ it is mandatory for U.S. federal-aid projects



Purpose of SE Model Documents

- Evaluate need for Adaptive Control
- Help agencies identify verifiable, needs-driven requirements for evaluating design and implementation choices
- Model documents greatly reduce systems engineering effort by providing wording and documentation...
- ...but agencies still must identify their needs



Model Document *Process*

Build Requirements

- Answer questions
 - About the situation
 - About you
- Select and tailor ConOps statements
- Select and tailor requirements

Evaluate Alternatives

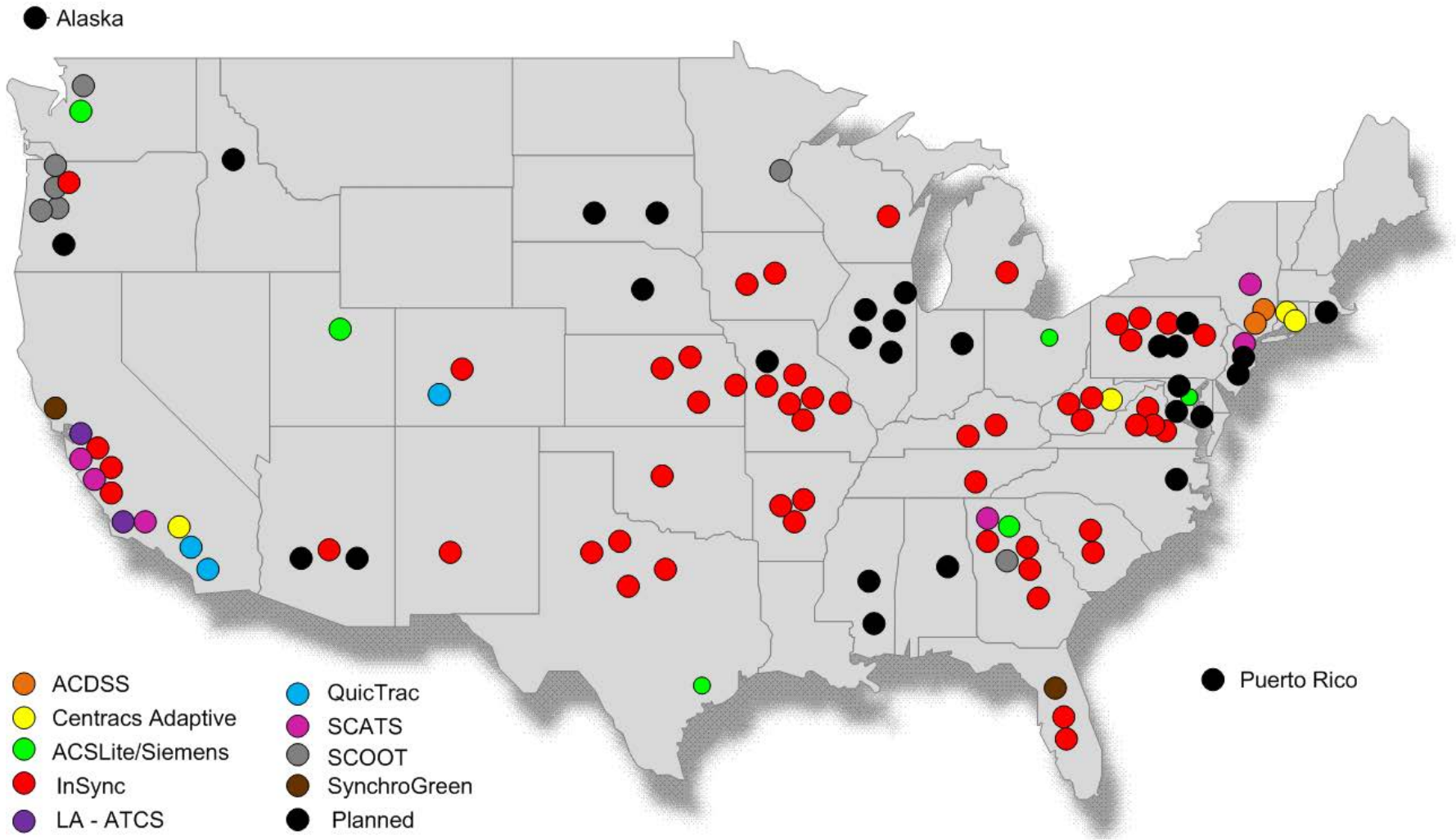
- Evaluate proposed approaches/products against requirements
- Solution feasible given constraints?

Continue Tailoring Until Solutions...

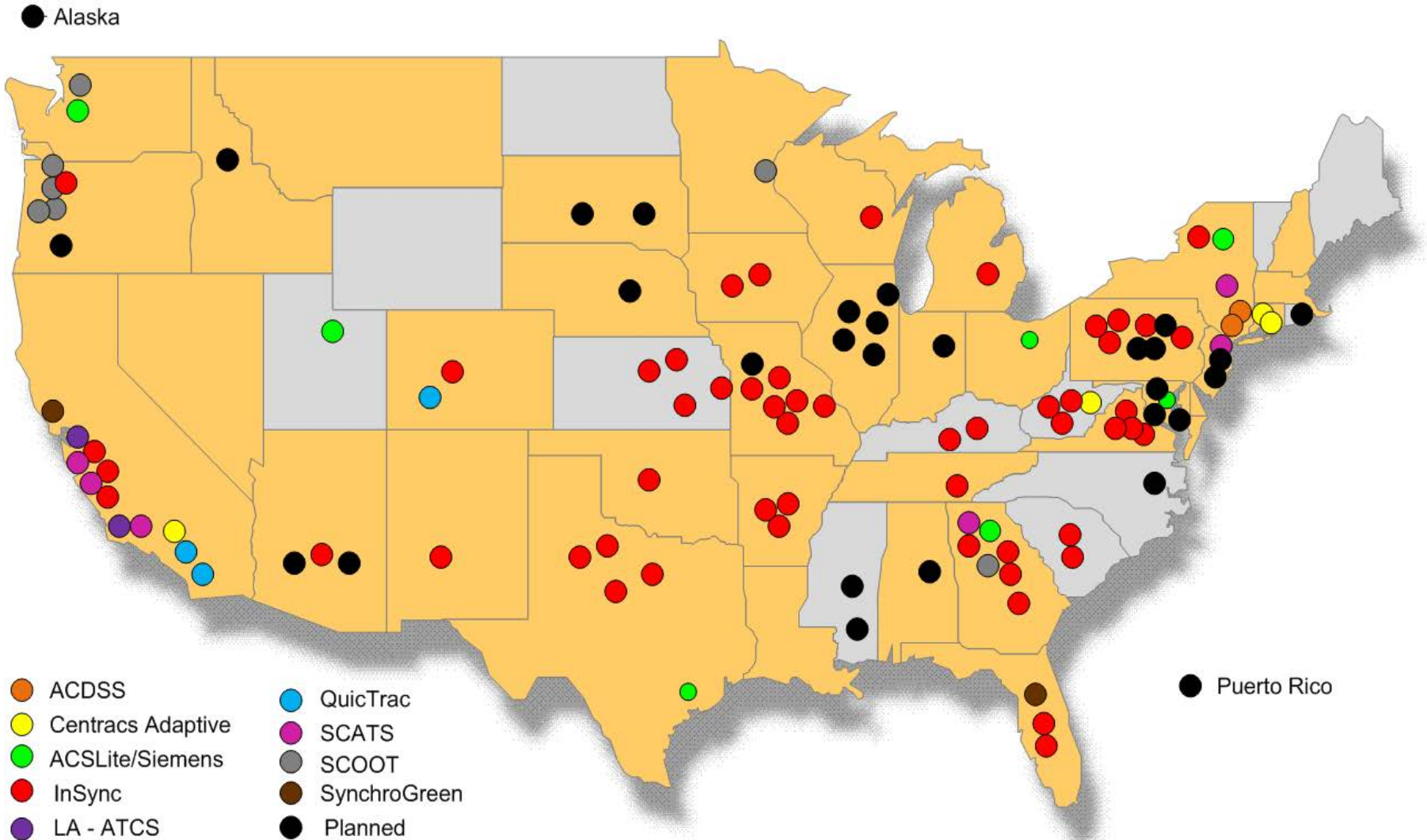
- Fulfill requirements
- Are feasible



US Implementation 2010 - 2012



FHWA EDC/ASCT Influence 2010-2012



Summary

- **ASCT investments can produce significant benefits**
- **Barriers to more widespread adoption still exist**
- **Barriers can be overcome by focusing on managing risks and using systems engineering process**
- **Use of systems engineering process has helped spur a dramatic increase in ASCT deployments in the United States**



Questions?