Managing ITS Technology Deployment Using Systems Engineering

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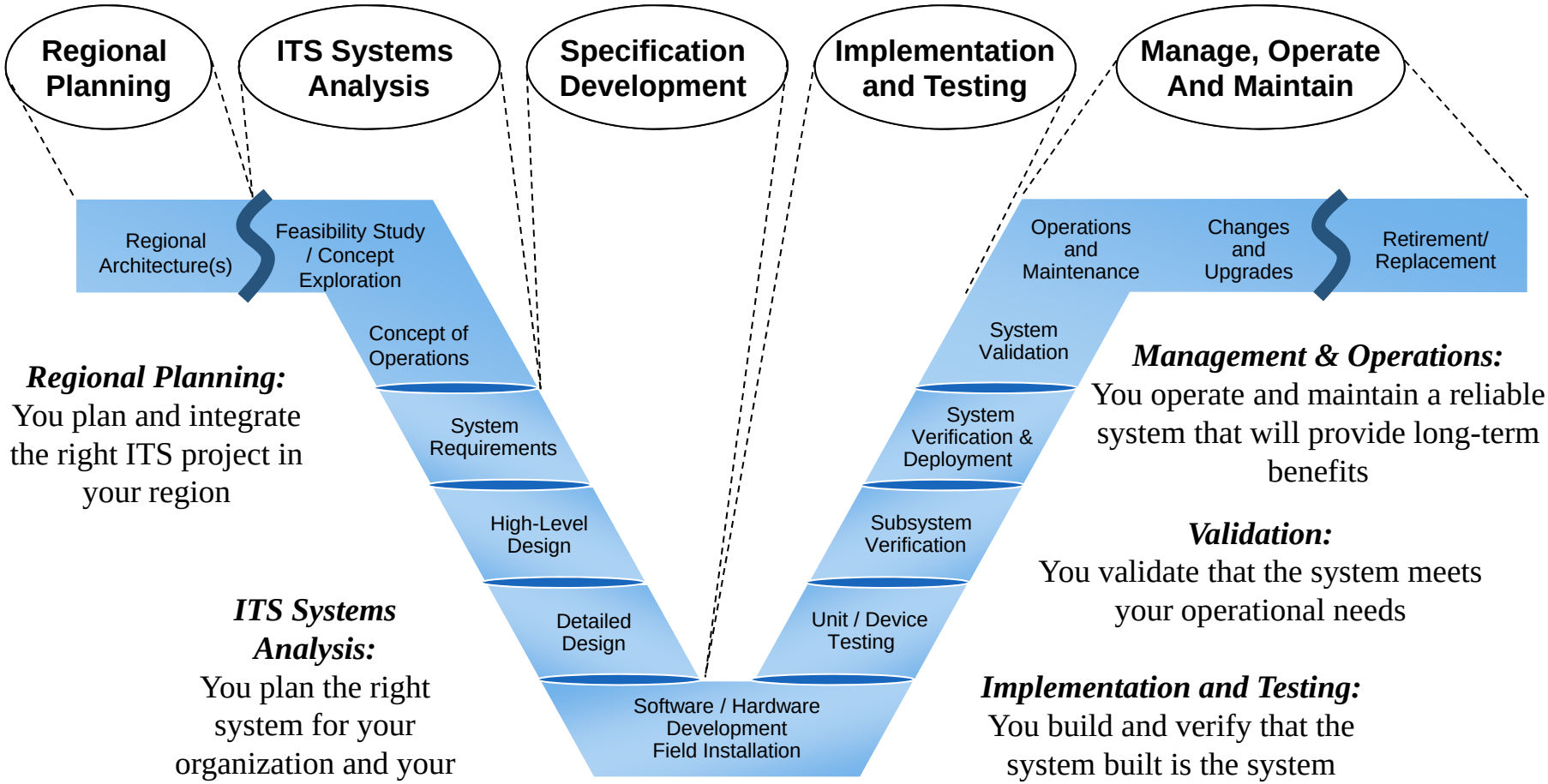
Systems Engineering Process / ITS System Life Cycle



Regional Planning:
You plan and integrate the right ITS project in your region

ITS Systems Analysis:
You plan the right system for your organization and your customers

Specification Development:
You design a high quality, high value system for the least cost

Implementation and Testing:
You build and verify that the system built is the system specified

Validation:
You validate that the system meets your operational needs

Management & Operations:
You operate and maintain a reliable system that will provide long-term benefits

Probably Already Doing Some SE

Systems Engineering	Project Development
Regional ITS Architecture	Transportation Planning
Feasibility	Project Scoping
Risk Management	-
Concept of Operations	Project Scoping / Design Report
System Requirements	Design Report
High-Level Design	Advanced Detail Plans
Detailed Design	100% Plans, Specifications
Software/Hardware Development	Construction
Unit / Device Testing	Factory / Installation Testing
Subsystem Verification	Integration Tests
System Verification & Deployment	Burn-In Tests
System Validation	Evaluation

Systems Engineering Today

- **Used in the Military and Space Programs and Commercial Systems to manage complex systems**
- **Transportation**
  - **Requirement for FHWA Rule 940/FTA Policy**
  - **ITS Standards**
    - **NTCIP 1203, 1204**
    - **TMDD Version 3, IEEE 1512 Implementation Guide**
    - **NTCIP 1202, NTCIP 1210, NTCIP 1211 (Planned)**

Project Critical Success Factors

From a Standish Group Report

Project Success Factors	Success Points
1. User Involvement	19
2. Executive Management Support	16
3. Clear Statement of Requirements	15
4. Proper Planning	11
5. Realistic Expectations	10
6. Smaller Project Milestones	9
7. Competent Staff	8
8. Ownership	6
9. Clear Vision & Objectives	3
10. Hard-Working, Focused Staff	3
Total	100%

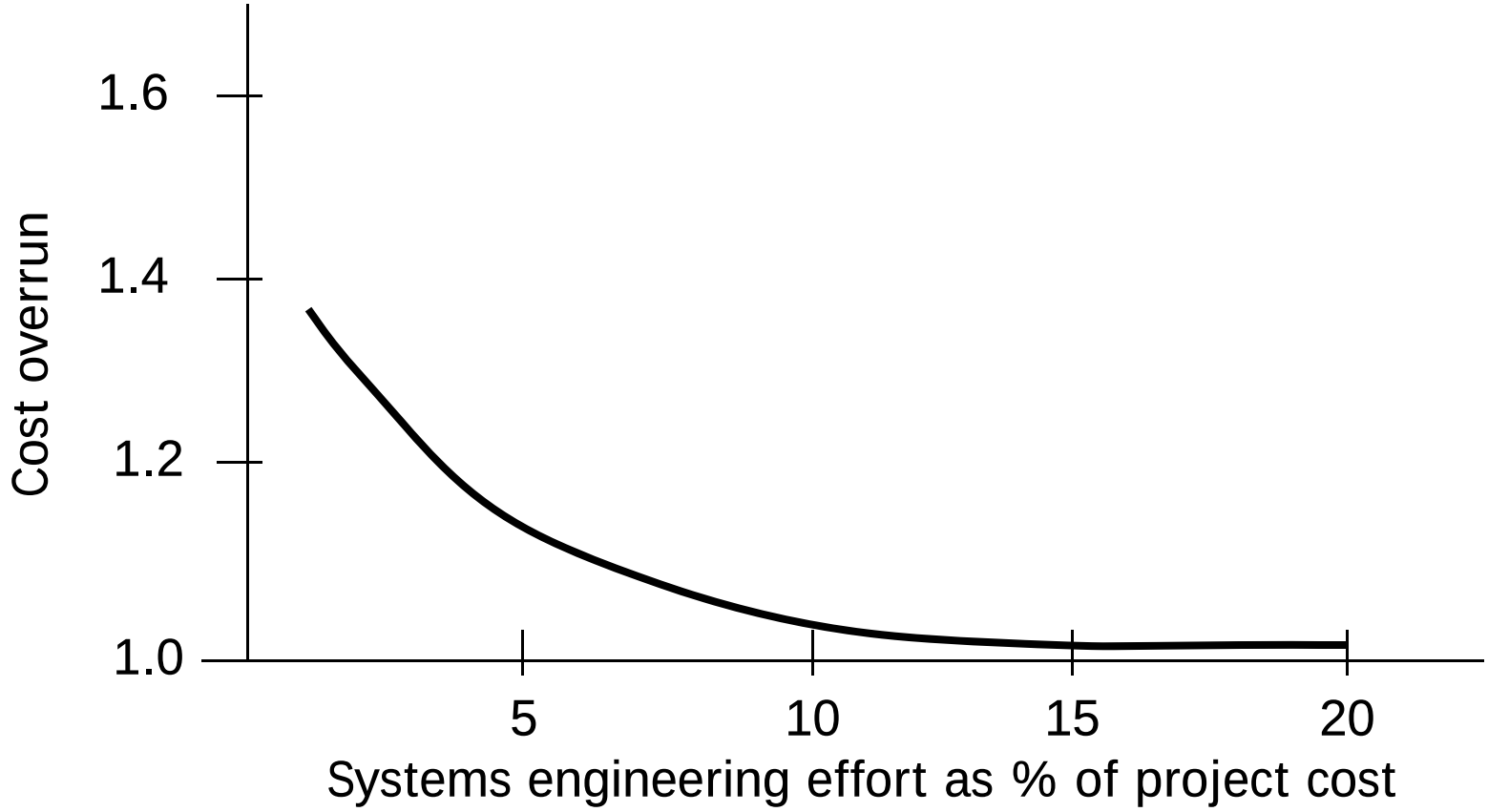
User Involvement

- Get all the stakeholders involved
  - Consider the project life-cycle
    - Who provides the information
    - Who controls the system
    - Who uses the system
    - Who maintains the system
    - Who receives the benefits
- Bound the system

Executive Management Support

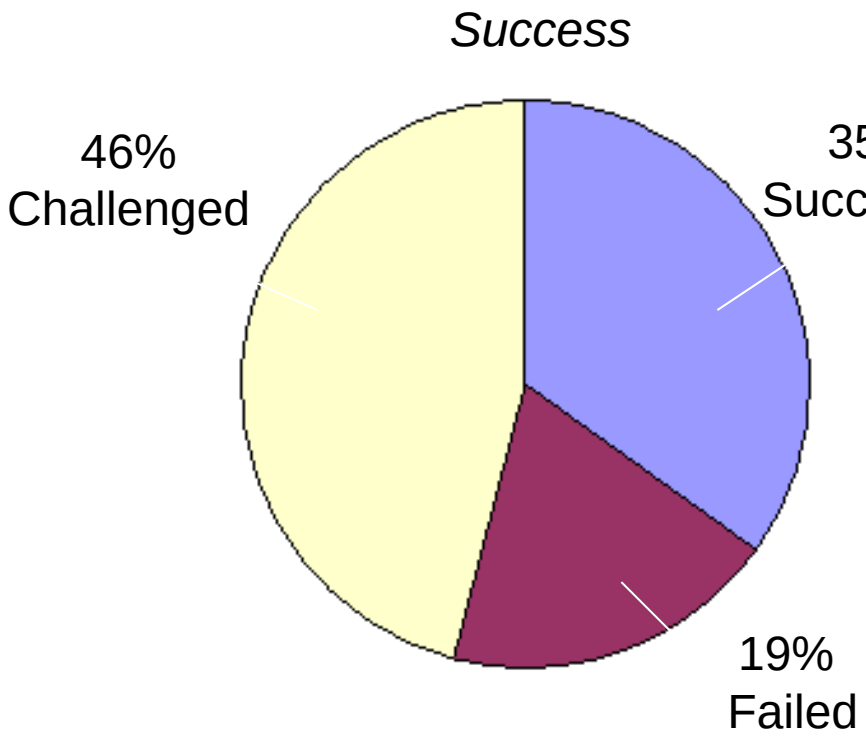
- **Need to get their approval**
- **Build Systems Engineering knowledge**
- **But, how do I prove that SE works?**

SE Helps Reduce Project Costs



Source: Honour, et al., 2004,*Value of Systems Engineering*, Honourcode, Inc., Pensacola, FL

SE Helps Avoid Problems of the Past



Standish Group Chaos Report 2006

Success Rate	2006	2001	1994
Succeeded	35%	23%	16%
Challenged	46%	49%	31%
Failed	19%	28%	53%

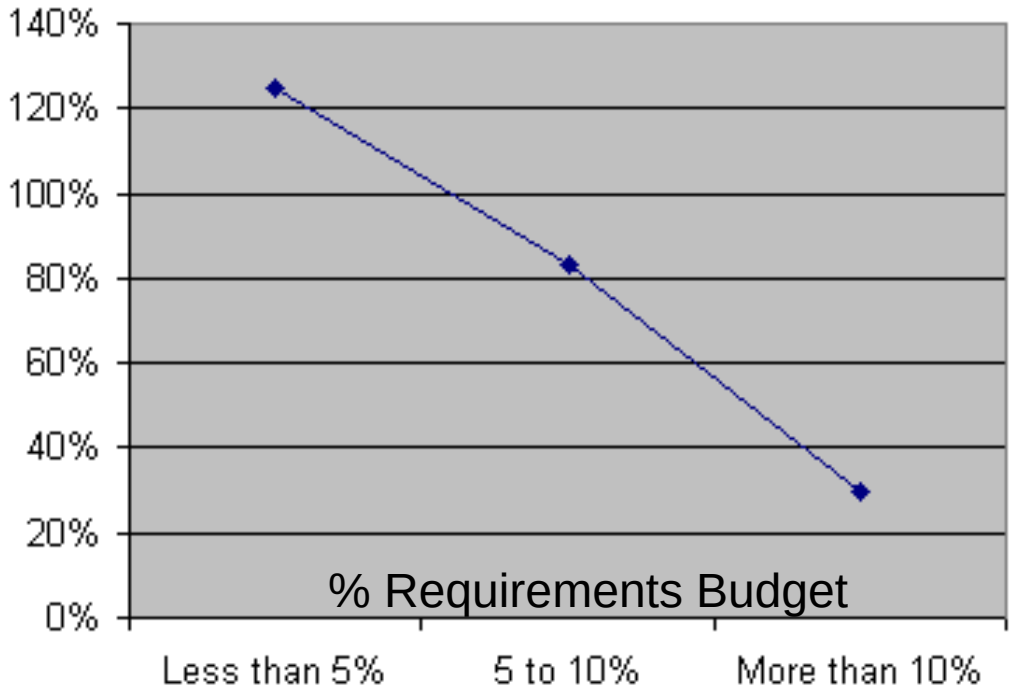
Systems engineering is a contributing factor to project success rates.

Clear Statement of Requirements

- **"Something that governs what, how well, and under what conditions a product will achieve a given purpose"**
- **Provides**
  - **Shared understanding of the problem**
  - **Firm basis for managing project scope**
  - **Connect between user needs and system design**
  - **Foundation for system verification/testing**
- **But, don't forget to include what happens when the system fails!**

Requirements Management Reduces Risk to Budget

- ***NASA Comptroller's Office,***
  as reported by Hooks and Farry, 2001



Spending time on requirements up-front reduces project cost overruns.

Requirements Management Reduces Risk to Budget

- ***Global Survey of Software Developers***
  IEEE Transactions on Software Engineering, 1996

Later Project Phases: Design, Implementation, Test	Effort = Man-Hours Devoted to Requirements	Time = Schedule Devoted to Requirements
Project Completed Faster >>	14%	17%
Project Completed Slower >>	7%	9%

Requirements management results in projects completed with less effort and in less time!

Proper Planning

- **Have a formal process**
  - **Be proactive**
  - **Monitor quality**
  - **Manage risk**

Contribution of ITS Architecture and Systems Engineering to Project Success

Project Success Factors	Points	Success Potential of Your Project Yes = Add Points Value; No = 0
1. User Involvement	19	ITS Architecture: Involves all stakeholders
2. Executive Management Support	16	ITS Architecture: Involves Executive Mgmt. & Policy Makers
3. Clear Statement of Requirements	15	Systems Engineering: Requirements Mgmt.
4. Proper Planning	11	ITS Architecture & Systems Engineering: Planning throughout Project Life-Cycle
5. Realistic Expectations	0	*Project Specific*
6. Smaller Project Milestones	0	*Project Specific*
7. Competent Staff	0	*Project Specific*
8. Ownership	0	*Project Specific*
9. Clear Vision & Objectives	0	*Project Specific*
10. Hard-Working, Focused Staff	0	*Project Specific*
Total	61%	

Conclusions

- **Systems Engineering can help manage your projects to be on-schedule, on-budget and without sacrificing functionality.**
- **Get Executive Management Support.**
- **Involve all stakeholders**
- **Spend the time to manage requirements**
- **Formalize your project development process.**
- **The Regional ITS Architecture supports systems engineering.**

Resources

- **Systems Engineering Handbook**

http://ops.fhwa.dot.gov/publications/seitsguide/index.htm

- **California Systems Engineering Guidebook**

http://www.fhwa.dot.gov/cadiv/segb/

- **Systems Engineering Web Page (FHWA)**

http://www.ops.fhwa.dot.gov/int_its_deployment/sys_eng.htm

THANK YOU

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