Systems Engineering Revitalization Efforts

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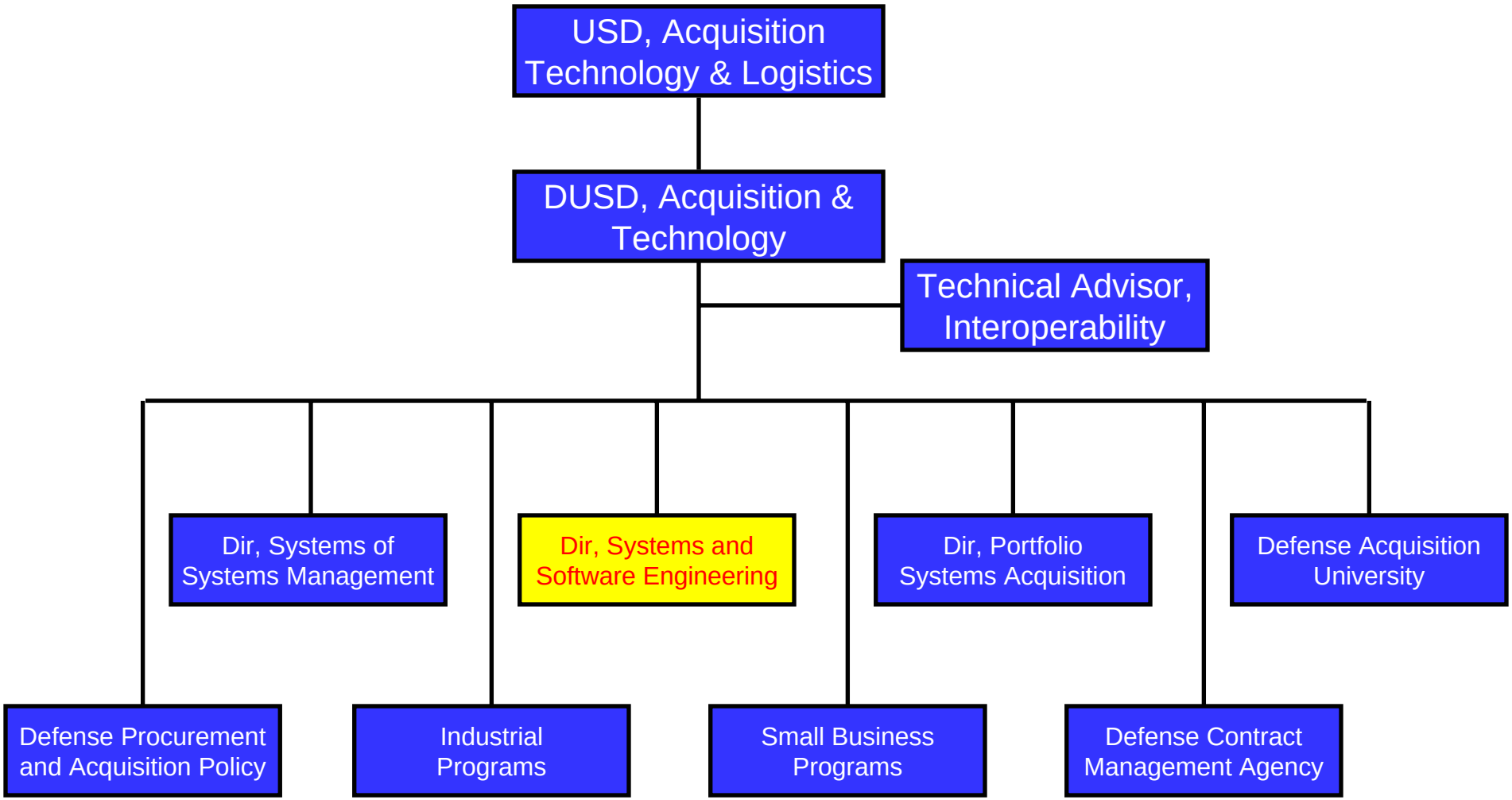
Systems and Software Engineering Mission Statement

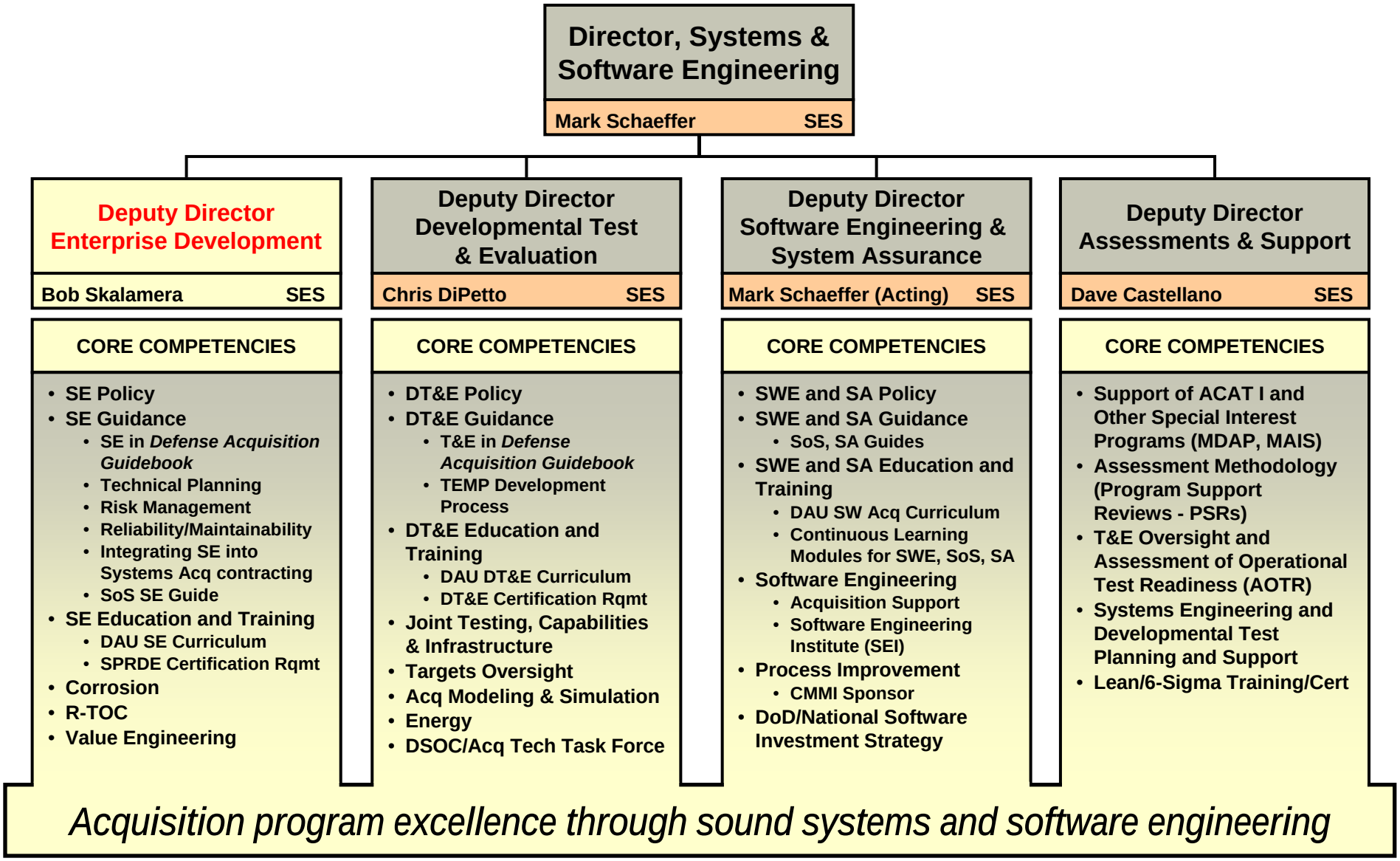
- Shape acquisition solutions and promote early technical planning
- Promote the application of sound systems and software engineering, developmental test and evaluation, and related technical disciplines across the Department's acquisition community and programs
- Raise awareness of the importance of effective systems engineering and drive the state-of-the-practice into program planning and execution
- Establish policy, guidance, best practices, education, and training in collaboration with academia, industry, and government communities
- Provide technical insight to program managers and leadership to support decision making

Driving Technical Excellence into Programs!

ODUSD, Acquisition and Technology



Systems and Software Engineering
Organizational Core Competencies



Acquisition program excellence through sound systems and software engineering

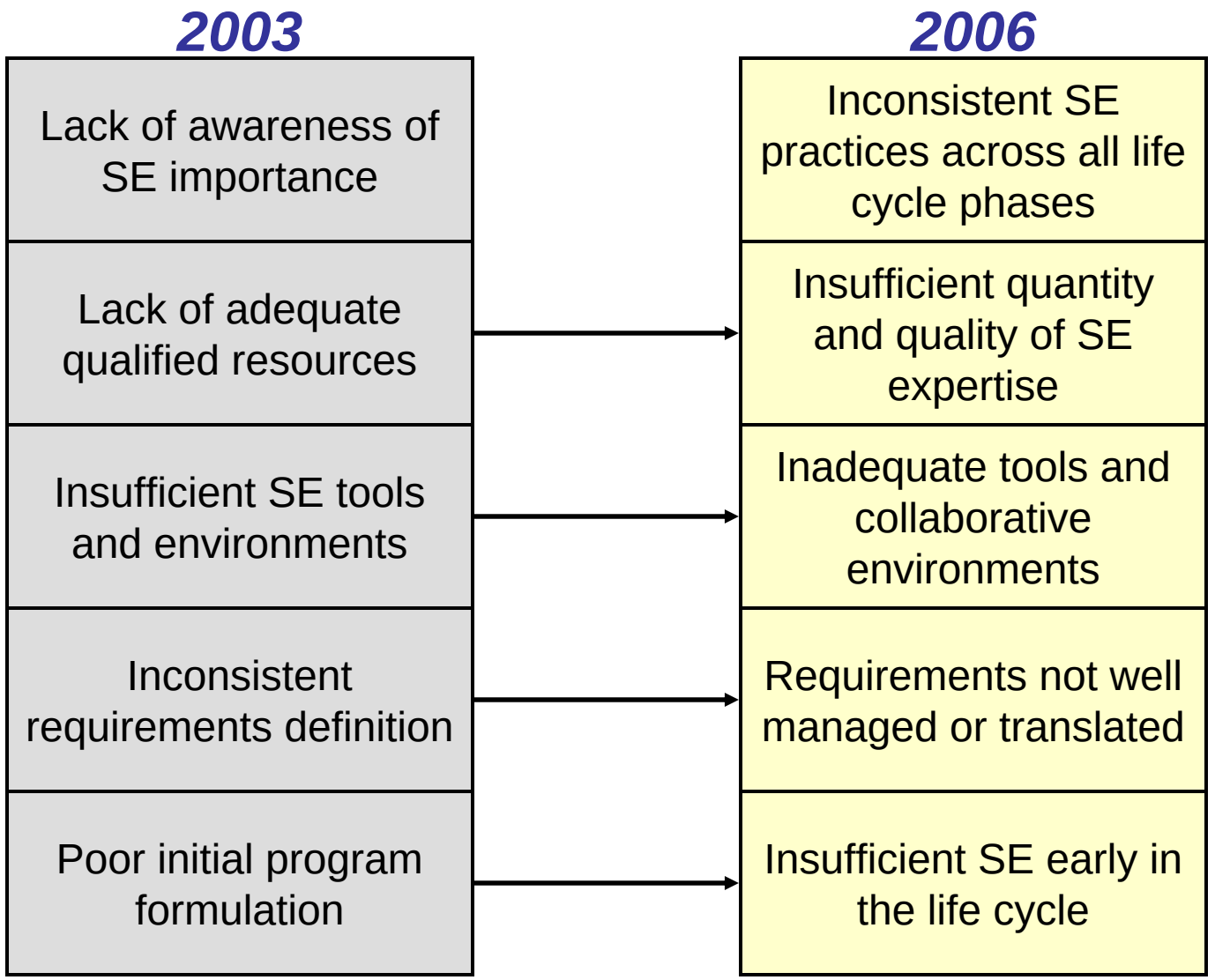
Update:

DoD SE Revitalization

Systems Engineering Revitalization Effort

- Issued Department-wide Systems Engineering (SE) policy
- Issued guidance on SE, T&E, and SE Plans (SEPs)
- Instituted system-level assessments in support of DAB, OIPT, DAES, and ad hoc reviews
- Established SE Forum to ensure senior-level focus within DoD
- Integrating DT&E with SE policy and assessment functions--focused on effective, early engagement of both
- Instituting a renewed emphasis on modeling and simulation in acquisition
- Working with Defense Acquisition University to revise curricula (SPRDE, T&E, PQM, LOG, PM, ACQ, FM, CONT)
- Leveraging close working relationships with industry and academia

Evolution of Top 5 SE Issues



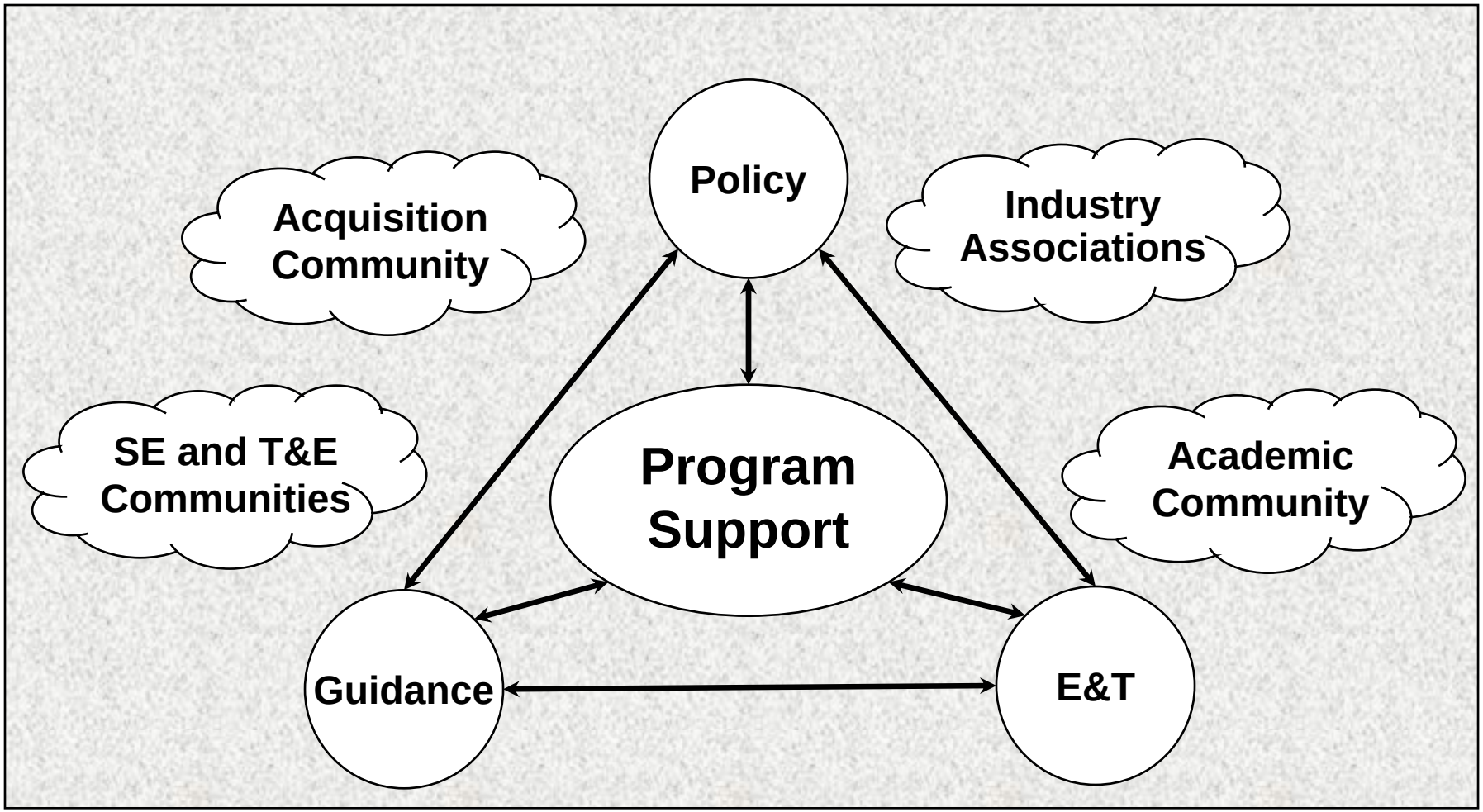
Source: NDIA Systems Engineering Division

USD(AT&L) Goals

USD(AT&L) Goals enabled by strengthened SE:

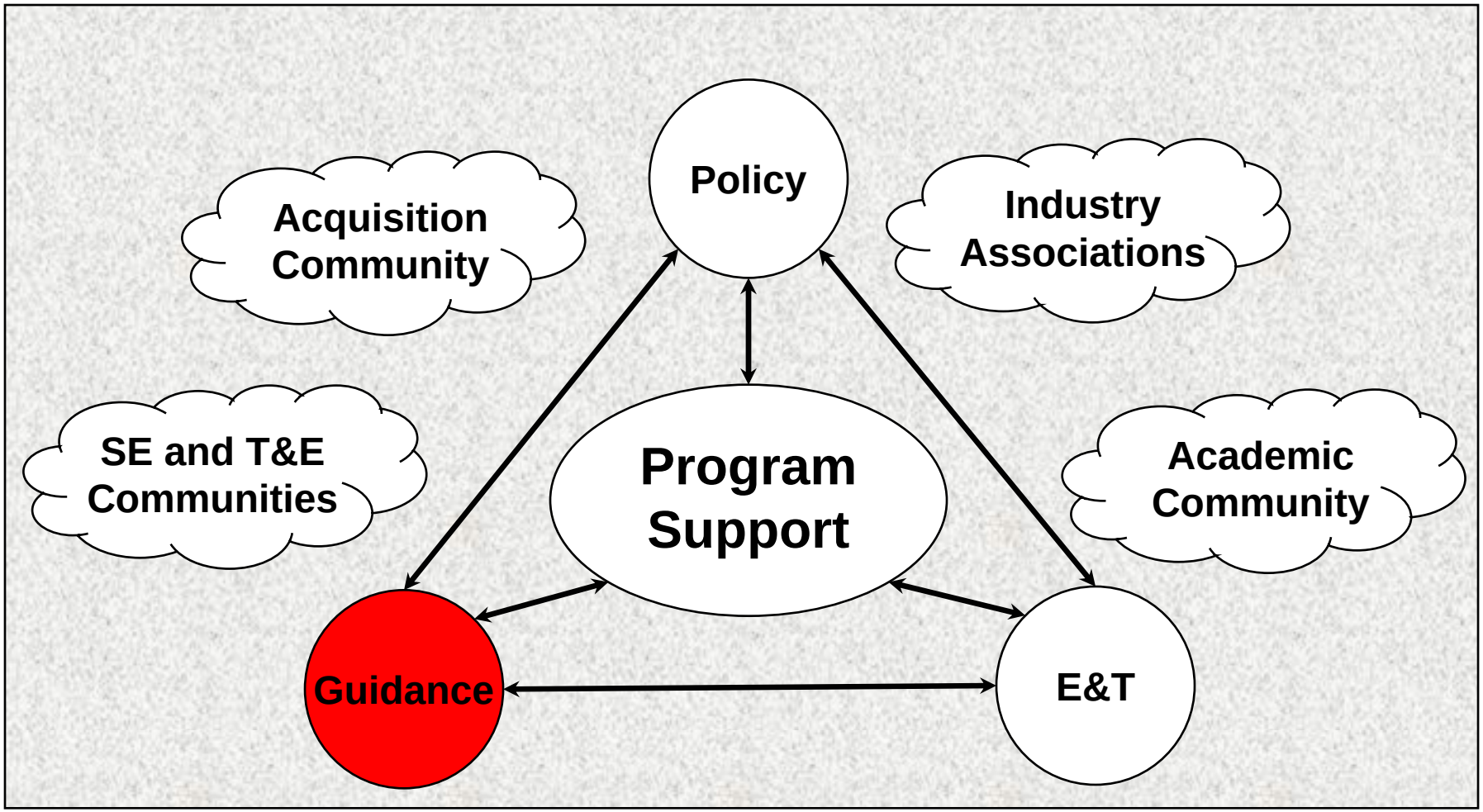
- **Goal 1 – High Performing, Agile and Ethical Workforce**
  - **Outcome 1 - Future DoD AT&L Workforce Shaped and Recapitalized to Enable Smart Workforce Decisions**
  - **Outcome 2 - A Knowledge-Enabled AT&L Workforce to Support the DoD Acquisition, Technology and Logistics Mission**
- **Goal 2 – Strategic and Tactical Acquisition Excellence**
  - **Outcome 1 - Acquisition agenda aligned with the Department's core values, policy objectives, joint needs, and available resources to attain best value solutions**
  - **Outcome 2 - Risk, outcomes, schedule, and cost balanced when planning and adjusting portfolios, programs, and procurements**
  - **Outcome 3 - Acquisition execution improved across the total life cycle through the use of sound business and technical practices**

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Guidance

- **What's new:**
  - DoD Guide for achieving Reliability, Availability, and Maintainability
  - Integrated Master Plan / Integrated Master Schedule (IMP/IMS) Guide
  - Updated Systems Engineering Preparation (SEP) Guide
  - Risk Management Guide for DoD Acquisition
- **What's coming:**
  - Systems of Systems SE Guide
  - Integrating SE Into Systems Acquisition Contracting Guide
  - Defense Acquisition Guidebook update
    - Chapter 4 -- Systems Engineering
    - Chapter 9 -- Test and Evaluation
  - SEP Guide update

DoD Guide for Achieving Reliability, Availability, and Maintainability

- **Defines model for improving RAM management and technical processes**
  - Integrates RAM model with other processes
  - Reflects DoD / Industry / Academia best practices
  - Provides front-end of Guide detail appropriate for senior managers
  - Focuses remainder of Guide on RAM practitioners
- **Focuses on what can be done as part of SE process to:**
  - ***Achieve*** satisfactory levels of RAM
  - ***Successfully demonstrate*** RAM levels during test and evaluation
  - ***Sustain*** RAM levels throughout system's life cycle

IMP/IMS Guide

- **Defines IMP/IMS as model for effective planning, scheduling and execution of work efforts**
  - **Presents IMP/IMS as key day-to-day tool for tracking program technical, schedule, cost status across lifecycle, including risk mitigation efforts**
  - **Amplifies event-based technical approach**
  - **Emphasizes upfront technical planning**
  - **Incorporates Earned Value Management policies**
- **Provides guidance on:**
  - **Developing IMP/IMS to successfully plan/execute program**
  - **Tailoring requirements in RFPs and evaluating proposals**
  - **Linking IMP/IMS with other technical management tools**

Systems Engineering Plan Guide

- **Provides insight into every aspect of a program's technical plan to aid programs in thinking through their SE process**
  - **What are the program requirements?**
  - **Who has responsibility and authority for managing technical issues—what is the technical staffing and organization?**
  - **How will the technical baseline be managed and controlled?**
  - **What is the technical review process?**
  - **How is the technical effort linked to overall management of the program?**
- **Latest version published in Feb 06--not meant to be used as a boiler plate**
- **Should be key part of the acquisition strategy/built into RFP**
- **Now's the time to provide comments for next update (FY07)**

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

Systems Engineering Plan Trends

➢ What's working:

- Programs beginning to establish SE WIPTs early in the life cycle to develop and document their technical planning
- Increased Program Executive Office level Lead/Chief Systems Engineers involvement in SEP development
- Movement to event-driven versus schedule-driven programs
  - More focus entry and exit criteria for technical reviews

➢ What needs work:

- Firming up technical planning prior to RFP release
- Proposed processes for a program not always tailored to fit program
  - Often appear to be copied from a manual or guide
- SEP author is someone in program office (contractor or junior person) who is not familiar with the technical strategy
- SEPs need to be consistent with key program documents

Risk Management Guide

SSE has published an updated Risk Guide that:

- **Clarifies the definition of risk and ties risk likelihood to the root cause rather than the consequence**
- **Distinguishes between risks and issues**
- **Stresses a five-step risk management process for identifying and mitigating risk**
- **Places the focus on event-driven technical reviews to help identify risk areas as early as possible**

How Guide Defines Risk

A measure of future uncertainties in achieving program goals and objectives within defined cost, schedule and performance constraints. Risk has three components:

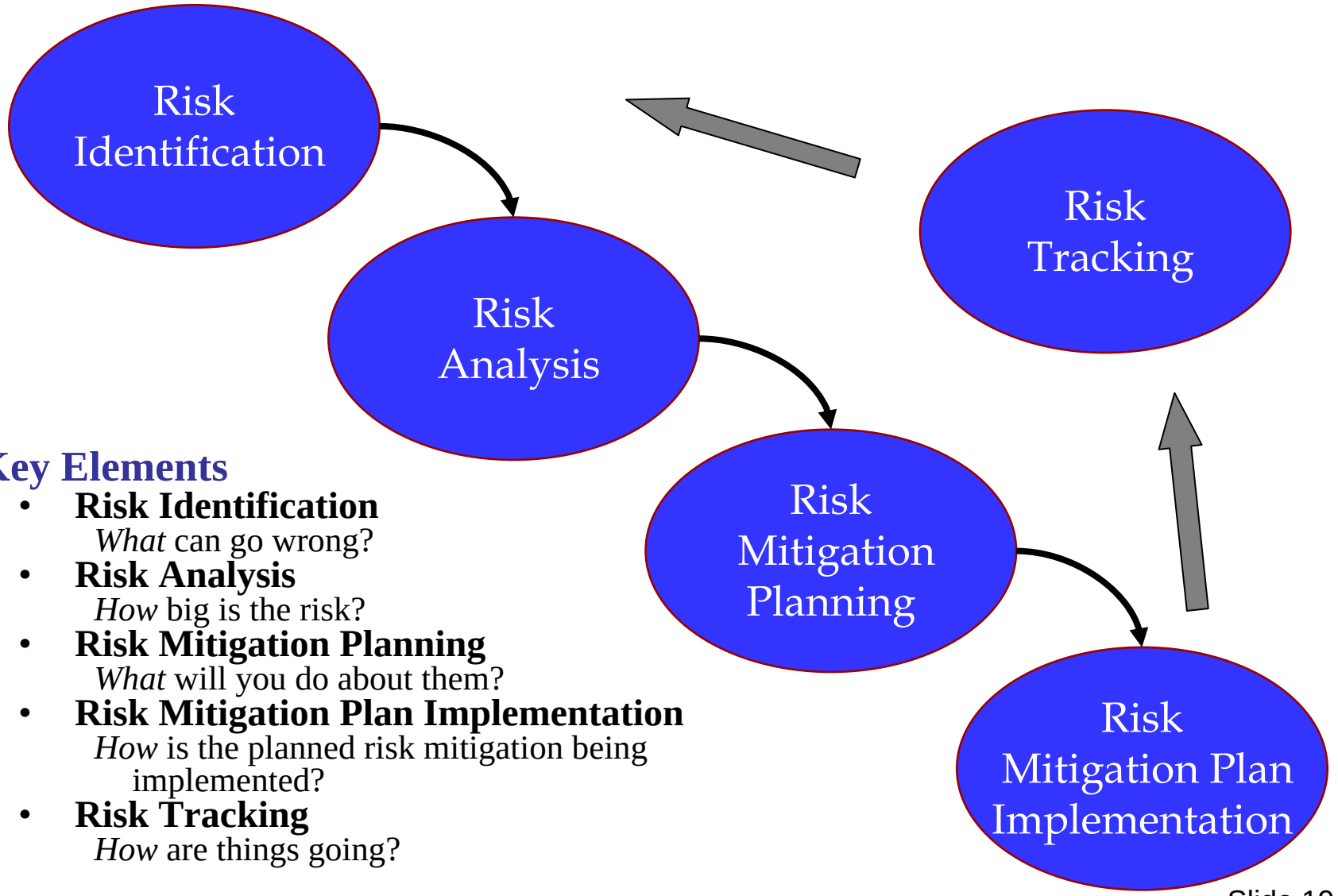
- **A *future root cause***
- **A *likelihood* (or probability) assessed at the present time of a future root cause occurring**
- **The *consequence* (or effect) of a future root cause**

Risks vs. Issues

- **Risks: *yet to happen***
  - **Future consequences**
  - **Can be closed only after successful mitigation through avoiding, controlling, transferring, or assuming the risk**
- **Issues: *current* problems and/or challenges**
  - **Real-time consequences**
  - **Can be closed within 30-60-90 days windows**

If it's already occurred, it's an issue, not a risk

Risk Management Process Model



Key Elements

- **Risk Identification**
  What can go wrong?
- **Risk Analysis**
  How big is the risk?
- **Risk Mitigation Planning**
  What will you do about them?
- **Risk Mitigation Plan Implementation**
  How is the planned risk mitigation being implemented?
- **Risk Tracking**
  How are things going?

Risk Summary

Guide may positively affect:

- **Near-term resolution of issues**
- **Better focus on risk mitigation**
- **Leveraging of event-based technical reviews**
- **Better linkage of systems engineering to program**
- **Management and execution**

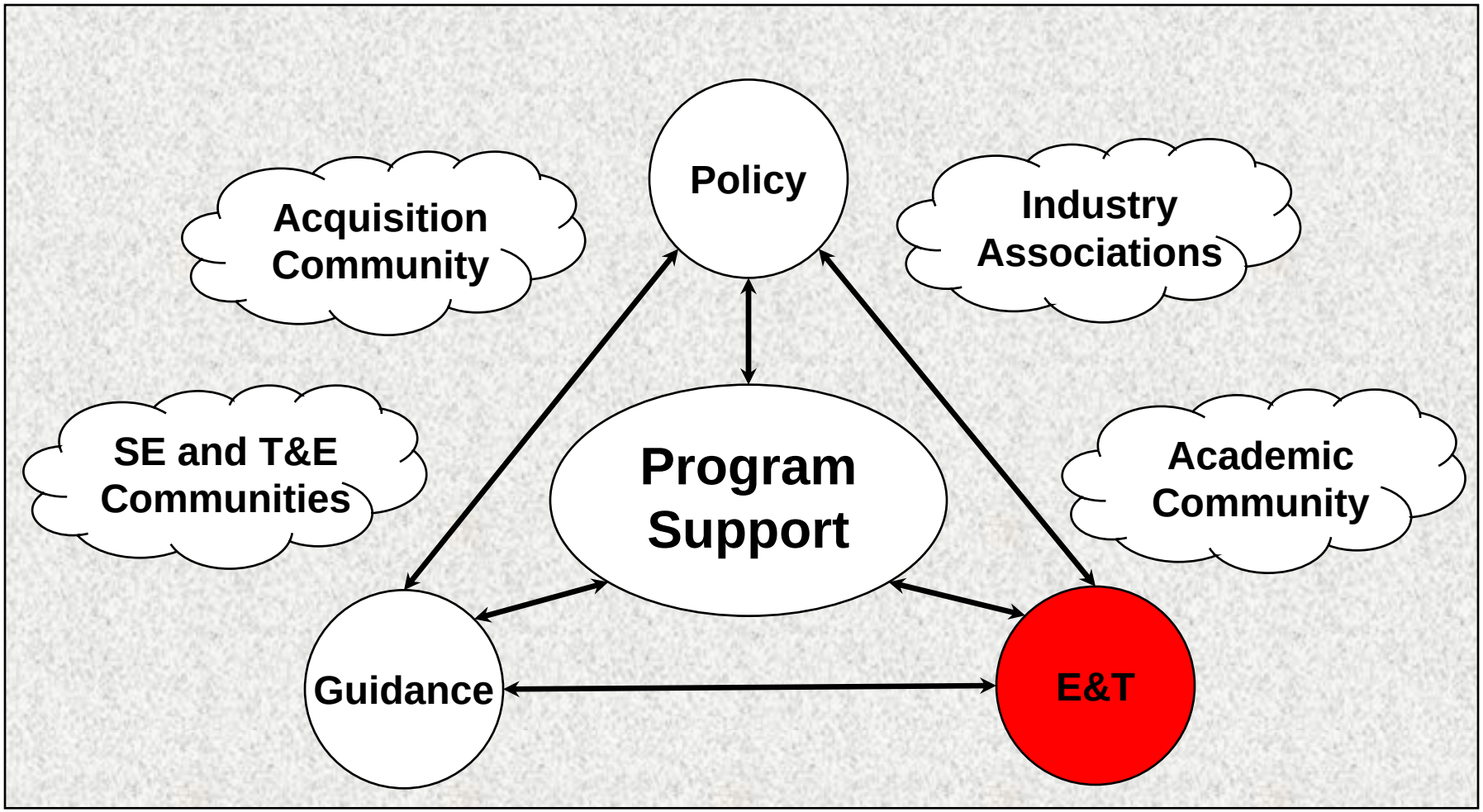
Integrating SE into Systems Acquisition Contracting

- Ensure that SE best practices are in the Request for Proposal through inclusion of SEP
- Targets PMs, lead systems engineer along with contracting team—not intended to cover all aspects of contracting
- Scope:
  - Sample SE contracting language for SOO/SOW and Sections L&M of RFP
  - Primary focus is on SDD phase, but applicable across lifecycle
- Offerors requested to submit an integrated SEP in their proposal consistent with Government SEP
- After contract award, Government SEP and Contractor's SEP are integrated as the baseline program SEP
- Targeted for publication by December 2006

Systems of Systems (SOS) for SE Guide

- **Recognizes growing complexity of today's integrated joint battlefield**
- **Addresses lessons learned and identifies current/future challenges as they relate to SOS**
  - **Multiple system lifecycles, not necessarily single acquisition program**
  - **More diverse community involvement, stakeholders and governance**
  - **Multiple mission capabilities to support rapidly evolving objectives**
  - **Mix of legacy systems, developmental systems, and technology insertion**
  - **Difficulty in testing as opposed to single system**
- **Expected to be released by end of 2006**

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Education &Training

- **What's new**
  - **On-line Continuous Learning Modules: Reliability and Maintainability; Technical Reviews; System Safety, Modeling and Simulation; Technical Planning**
  - **On-line introductory course SYS101**
  - **On-line intermediate course SYS202**
  - **Strengthened certification requirements for systems engineers**
- **What's coming**
  - **New intermediate classroom course SYS203**
  - **New advanced classroom course SYS302**
  - **New Continuous Learning Modules for: Corrosion Prevention and Control; Modular Open Systems Approach; Trade Studies**

www.dau.mil/basedocs/trainingcourses.asp

New SE Courses

- **SYS 101--Fundamentals of Systems Planning, Research, Development & Engineering**
  - On-line introduction to SE and the 16 technical and tech management processes
- **SYS 202--Intermediate Systems Planning, Research, Development & Engineering, Part I**
  - On-line journeyman course to provide understanding of how the DoD SE processes can be applied throughout program lifecycle. Includes scope/role of SE and its key technical inputs/outputs; key aspects of technical baselines/role of technical reviews; and key design considerations
- **SYS 203--Intermediate Sys Planning, Research, Development & Engineering, Part II**
  - Journeyman-level classroom-based course that applies the DoD Systems Engineering processes and techniques learned in SYS 202. Involves students working in Integrated Product Teams and applying SE technical processes and technical management processes to a defense system
- **SYS 302--Technical Leadership in Systems Engineering**
  - Advanced classroom-based course using single, fictitious acquisition program that progresses through development in six linked exercises. Covers current issues including hardware and software interoperability how they relate to SE processes

New SPRDE Systems Engineer Certification Criteria

SPRDE/Systems Engineer

LEVEL I (2 Years)

- ACQ 101
- SYS 101
- Two additional Level 100 courses from a variety of disciplines
- XXX 101
- AND
- XXX 101

LEVEL II (4 Years)

- ACQ 201A
- ACQ 201B
- CLM 003
- SYS 202/203
- LOG 204 (CM) + one additional Level 100 or 200 course from a variety of disciplines
- LOG 204
- XXX 101
- OR
- XXX 201

LEVEL III (8 Years)

- CLL 008
- SYS 302
- Two additional Level 200 or 300 courses from a variety of disciplines
- XXX 201
- AND
- XXX 301

SPRDE/General

LEVEL I (1 Years)

- ACQ 101
- SYS 101

LEVEL II (2 Years)

- ACQ 201A
- ACQ 201B
- CLM 003 (Tech Reviews)
- SYS 202/203

LEVEL III (4 Years)

- CLL 008
- SYS 302

Education & Training
New SPRDE Career Path Implementation

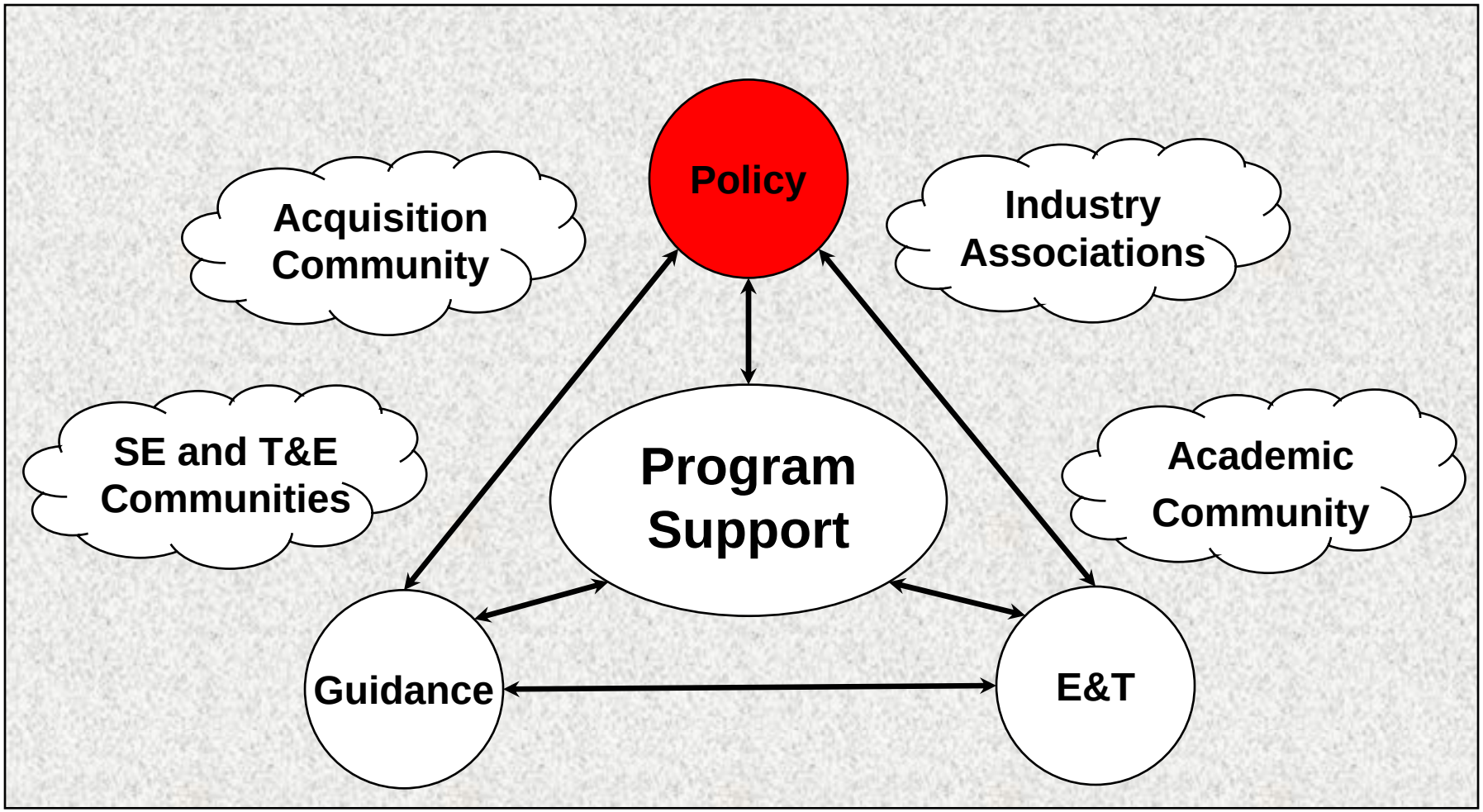
➢Workforce Certification

- **All currently coded SPRDE/SE certifications remain valid with additional certification in SPRDE/General**

➢Position Coding

- **All current SPRDE/SE positions will be recoded SPRDE/General**
- **Functional managers and career management offices (at the Components) will evaluate individual SPRDE positions and recode to SPRDE/SE as necessary**

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Systems Engineering Policy

Policy Memorandum (February 2004) and Policy Addendum (October 2004)

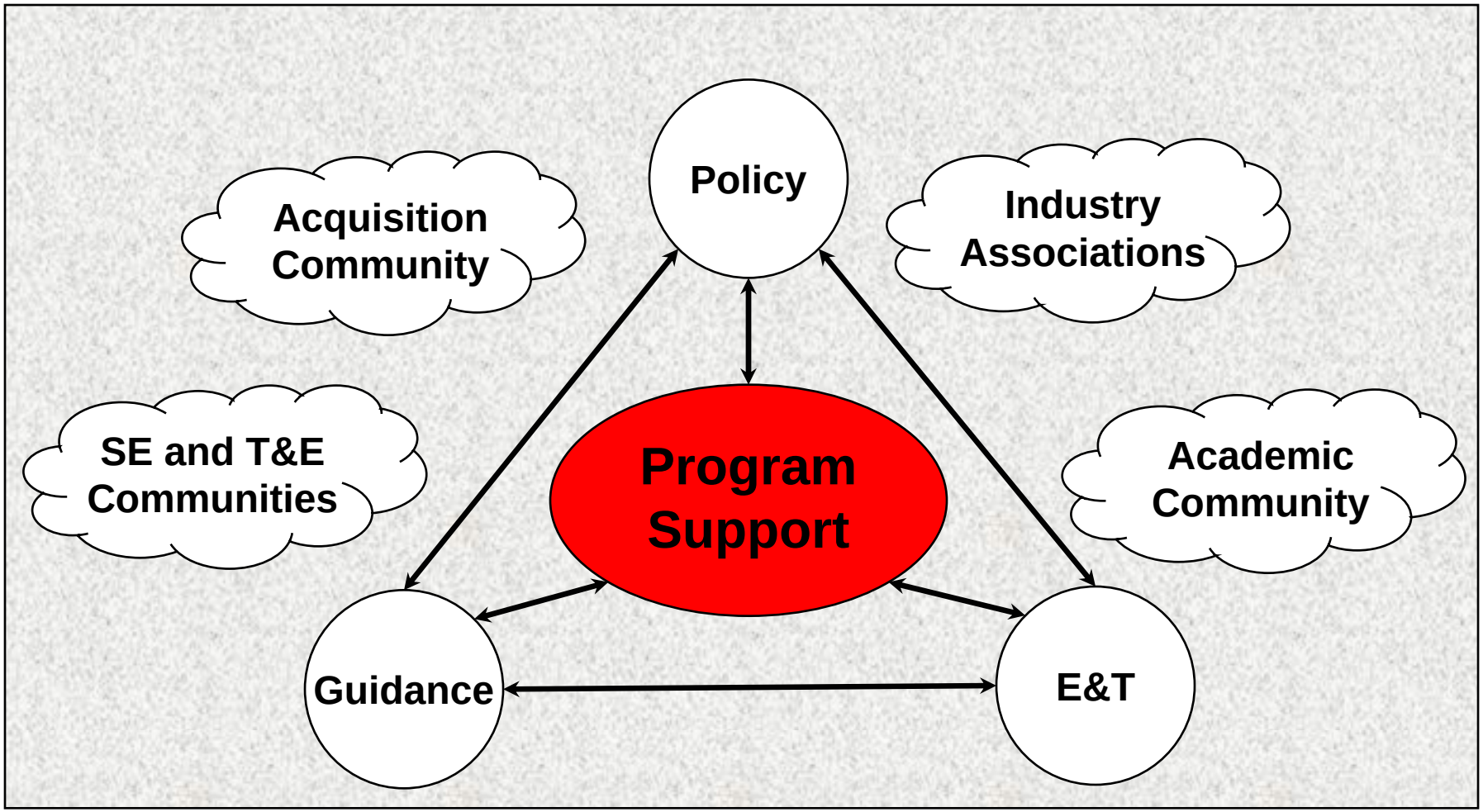
- **Programs shall apply robust SE approach and develop a SE plan**
- **Each PEO shall have a lead/chief systems engineer**
- **Programs shall use event-driven technical reviews with entry criteria and independent SMEs unless waived by MDA**
- **OSD shall review program SEPs for ACAT ID and IAM programs**
- **Defense Systems (now Systems and Software Engineering) shall establish a SE Forum**

Policy

What's coming:

- **DoDI 5000.2: Enclosure on SE**
  - 2004 policy memorandums
  - MOSA
  - Corrosion Prevention
  - UID
  - Systems Safety
- **SEP Timing Policy**
  - Revise current SEP submission policy of 30 days before DAB-- make ACAT ID SEP and Acquisition Strategy submissions coincidental

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Driving Technical Rigor Back Into Programs
"Program Support Reviews"

- **Program Support Reviews provide insight into a program's technical execution focusing on:**
  - **SE as envisioned in program's technical planning**
  - **T&E as captured in verification and validation strategy**
  - **Risk management—integrated, effective and resourced**
  - **Quantifiable milestone exit criteria as captured in Acquisition Decision Memo**
  - **Acquisition strategy as captured in Acquisition Strategy Report**
- **Independent, cross-functional view aimed at providing risk-reduction recommendations**

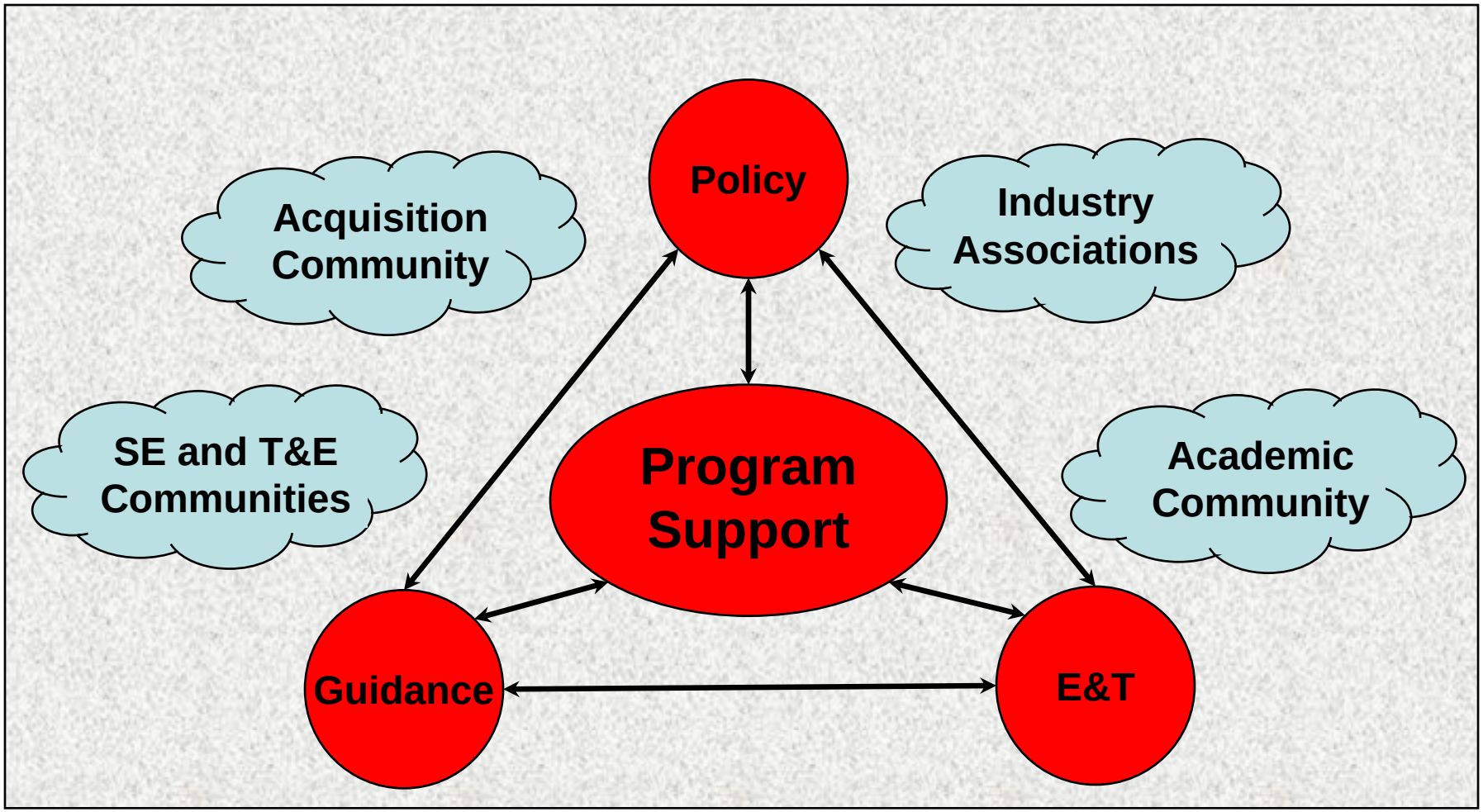
The PSR reduces risk in the technical and programmatic execution on a program

Top 10 Emerging Systemic Issues

1. **Management**	• IPT roles, responsibilities, authority, poor communication • Inexperienced staff, lack of technical expertise
2. **Requirements**	• Creep/stability • Tangible, measurable, testable
3. **Systems Engineering**	• Lack of a rigorous approach, technical expertise • Process compliance
4. **Staffing**	• Inadequate Government program office staff
5. **Reliability**	• Ambitious growth curves, unrealistic requirements • Inadequate “test time” for statistical calculations
6. **Acquisition Strategy**	• Competing budget priorities, schedule-driven • Contracting issues, poor technical assumptions
7. **Schedule**	• Realism, compression
8. **Test Planning**	• Breadth, depth, resources
9. **Software**	• Architecture, design/development discipline • Staffing/skill levels, organizational competency (process)
10.**Maintainability/Logistics**	• Sustainment costs not fully considered (short-sighted) • Supportability considerations traded

Major contributors to poor program performance

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Systems Engineering
The Way Forward

- Updating DoDI 5000.2 to incorporate policy memorandums of record
- Issuing new guidance on Systems of Systems SE and integrating SE Into systems acquisition contracting
- Updating *Defense Acquisition Guidebook* Chapters 4 & 9 and SEP Preparation Guide
- Working to institutionalize use of system-level assessments/ad hoc reviews at the Component level
- Continuing to work with DAU to revise curricula in SPRDE, T&E, and PQM career fields

Back-up

Acquisition Initiatives:
SE considerations

Initiatives For Strategic and Tactical Acquisition Excellence

STRATEGIC
"Big A"

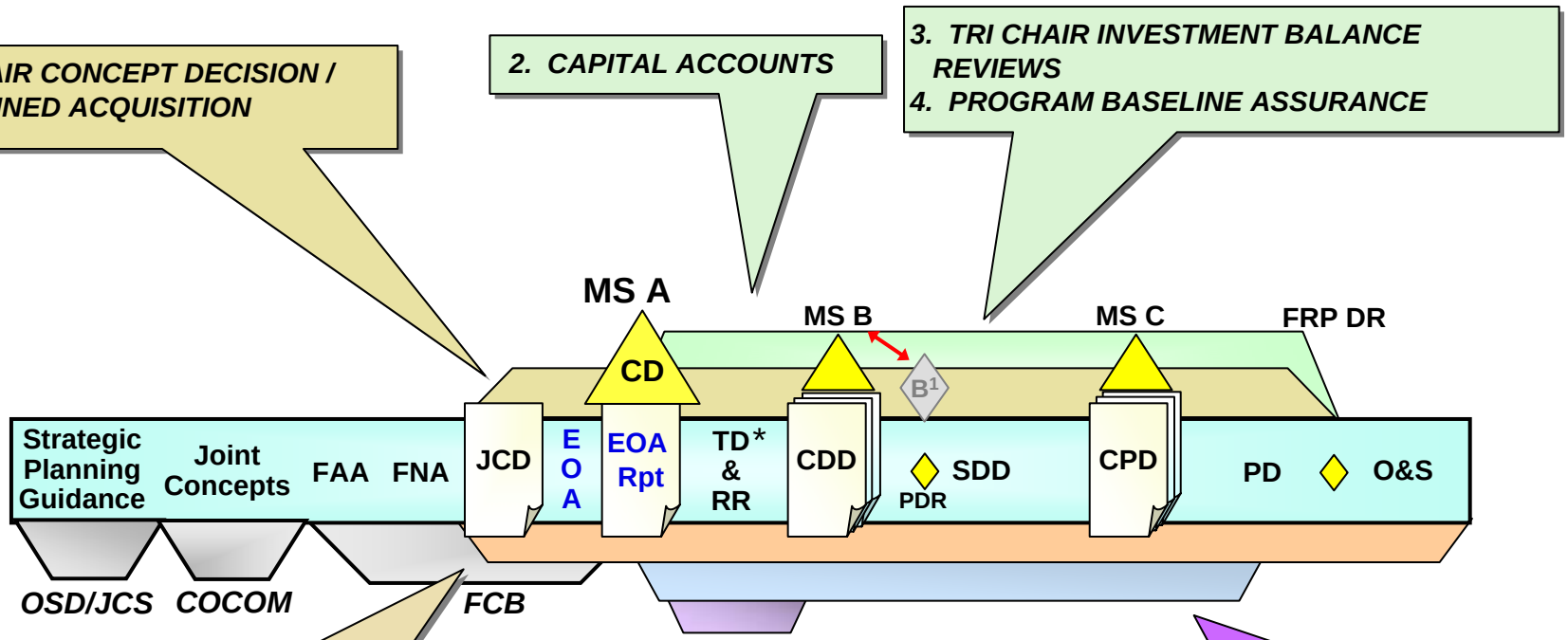
"Little A"
TACTICAL

OBJECTIVES	INITIATIVES
Making Decisions that Balance the Trade-Space • Affordable, Feasible Investments	• Portfolio Management • Tri-Chair Concept Decision / Time-Defined Acquisition • Evaluation of Alternatives • Synchronize Existing Processes • Tri-Chair Investment Balance Reviews
Starting Programs Right • Improved, Up-Front Planning • Awareness of Risk / Improved Source Selection • More Responsive Acquisition Solutions	• Risk-Based Source Selection • Small Business Innovative Research • Acquisition of Services Policy • Systems Engineering Excellence • Award Fee and Incentives
Process efficiency • Tailored, agile, transparent	• DAB / OIPT Process Optimization • Common Data / DAMIR • Restructured DAES
Program Stability • No Downstream Surprises • Issue Awareness	• Program Baseline Assurance • Capital Accounts

Improving the Full Range of Acquisition Execution

Improving Strategic & Tactical Acquisition Excellence

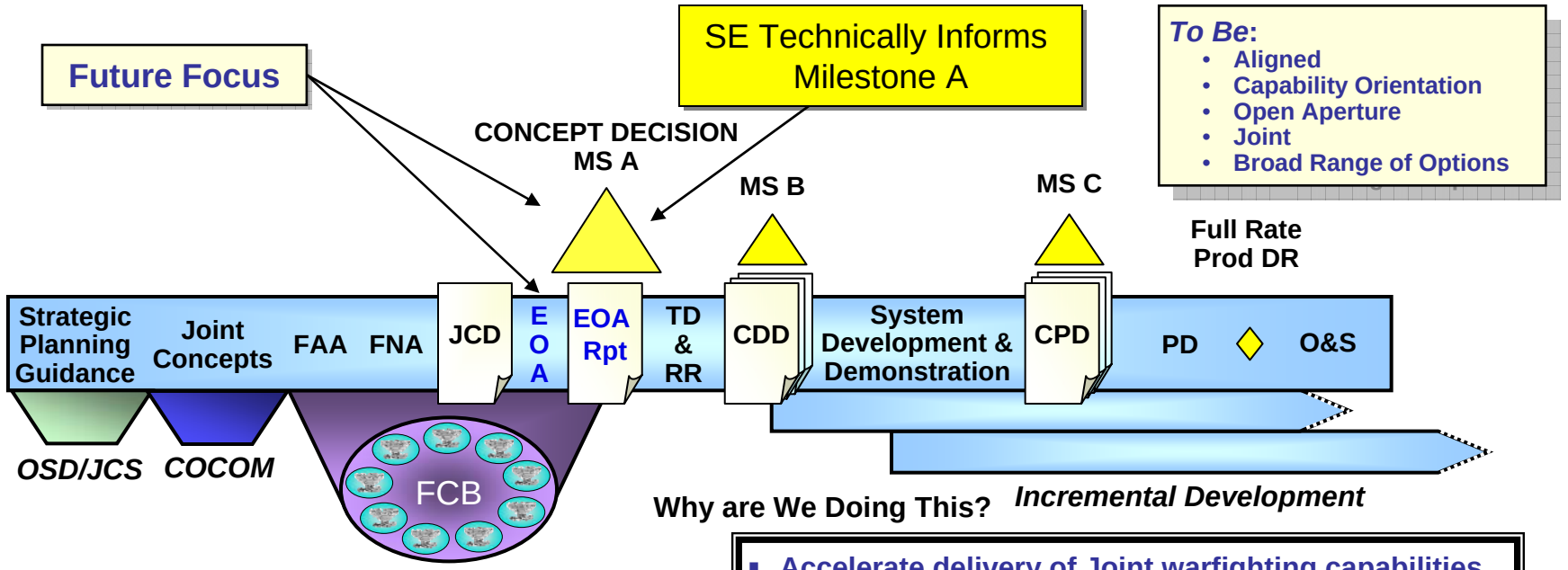
An Evolving Toolkit



Critical SE Leading Acquisition Initiatives

- **Tri-Chair Concept Decision / Milestone A**
  - Technical plans provide understanding for the TD&RR Phase
- **Risk-Based Source Selection**
  - Identified low risk strategies
  - Technical maturity to lower contract risk
  - DT&E validation of technical maturity
- **Time-Defined Acquisition**
  - Technical risk evaluations scope time-defined increments of capability
- **Use of SE to Trust AND Verify – Gaining Knowledge Over Time**
  - Verify technology readiness through DT&E
  - Technical reviews provide indications of performance

Concept Decision / Evaluation of Alternatives / Milestone A



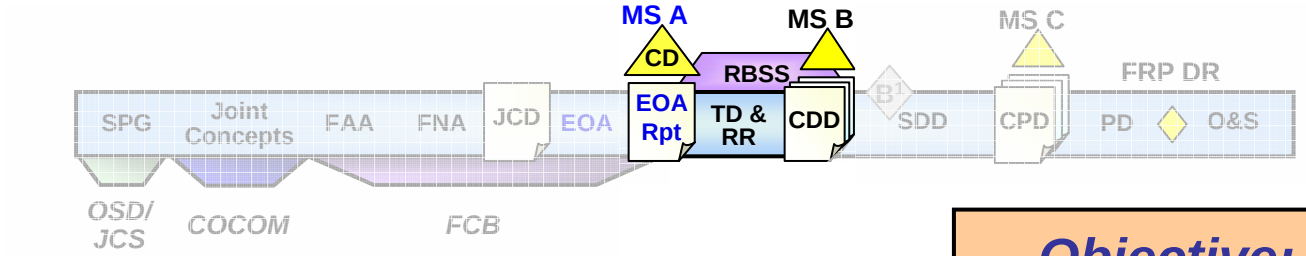
Concept Decision

- Tri-Chair approved experiment on 24 July
- Four pilots identified and in process
- EoA / Business Process Wargame conducted 7-8 Sep

- **Accelerate delivery of Joint warfighting capabilities**
  - Current process slow to respond to warfighter needs
- **Address resource/funding constraints early**
  - Necessary to control cost growth/requirements creep
  - Adequately fund and stabilize funding stream
  - Leverage SE understanding for cost, schedule, and performance estimates
- **Leverage Service/organizational competencies**
  - Delegate execution
  - Minimize oversight
  - Engage SE competencies

Systems Engineering more important than ever

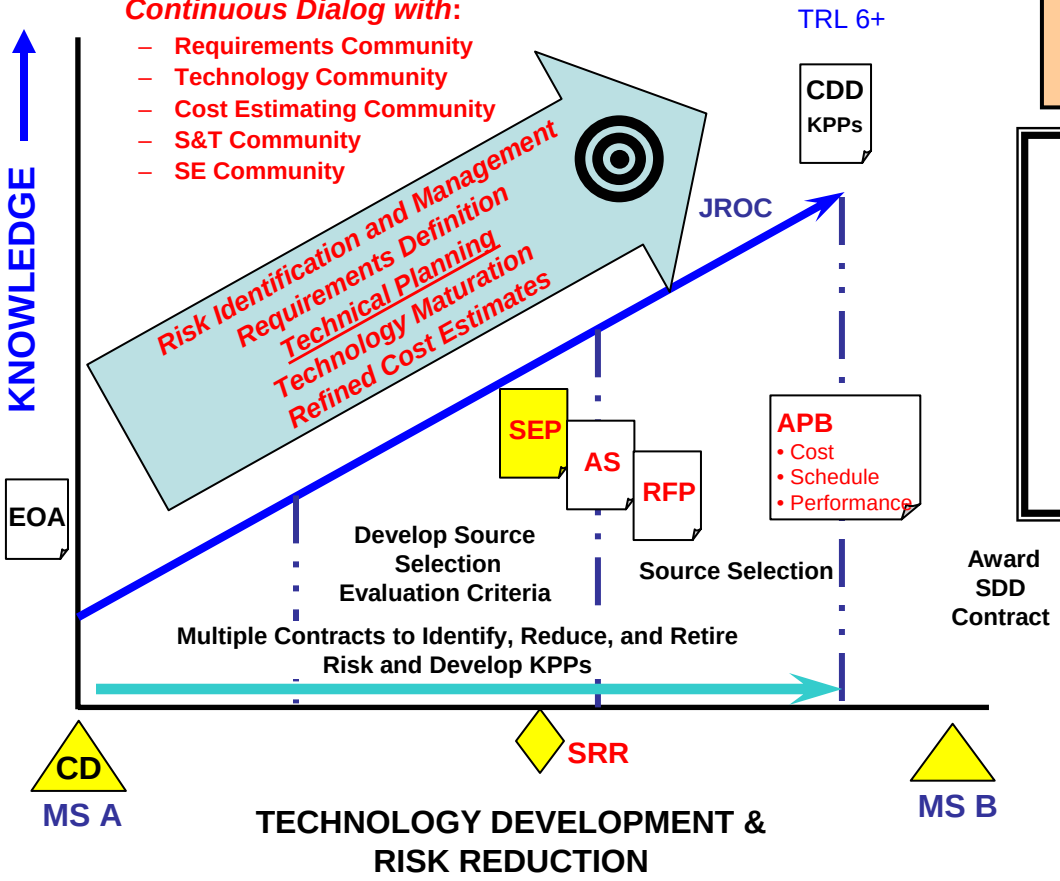
Risk-Based Source Selection



CONCEPT APPROACH

***Continuous Dialog with*:**

- Requirements Community
- Technology Community
- Cost Estimating Community
- S&T Community
- SE Community

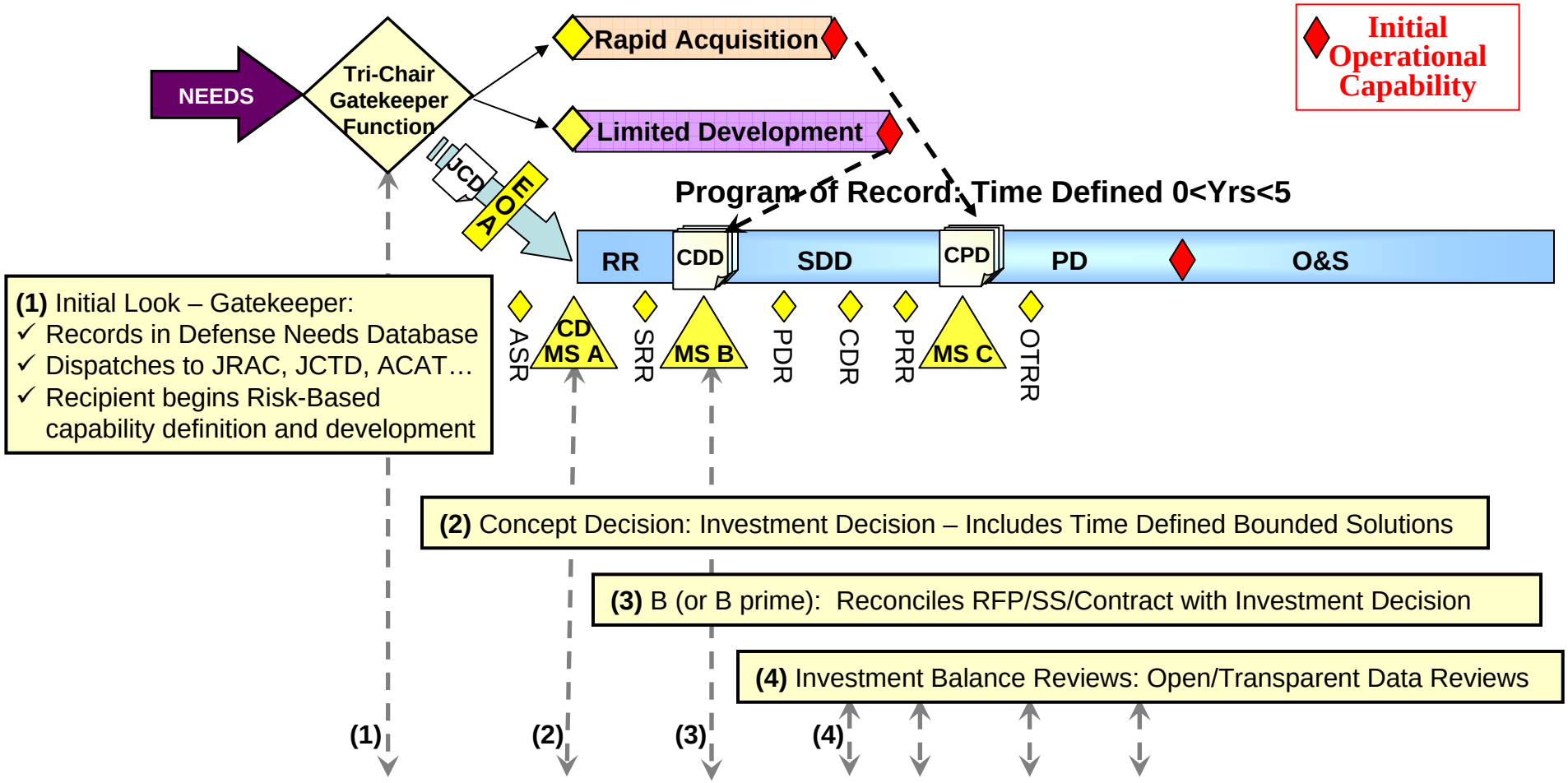


Objective: Starting Programs Right—earlier technical insight

Identify, quantify and mitigate risk, stabilize requirements definition, refine cost estimation, and improve source selection decision making.

Time-Defined Acquisition

Defining an optimum path – Keeping programs on track



Focus on Customer Outcome – Start Programs with Transition in Mind
Capitalize on Strong Technical Planning and Event-Based Reviews