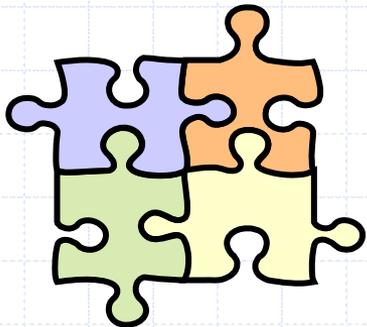


# Systems Engineering

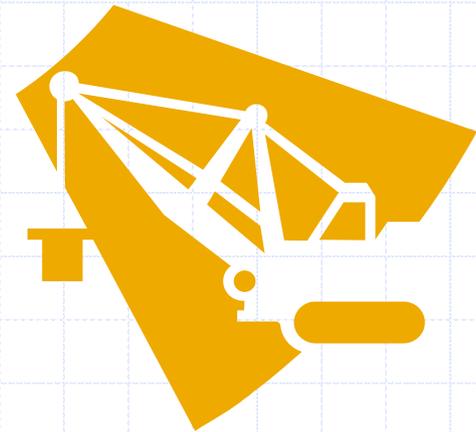
“Understanding Where it Fits in Your Agency”



a session in fhwa's Systems Engineering t3 series  
aug. 02, 2007

# Presentation Overview

- ◆ Purpose
- ◆ Background
- ◆ Systems Engineering (SE) in the Process
- ◆ SE Challenges and Recommendations
- ◆ Conclusions
- ◆ Resources



# Purpose of Session

- ◆ Illustrate where, in an agency's business processes and practices, to consider systems engineering
- ◆ Illuminate challenges to including systems engineering
- ◆ Provide recommendations on inclusion of systems engineering in your processes



# Systems Engineering Background

- ◆ National need for quality assurance and control in the ITS project delivery process
  - Planning
  - Deployment
  - Operations and Maintenance
- ◆ Federal philosophy on SE and ITS Projects
  - Make sure, place and time, the right system is proposed, implemented AND delivered on time and within budget

# Systems Engineering Background

- ◆ ITS Final Rule Key Legislative Points
  - Regional Architecture Development
  - Use of ITS standards
  - Use of Systems Engineering in the project delivery process (23 CFR 940.11)



# Systems Engineering Background

Is Systems Engineering  
Really New To  
Transportation



# Systems Engineering Background

Not Really...

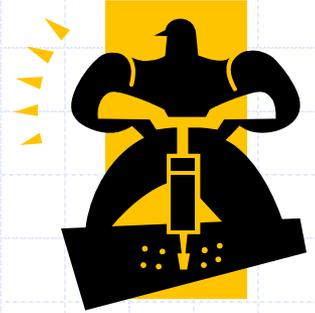


U.S. Interstate Highway **System** built using many systems engineering principles

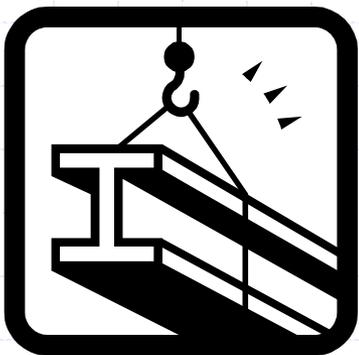
# Systems Engineering Background

- ◆ Systems Engineering and the Interstate
  - Started with a vision of the needs the interstate system would provide for
  - Required planning and stakeholder collaboration
  - Set requirements and standards for seamless connectivity
  - Led to design expectations and quality control and assurance
  - Incorporated operations and maintenance





“Many local programs are modeled after the same project delivery process used to build the Highway Interstate System”



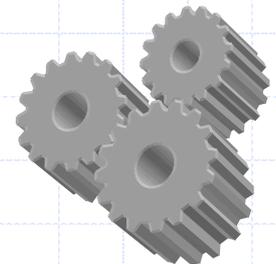


“Systems engineering may  
already be part of your  
Agency's business  
processes”



# Where to Consider SE

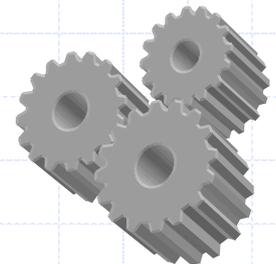
- ◆ What is meant by “mainstreaming” and “integrating systems engineering into your business processes and practices
  - Evaluation and selection within your formal project planning/program funding process
  - Formally addressing ITS in your project delivery documents



# Where to Consider SE

## ◆ Should address:

- Project selection based on regional transportation merits and needs
- Use similar quality assurance and control you apply on your traditional roadway projects



# Where to Consider SE

- ◆ Ideally, systems engineering is specialized enough to have a separate group provide agency support full-time
  - For many agencies, frequency and level of ITS do not justify this level of support

# Where to Consider SE

## ◆ Planning and Program Funding

- TIP/STIP

## ◆ Design

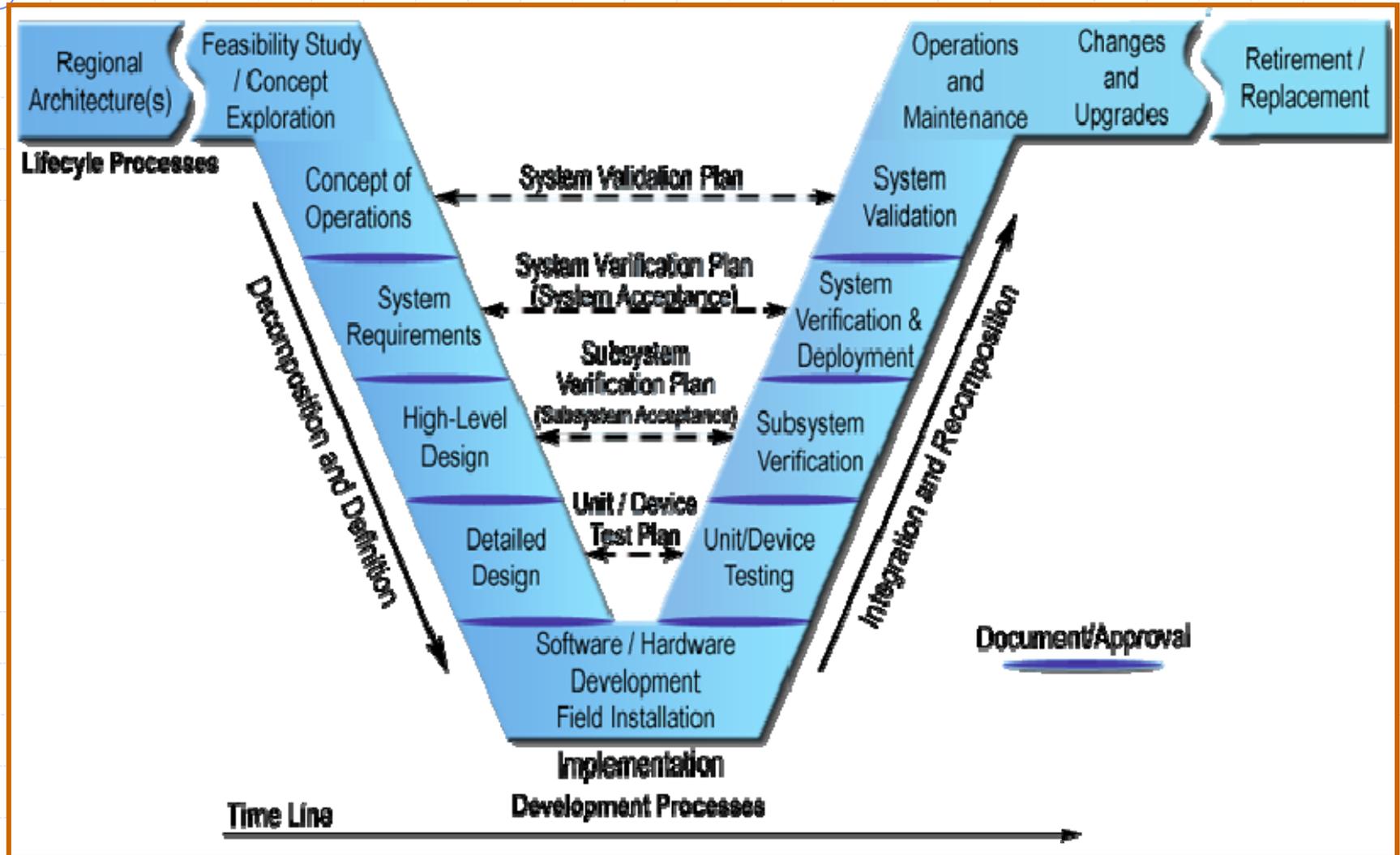
## ◆ Procurement

- Selecting the appropriate contract

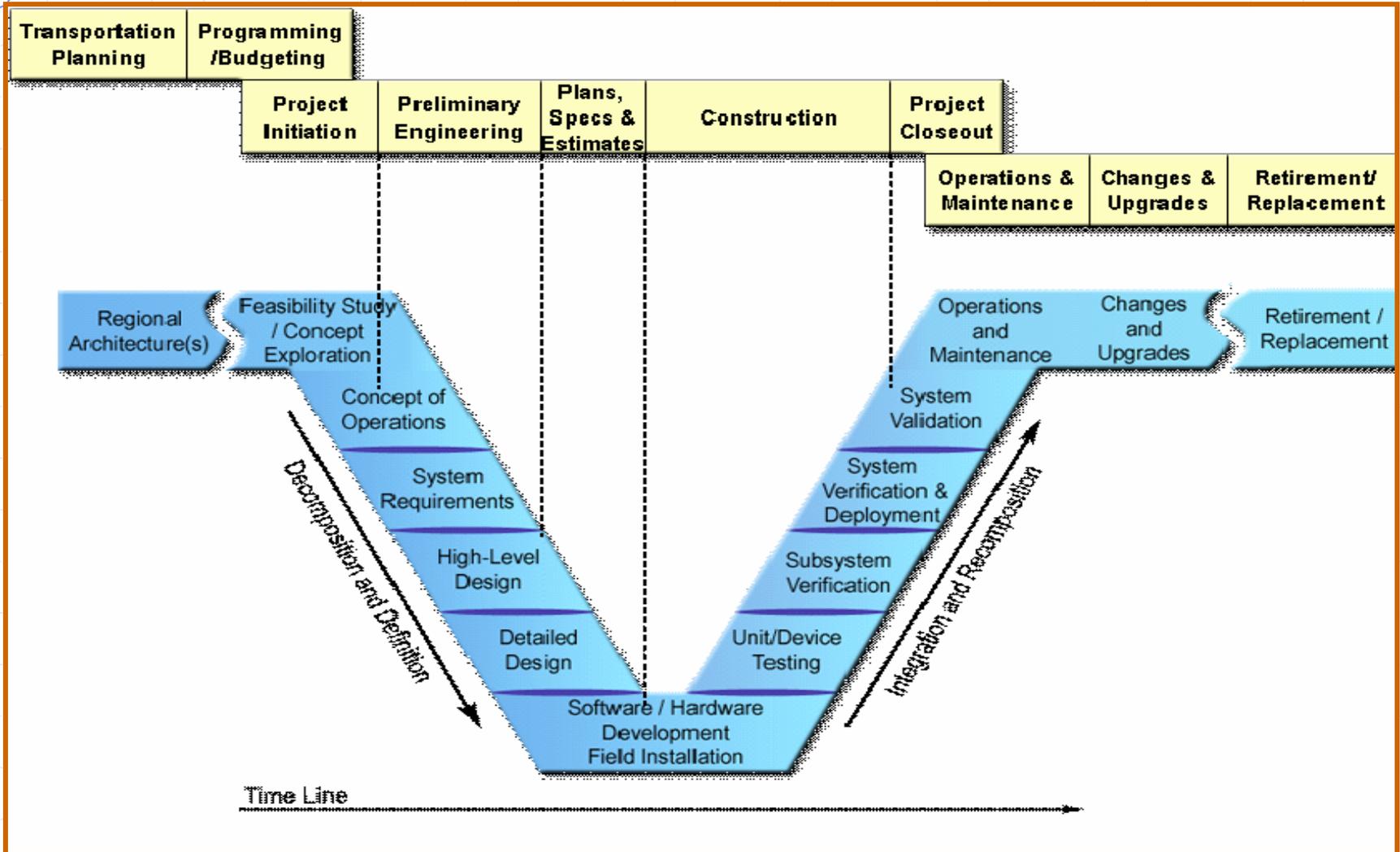
## ◆ Implementation

- Consider O&M and system upgrades/retirement

# Where to Consider SE



# Where to Consider SE



# Where to Consider SE

- ◆ Systems Engineering by the numbers
  - ITS Final Rule, 23 CFR 940.11 Compliance
    - ◆ Use of Regional ITS Architecture
    - ◆ Identify project roles and responsibilities
    - ◆ Define requirements
    - ◆ Conduct an alternative analysis
    - ◆ Address procurement options
    - ◆ Use of ITS standards
    - ◆ Operations and Maintenance



# Systems Engineering Challenges

## ◆ Institutional

- Attitude that systems engineering is new. "Our way of doing it is fine"
- Others within or among agencies may need assistance

## ◆ Resource Management

- Knowledge and time. "Staff has enough to do without having something new to learn"
- Long term operational and maintenance considerations

## ◆ Support

- Contractor and professional services also just learning about SE

# Recommendations

- ◆ Have a vision for your ITS projects/programs
- ◆ Know what you have first
  - SE Process Improvement Review
- ◆ Use existing processes if possible; modify as needed
- ◆ Risk management is key
  - Secure the right resources
  - Establish formal processes
    - ◆ When possible apply existing ones to ITS
    - ◆ Be prepared to add additional elements



# Conclusions

- ◆ Systems engineering is already being done by many agencies
- ◆ Political, management and staff turn-over is inevitable
  - Institutionalizing systems engineer will reduce risk of selecting ITS projects that don't meet their intended need and end up over budget and late

# Resources

- ◆ Contact FHWA Resource Center/Division Offices
- ◆ Systems Engineering Web Page (FHWA)  
[http://www.ops.fhwa.dot.gov/int\\_its\\_deployment/sys\\_eng.htm](http://www.ops.fhwa.dot.gov/int_its_deployment/sys_eng.htm)
- ◆ Lessons Learned Knowledge Resource (ITS JPO)  
[http://www.itslessons.its.dot.gov/its/benecost.nsf/LessonSystem\\_sEng](http://www.itslessons.its.dot.gov/its/benecost.nsf/LessonSystem_sEng)
- ◆ Archived T3 Webinars  
<http://www.pcb.its.dot.gov/T3/archives.asp>
- ◆ California SE Guide Book  
<http://www.fhwa.dot.gov/cadiv/segb>
- ◆ Guide to Contracting ITS Projects (NCHRP)  
<http://www.trb.org/nchrp/its/index.htm>

# For Presentation Information

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