Technical Planning for Acquisition Programs: An OSD Perspective

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Defense Systems, Systems Engineering, Enterprise Development

Top Five Systems Engineering Issues

- Lack of awareness of the importance, value, timing, accountability, and organizational structure of SE on programs
- Adequate, qualified resources are generally not available within government and industry for allocation on major programs
- Insufficient SE tools and environments to effectively execute SE on programs
- Poor initial program formulation
- Requirements definition, development, and management is not applied consistently and effectively

NDIA Study in January 2003

DoD Systems Engineering Shortfalls*

- Root cause of failures on acquisition programs include:
  - Inadequate understanding of requirements
  - Lack of systems engineering discipline, authority, and resources
  - Lack of technical planning and oversight
  - Stovepipe developments with late integration
  - Lack of subject matter expertise at the integration level
  - Availability of systems integration facilities
  - Incomplete, obsolete, or inflexible architectures
  - Low visibility of software risk
  - Technology maturity overestimated

Major contributors to poor program performance

USD(ATL) Imperatives

- "Provide a context within which I can make decisions about individual programs."

- "Achieve credibility and effectiveness in the acquisition and logistics support processes."

- "Help drive good systems engineering practices back into the way we do business."

No Course Change from Mr. Krieg—Press On

DoD Response Policy

- All programs shall develop a SE Plan (SEP)

- Each PEO shall have a lead or chief systems engineer who monitors SE implementation within program portfolio

- Event-driven technical reviews with entry criteria and independent subject matter expert participation

- OSD shall review program's SEP for major acquisition programs (ACAT ID and IAM)

Two Policy Memos: Feb 20 and Oct 22, 2004

Striving for Technical Excellence

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- Technical planning

- Technical leadership

- Technical execution

Technical excellence

Strong technical foundation is the value of SE to the program manager

DoD Response
Guidance and Tools

- ## Defense Acquisition Guidebook:
  - SE in DoD Acquisition
  - SE Processes
  - SE Implementation in the System Life Cycle   Chapter 4
  - SE Tools and Techniques, and SE Resources
  - Test & Evaluation   Chapter 9

- ## Systems Engineering Plan:
  - Interim guidance
  - Preparation Guide—Version 1.0 in coordination
  - Twenty-five focus areas to address in technical planning
    - One each, tailored for Milestones A, B, and C

Driving Technical Rigor Back into Programs "Importance and Criticality of the SEP"

- Program's SEP provides insight into every aspect of a program's technical plan, focusing on:
  - What are all the program requirements?
  - Who has responsibility and authority for managing technical issues—what is the staffing and organization to support the effort?
  - How will the technical baseline be managed and controlled?
  - What is the technical review process?
  - How is that technical effort linked to overall management of program?

- Living document with use, application, and updates clearly evident

> **The SEP is fundamental to technical and programmatic execution on a program**

Driving Technical Rigor Back Into Programs
SEP Focus Areas for Milestone B

- Program Requirements
  - Capabilities, CONOPS, KPPs
  - Statutory/regulatory
  - Specified/derived performance
  - Certifications
  - Design considerations
- Technical Staffing/Organization
  - Technical authority
  - Lead Systems Engineer
  - IPT coordination
  - IPT organization
  - Organizational depth
- Technical Baseline Management
  - Who is responsible
  - Definition of baselines
  - Requirements traceability
  - Specification tree and WBS link
  - Technical maturity and risk

- Technical Review Planning
  - Event-driven reviews
  - Management of reviews
  - Technical authority chair
  - Key stakeholder participation
  - Peer participation

- Integration with Overall Management of the Program
  - Linkage with other program plans
  - Program manager's role in technical reviews
  - Risk management integration
  - Test and logistics integration
  - Contracting considerations

Driving Technical Rigor Back Into Programs
SEP Focus Areas for Milestone A

- Program Requirements
  - **Desired capabilities; required attributes**
  - **Potential statutory/regulatory, specified/derived performance, certifications, design considerations**
  - **Enabling technologies**
  - **Cost/schedule constraints**
  - **Future planning**

- Technical Staffing/Organization
  - Technical authority
  - Lead Systems Engineer
  - **SE role in TD IPT**
  - IPT organization and coordination
  - Organizational depth

- Technical Baseline Management
  - Who is responsible
  - Definition of baselines
  - **ICD/CDD traceability**
  - Technical maturity and risk

- Technical Review Planning
  - Event-driven reviews
  - Management of reviews
  - Technical authority chair
  - Key stakeholder participation
  - Peer participation

- Integration with Overall Management of the Program
  - Linkage with other program plans
  - Program manager's role in technical reviews
  - Risk management integration
  - Test and support strategy
  - Contracting considerations

Driving Technical Rigor Back Into Programs
SEP Focus Areas for Milestone C

- Program Requirements
  - **Technical surveillance approach**
  - **Tracking of actual vs. planned usage**
  - **Monitoring of system hazards, risks, certifications**
  - **Tracking of usage, corrosion-related maintenance and repair costs, and total ownership costs**
  - **Management of configuration changes and incremental modifications**

- Technical Staffing/Organization
  - Technical authority
  - Lead Systems Engineer
  - **Coordination of sustaining engineering with operational, maintenance, and repair domains**
  - **Sustaining support organization**
  - Organizational depth

- Technical Baseline Management
  - Who is responsible
  - Definition of baseline management
  - **Requirements and certification traceability and verification of changes**
  - Specification tree and WBS link
  - **Tracking of operational hazard risk against baseline**

- Technical Review Planning
  - **In-service reviews**
  - Management of reviews
  - Technical authority chair
  - Key stakeholder participation
  - Peer participation

- Integration with Program Management
  - **Linkage with overall sustainment**
  - **Program manager's role in in-service reviews**
  - Risk management integration
  - Logistics integration
  - Contracting considerations

DoD Response
Guidance and Tools

- SE in the Integrated Defense AT&L Life Cycle Management Framework Chart (v5.1)

- Guides:
  - Reliability, Availability, and Maintainability—published August 3, 2005
  - Integrated Master Plan/Integrated Master Schedule—in coordination
  - Contracting for SE—distributed for comment
  - Risk Management—in internal development

- Tools:
  - Defense Acquisition Program Support
  - Initial Operational T&E (IOT&E) Readiness
  - Capability Maturity Model Integrated Acquisition Module (CMMI-AM)

http://www.acq.osd.mil/ds/se

DoD Response
Education, Training, and Outreach

- Formal training updates across key career fields: SE, T&E, Acquisition, Program Management, Contract Management, Finance Management

- Continuous learning, on-line courses
  - Reliability and Maintainability, Technical Reviews, and System Safety already available
  - Trade Studies, Technical Planning, Modeling and Simulation, and Contracting for SE in development

- University engagement

- Director-level outreach to industry
  - Hosting of and speaking at conferences and symposia
  - Speaking to industry at senior leadership levels

http://www.dau.mil/basedocs/continuouslearning.asp

Driving Technical Rigor Back into Programs "Portfolio Challenge"

- **Defense Systems was tasked to:**
  - Review program's SE Plan (SEP) and T&E Master Plan (TEMP) for major acquisition programs (ACAT ID and IAM); conduct program support reviews (PSRs)

- **Portfolio includes:**
  - Business Systems
  - Communication Systems
  - C2ISR Systems
  - Fixed Wing Aircraft
  - Unmanned Systems
  - Rotary Wing Aircraft
  - Land Systems
  - Ships
  - Munitions
  - Missiles

Systems Engineering Support to Over 130 Major Programs in Ten Domains

Driving Technical Rigor Back Into Programs "Program Specific"

Topic	Systems Engineering	Test & Evaluation	Risk Management	Exit Criteria	Acquisition Strategy
Focus Areas	Requirements	V&V Traceability	Risk ID	Mission Systems	Mission Capability
	Organization & Staffing	Test Resources	Risk Analysis	Support	Resources & Management
	Technical Reviews	Test Articles	Risk Mitigation Planning	Manufacturing	Technical Process
	Technical Baseline	Evaluation	Risk Tracking	R & M	Technical Product
	Linkage w/ Other Program Mgmt & Controls	Linkage w/ Other Program Mgmt & Controls	Evidence of Effectiveness	Net Centric	Enterprise Environment
Product	SEP	TEMP	RM Plan	Phase Exit Criteria	ASR/APB

Driving Technical Rigor Back Into Programs
"Emerging SEP Comments (First Drafts)"
(not systemic across all programs)

- Incomplete discussion of program requirements
  - Missing categories such as statutory, regulatory, or certifications
- Minimal discussion of program IPTs
  - Need to identify technical authority, lead systems engineer, and key stakeholders
  - Addresses part of SE organization, such as prime; no mention of government, subcontractors, or suppliers
- Incomplete technical baseline
  - How does the program go from CDD to product—traceability?
  - Linkage to EVM—not able to measure technical maturity via baselines
- Incomplete discussion of technical reviews
  - How many, for what (should tie to baselines and systems/subsystems/configuration items), and by whom (should tie to staffing)?
  - Lacking specific entry criteria
  - Peer reviews
- Integration with other management planning
  - Linkage with acquisition strategy, IMP, IMS, logistics, testing, and risk management
  - Schedule adequacy—success-oriented vice event-driven; schedule realism
  - Contracting for SE

58 SEPs reviewed from 36 programs

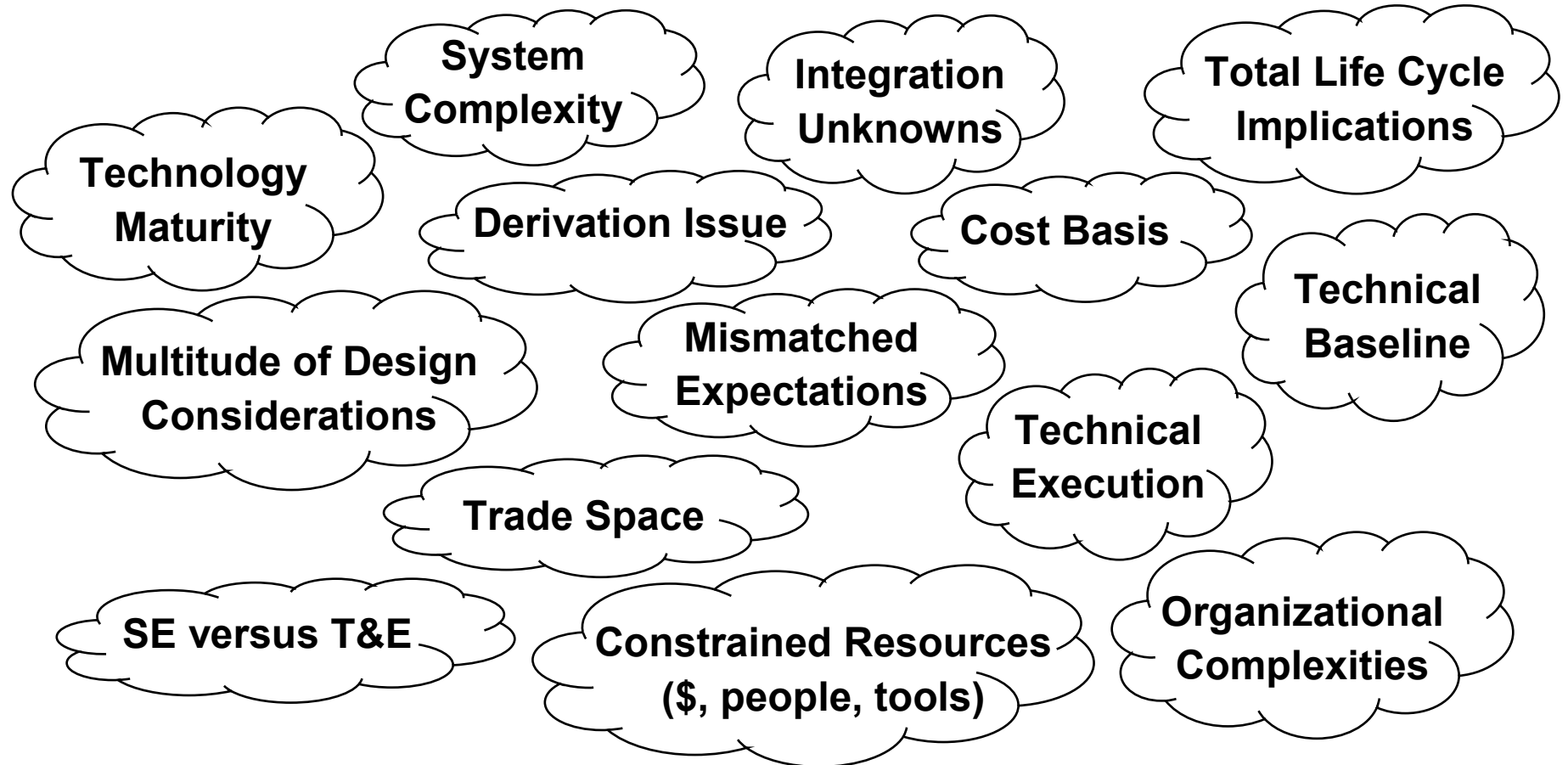*Compelling Need to Engage with Programs Early in Process*

SEP Observations

- Descriptions vice plans
  - Regurgitated theory
  - Generic text, applicable to _____
  - Disconnected discussion
  - No numbers or specifics
  - No names
  - No timeframes or ordered relationships

    - What
    - Why
    - How
    - Who
    - When
    - Where

- Not reflective of known industry best practice
  - Technical baselines
  - Technical reviews
    - Entry criteria for technical reviews
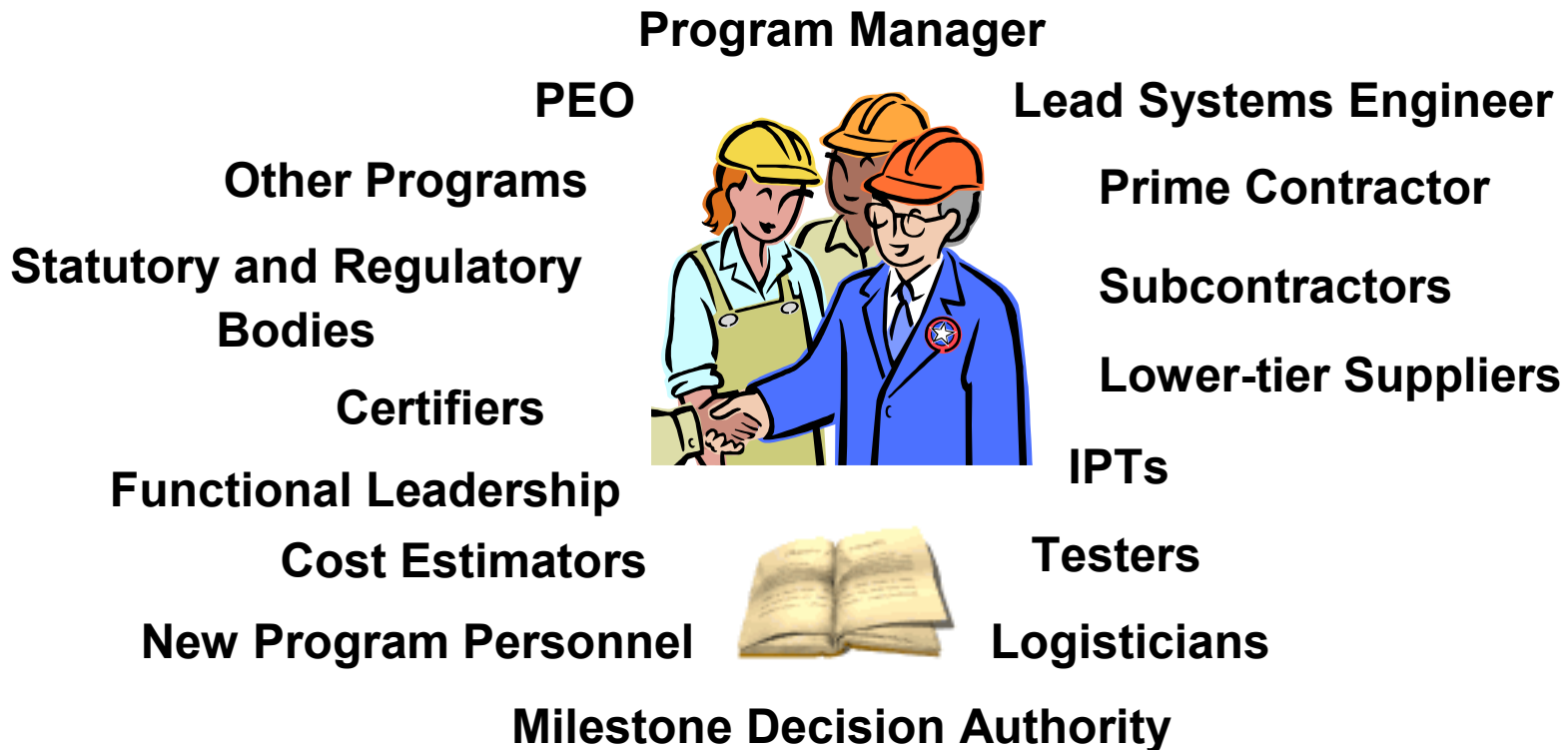   - Peer participation

Technical Planning Drivers

System Complexity

Integration Unknowns

Total Life Cycle Implications

Technology Maturity

Derivation Issue

Cost Basis

Technical Baseline

Multitude of Design Considerations

Mismatched Expectations

Technical Execution

Trade Space

SE versus T&E

Constrained Resources ($, people, tools)

Organizational Complexities

What does "SE" mean on your program?

SEP Stakeholders

Program Manager

PEO

Lead Systems Engineer

Other Programs

Prime Contractor

Statutory and Regulatory Bodies

Subcontractors

Lower-tier Suppliers

Certifiers

Functional Leadership

IPTs

Cost Estimators

Testers

New Program Personnel

Logisticians

Milestone Decision Authority

A SEP Provides a Means for Collective Understanding Among All Stakeholders as to Program's Technical Approach

Technical Planning Timeline

Milestone

- RFP Preparation
  - Acquirer's Technical Approach as Documented in Draft SEP
  - Written by Program Manager, Lead SE, Lead Tester, and Lead Logistician

- Source Selection
  - Offeror's Proposed Technical Approach based on Draft SEP
  - Evaluated by Source Selection Evaluation Board

- Post-Award Planning
  - Program Team's Technical Approach as Documented in Program SEP
  - Written by Program Manager, Lead SE, Lead Tester, and Lead Logistician from Government, Prime, Subs, and Suppliers
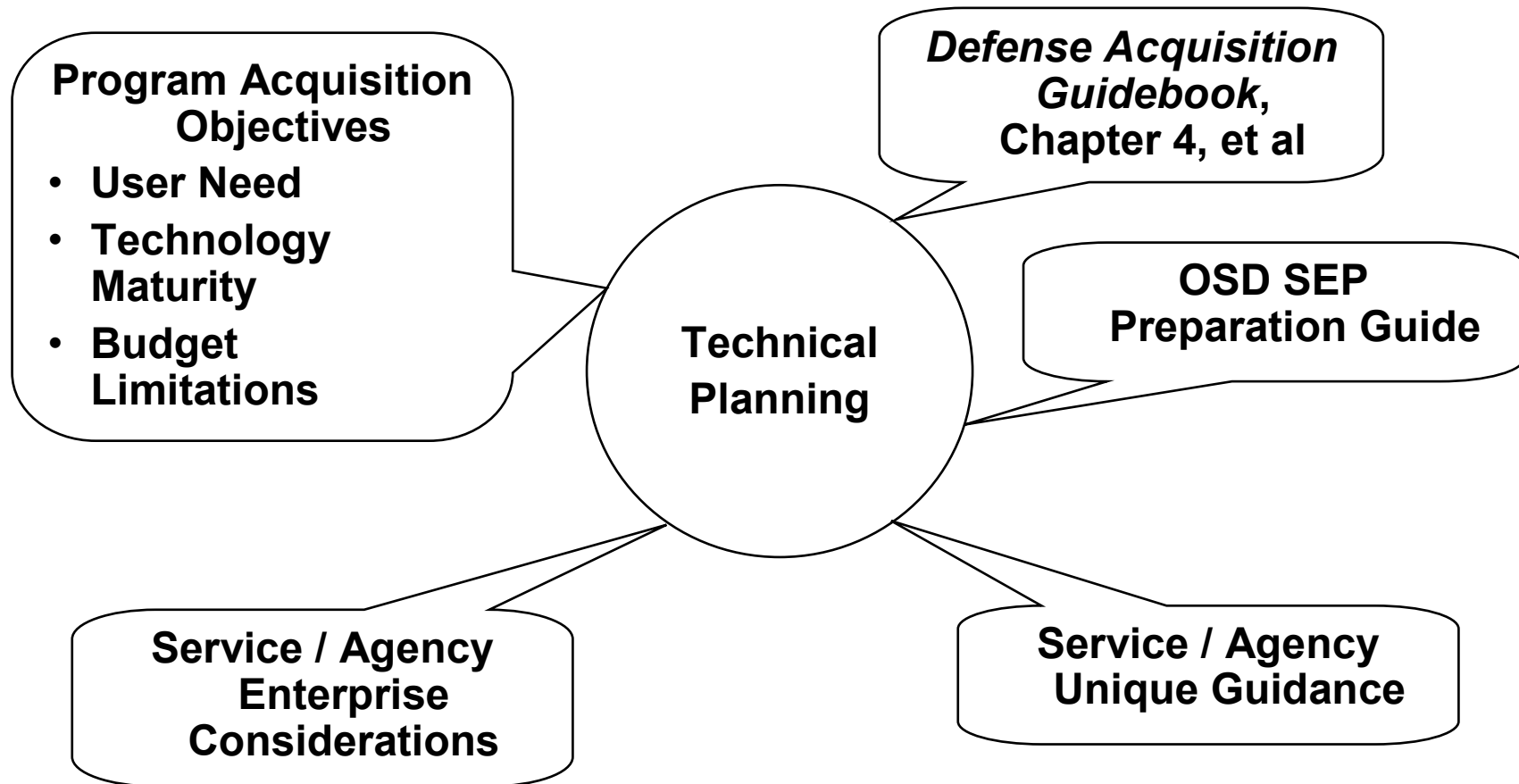
- Execution
  - Execute the Technical Approach
  - Updated by Program Team

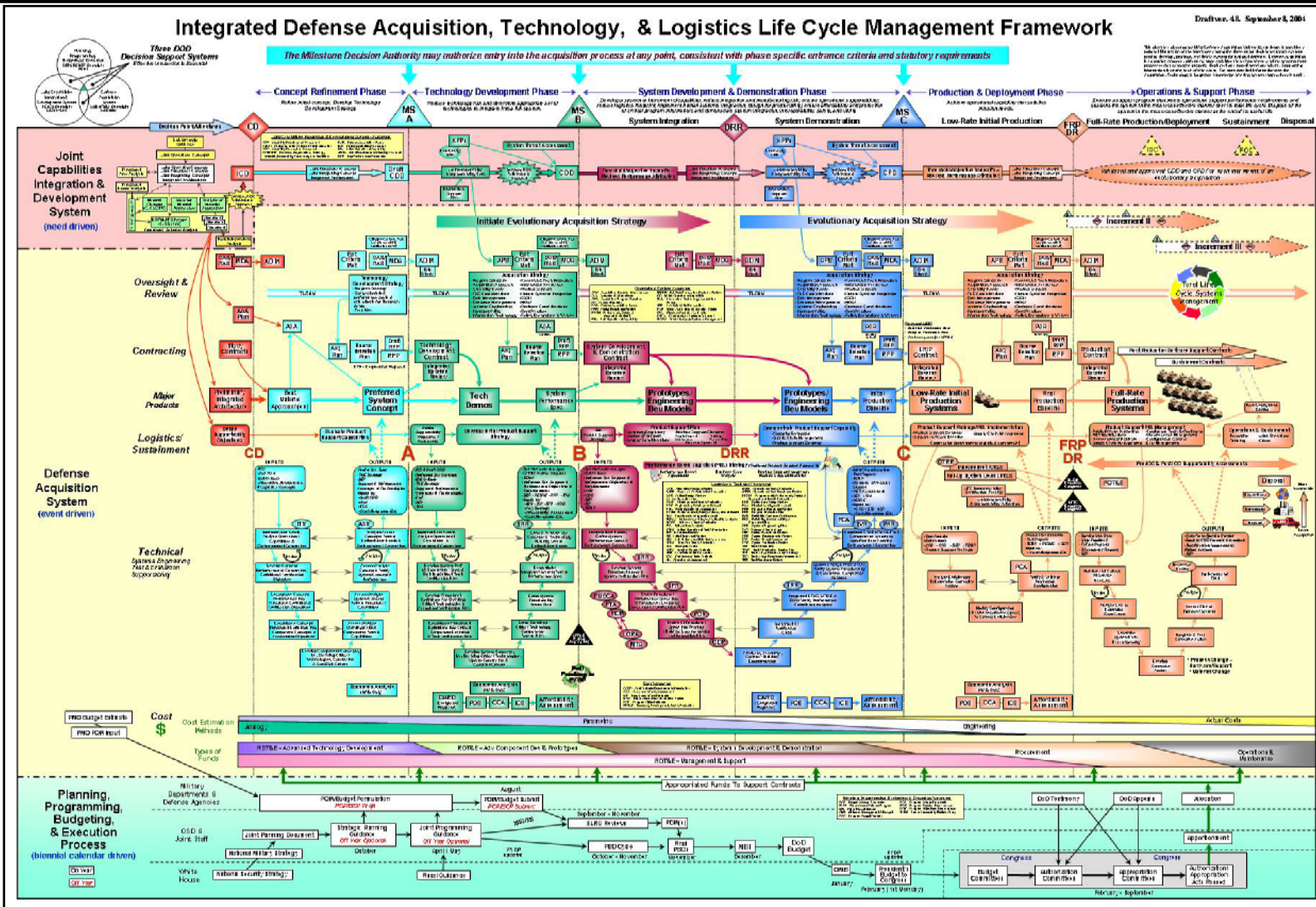**A shared "vision" of SE on your program.**

Technical Planning Considerations

Program Acquisition Objectives

- **User Need**
- **Technology Maturity**
- **Budget Limitations**

Defense Acquisition Guidebook, Chapter 4, et al

Technical Planning

OSD SEP Preparation Guide

Service / Agency Enterprise Considerations

Service / Agency Unique Guidance

SE in the System Life Cycle "The Wall Chart"

Integrated Defense Acquisition, Technology, & Logistics Life Cycle Management Framework

SE in the *Defense Acquisition Guidebook*

4.1 SE in DoD Acquisition

4.2 SE Processes: How SE is Implemented

4.3 SE in the System Life Cycle

4.4 SE Decisions: Important Design Considerations

4.5 SE Execution: Key SE Tools and Techniques

4.6 SE Resources

Systems Engineering Plan Preparation Guide

- Program description, technical status, and approach for updating the SEP
- SE applied and tailored to life cycle phases
  - System capabilities, requirements, and associated design considerations to be addressed
  - SE organizational integration and technical authority
  - SE processes selected and rationale
  - Technical management and control, including technical baseline implementation / control and technical reviews planned
  - Integration with overall program management control efforts—linkage with other programmatic management efforts, such as acquisition strategy, integrated master planning and schedule, risk management, earned value management, and contract management

http://www.acq.osd.mil/ds/se/index.html

Scope of Technical Planning
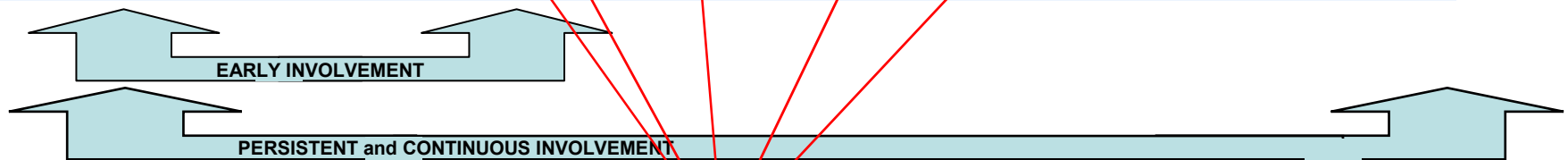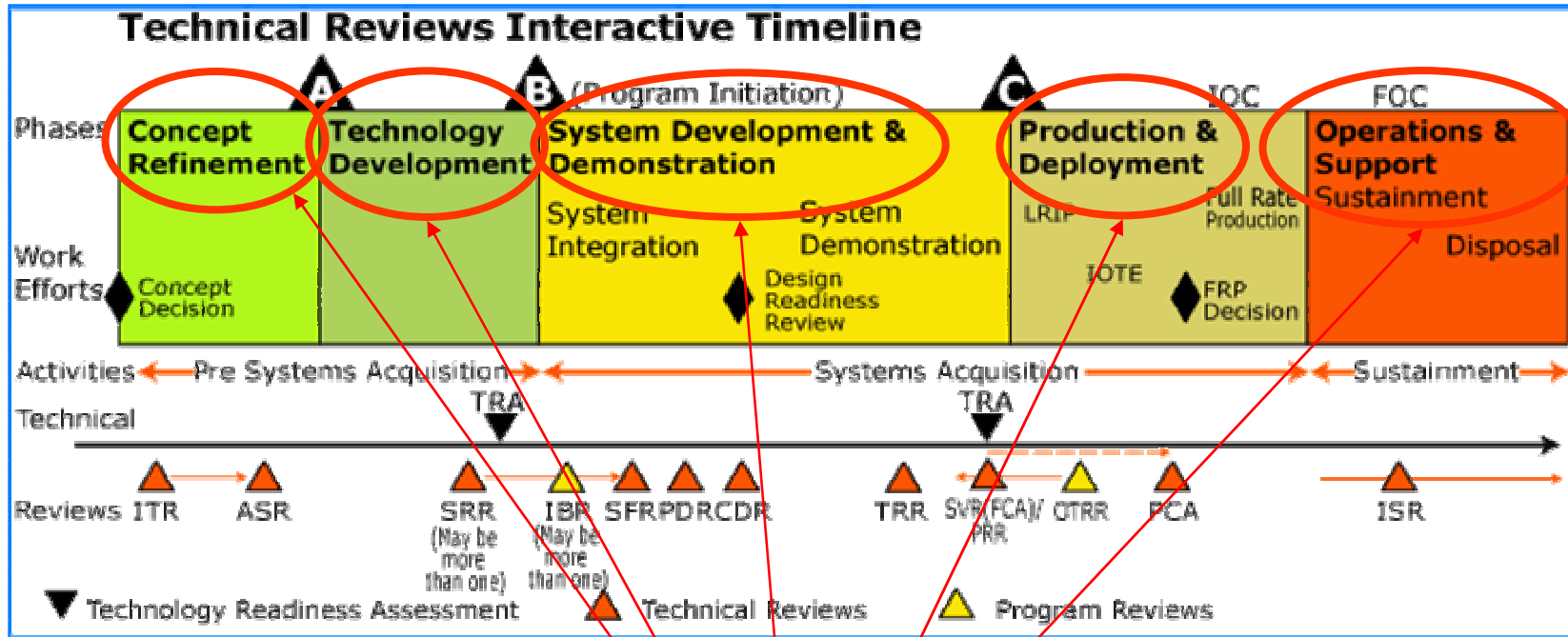
Sound technical planning is needed in EVERY acquisition phase

Summary

- Sound technical planning is fundamental to program success

- A well-written, comprehensive SEP enables collective understanding of the program's technical approach across all program stakeholders

"In preparing for battle I have always found that plans are useless, but planning is indispensable."
Dwight D. Eisenhower