The Role of T&E in the Systems Engineering Process

Keynote Address

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Top Priorities

1. *Successfully Pursue the Global War on Terrorism*

2. **Strengthen Combined/Joint Warfighting Capabilities**

3. **Transform the Joint Force**

4. **Optimize Intelligence Capabilities**

5. *Counter Proliferation of WMD*

6. *Improve Force Manning*

7. *New Concepts of Global Engagement*

8. *Homeland Security*

9. **Streamline DoD Processes**

10. *Reorganize DoD and USG to deal with Pre-War Opportunities and Post War Responsibilities*

Excerpt from SecDef Memo, 9/24/03

Current Situation
What We Need to Do Better

Requirements

- Adapting to changing conditions

- *Matching operational needs with systems solutions*

- Overcoming biases of Services and others

PPBES

- Laying analytical foundation for budget

- Moving to transform military

- Aligning budgets with acquisition decisions

Personnel and Readiness

- Treating people as a

Acquisition

- *Acquiring systems-of-systems*

- *Making system decisions in a joint, mission context*

- Transitioning technology

- *Assessing complexity of new work and ability to perform it*

- Controlling schedule and cost

Sustainment

- Controlling O&S costs

- *Passing operational*

- Reducing logistics tails
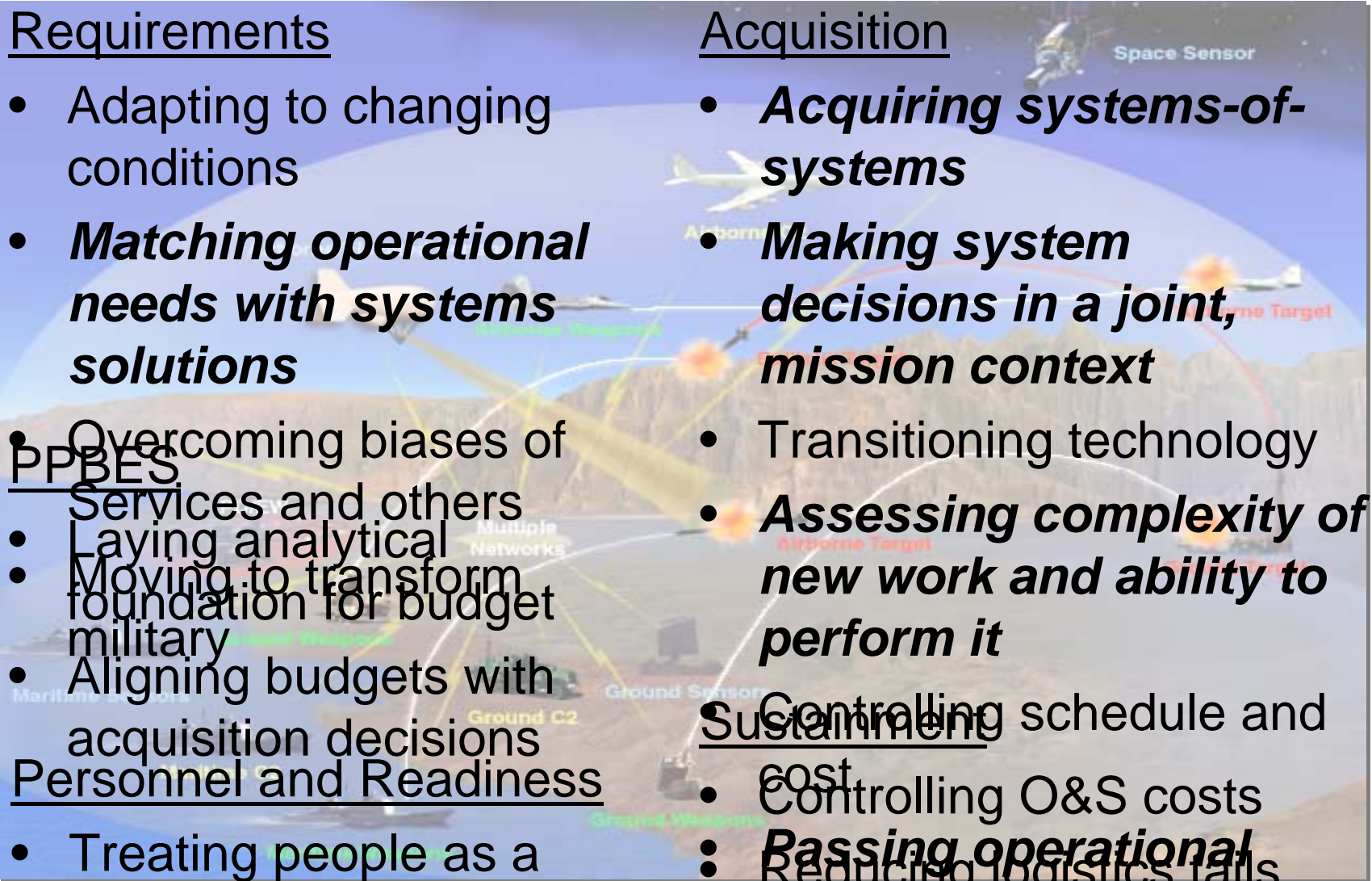
USD(AT&L) Imperatives

- "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 practice back into the way we do business."

How Defense Systems is Responding

- Instituted a new Systems and Mission Integration organization
  - Engaging OSD, Joint Staff, Services, and COCOM staffs to define joint integrated architectures
  - Synchronizing the requirements, acquisition, and budget processes
- Warfare offices tailoring the application of DoD 5000
  - Leading IPT process for program oversight and review
  - Role is to help programs succeed
- Formed a new Systems Engineering organization
  - Institutionalizing Systems Engineering across DoD
  - Setting policy for implementation, capturing best practices, setting standards for training and education
  - Enhancing emphasis on system assessment and support

Defense Systems Organization

DS
Defense Systems

Director — Dr. Glenn Lamartin
Principal Deputy — Mr. Mark Schaeffer

DS — Plans and Operations

SE
Systems Engineering
Director: Mr. Schaeffer

SA
Systems Acquisition
Director: Dr. Lamartin

SMI
Systems and Mission Integration
Director: Dr. Garber

Enterprise Development
Mr. Skalamera

Developmental Test & Evaluation
Mr. Lockhart

Assessments & Support
Mr. Castellano

Joint Force Application
Mr. Durham

Joint Force Integration
Ms. Quinlan

Joint Force Operation
Mr. Kistler

Air Warfare
Ms. Wright

Land Warfare & Munitions
Mr. Merlita

Naval Warfare
Ms. Costello

Missile Warfare
Dr. Stansberry

Treaty Compliance
Mr. Troyano

Systems Engineering

- Defines "good systems engineering" for the Department
- Finds, captures, and shares best practices
- Establishes systems engineering policy and procedures
- Implements education of government and industry workforce
- Conducts outreach with industry, academia, associations, individual programs, and others
- Directs and manages SE and SW studies and reviews
- Focal point for developmental test and evaluation
- Confirms designs meets specifications

Systems Engineering
Developmental Test & Evaluation

- A critical part of good systems engineering
- Ensures thorough test planning and assignment of resources
- Provides indication of technical maturity
- Verifies system performance
- Confirms the design meets specifications
- Stressing expanded use of models and simulation, especially for systems of systems
- Recommends changes to Department DT&E policies and procedures
- Key determinant of successful OT&E

T&E is integral to successfully fielding our weapon systems
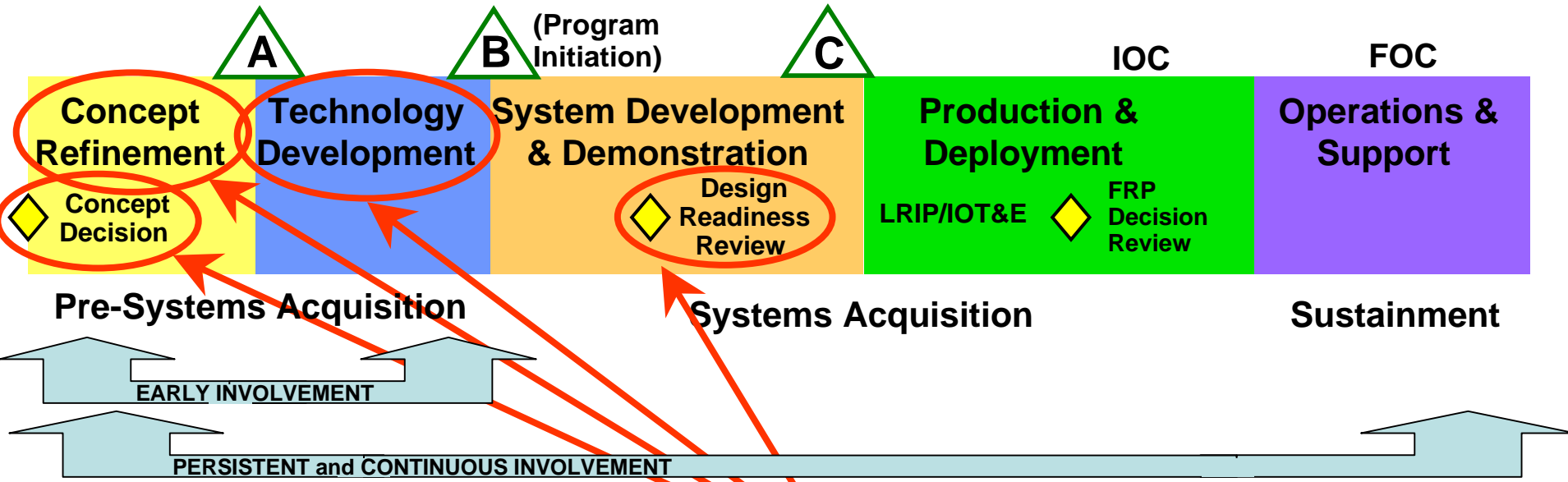
What We Have Done To Revitalize Systems Engineering

- Issued Department-wide SE policy and provided implementation guidance

- Established SE Forum to ensure senior-level focus

- Instituted "context" briefings as part of Milestone Reviews

- Instituted system-level assessments to aid PMs

- Working with Defense Acquisition University to revise curricula

- Re-focused Warfare offices to help guide programs through the Milestone Review process

- Leveraged close working relationships with industry and academia

- Integrating DT&E with SE policy and assessment functions - focused on effective, early engagement of both

Opportunity for Greater SE Role in Acquisition

A

B (Program Initiation)

C

IOC

FOC

Concept Refinement	Technology Development	System Development & Demonstration	Production & Deployment	Operations & Support
Concept Decision		Design Readiness Review	LRIP/IOT&E FRP Decision Review	

Pre-Systems Acquisition

Systems Acquisition

Sustainment

EARLY INVOLVEMENT

PERSISTENT and CONTINUOUS INVOLVEMENT

Increased use of disciplined Systems Engineering, including T&E and M&S, to effectively address technical issues

Current Challenges

- Focus shifting from platforms to capabilities and system solutions

- System complexity is increasing – Family of Systems and/or System of Systems interdependencies

- Demand for network centric capability drives higher levels of integration

- Functional and physical interfaces expanding in number and complexity

- Evolutionary acquisition institutionalizing change

- New approaches to testing balanced with modeling and simulation must match new systems views

What You Can Do

- Remember the Under Secretary's imperatives – our ultimate goal is to help our programs and ensure mission success

- Develop a strategy to better integrate T&E and M&S into program SE activities …

- Consider opportunities for expanded involvement in acquisition process — timing (early) and level (persistent and continuous)

- Think about SE, T&E, and M&S as they relate to Systems-of-Systems capabilities.
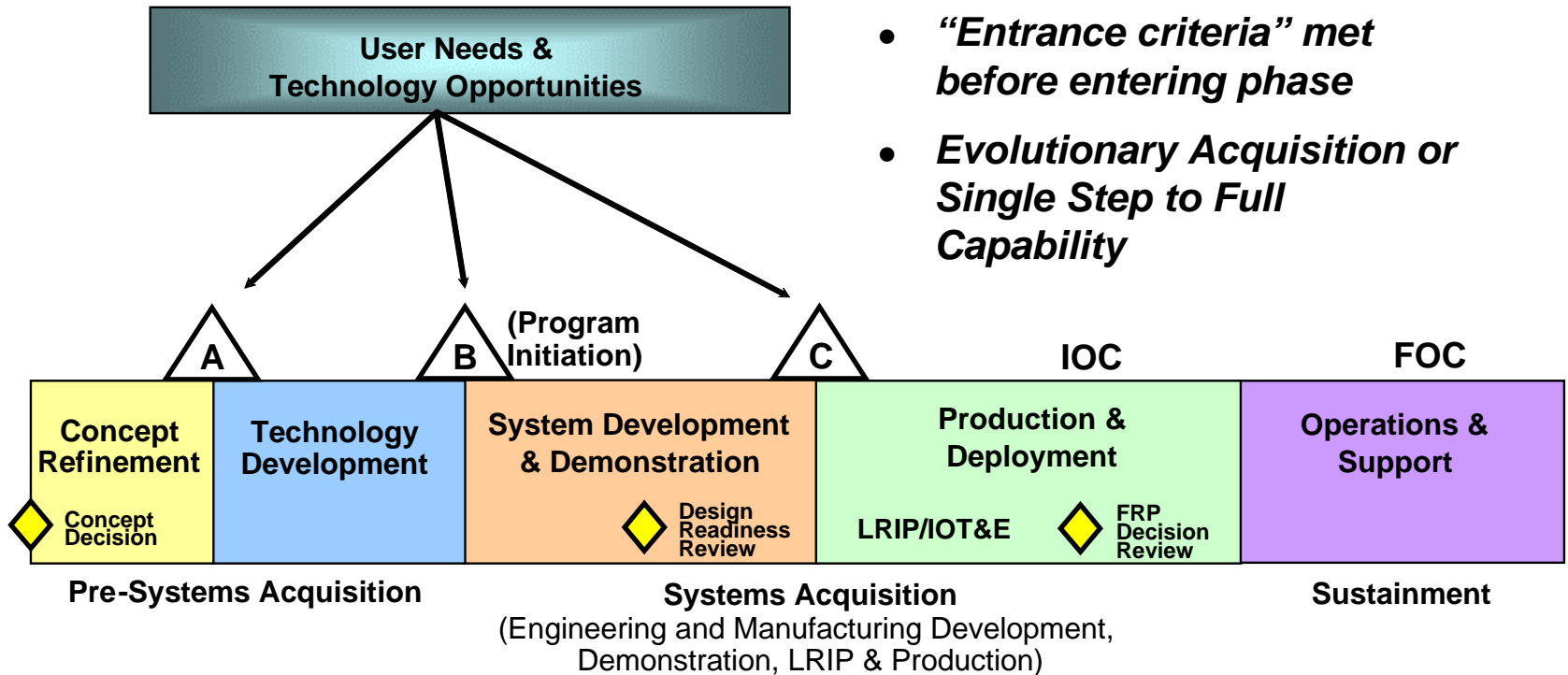
- Participate and engage … with an open mind

Backup Slides

The Acquisition Model
DoDD 5000

- *Process entry at Milestones A, B, or C (or within phases)*
- *"Entrance criteria" met before entering phase*
- *Evolutionary Acquisition or Single Step to Full Capability*

User Needs & Technology Opportunities

A

B (Program Initiation)

C

IOC

FOC

Concept Refinement	Technology Development	System Development & Demonstration	Production & Deployment	Operations & Support

Concept Decision

Design Readiness Review

LRIP/IOT&E

FRP Decision Review

Pre-Systems Acquisition

Systems Acquisition
(Engineering and Manufacturing Development, Demonstration, LRIP & Production)

Sustainment

Defense Systems Organization

DS — Defense Systems

Director — Dr. Glenn Lamartin
Principal Deputy — Mr. Mark Schaeffer

DS — Plans and Operations

SE — Systems Engineering
Director: Mr. Schaeffer

- **Enterprise Development** — Mr. Skalamera
- **Developmental Test & Evaluation** — Mr. Lockhart
- **Assessments & Support** — Mr. Castellano

SA — Systems Acquisition
Director: Dr. Lamartin

- **Air Warfare** — Ms. Wright
- **Land Warfare & Munitions** — Mr. Melita
- **Naval Warfare** — Ms. Costello (Acting)
- **Missile Warfare** — Dr. Stansberry
- **Treaty Compliance** — Mr. Troyano

SMI — Systems and Mission Integration
Director: Dr. Garber

- **Joint Force Application** — Mr. Durham
- **Joint Force Integration** — Ms. Quinlan
- **Joint Force Operation** — Mr. Kistler

Systems and Mission Integration

- Leads the development of systems views of integrated architectures
- Leads the development of integrated plans and/or roadmaps
- Establishes a broader context for DAB reviews
- Leads DAB reviews for Capability Areas
- Fosters interoperability, jointness, and coalition capabilities
- Develops/refines systems engineering concepts and practices for application at the architecture level
- Conducts systems assessments to judge how well newly fielded systems meet capability needs

Systems Acquisition

- Responsible for technical review and program oversight of assigned acquisition programs

- Leads overarching integrated product teams for strategic and tactical systems; develops recommendations on major weapon systems for the Defense Acquisition Board

- Provides technical support to arms negotiations, makes recommendations concerning treaty implications on the acquisition of new systems, and monitors compliance with treaties

- Tailoring the application of the revised DoD 5000 series
  - Emphasis now on helping programs succeed and transition to new Department processes
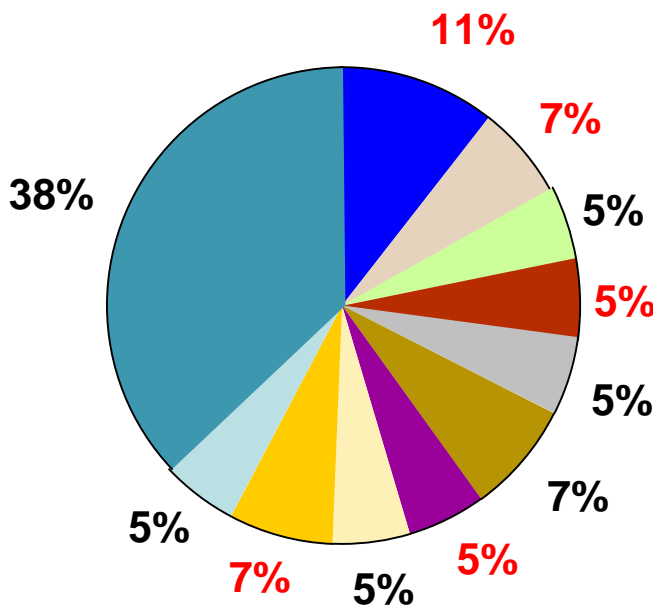
Development Growth Causes
(Stakeholder Analysis)

Principal Causal Factors:

- **Requirements Immaturity**
- **Requirements Creep**
- **Programs Budgeted Too Early**
- **Software and Integration Underestimated**
- **Budget Instability**
- **Competitive Process "Over-optimism"**
- **Inadequate Pre-Acquisition Planning & Risk Reduction**
- **Optimistic & Extrapolated Estimates**
- **Lack of System Engineers**
- **Program Director Turnover & Experience**
- **All Other Causes**

Other:

- Acquisition Reform
- Program Length
- Too Many KPPs
- No Management Reserve
- Program Management Optimism

Lack of adherence to SE practices/principles accounts for >35% of growth

Source: 83 surveys, 67 Organizations, frequency of mention, *Space Systems Development Cost Growth Analysis Booz-Allen-Hamilton*
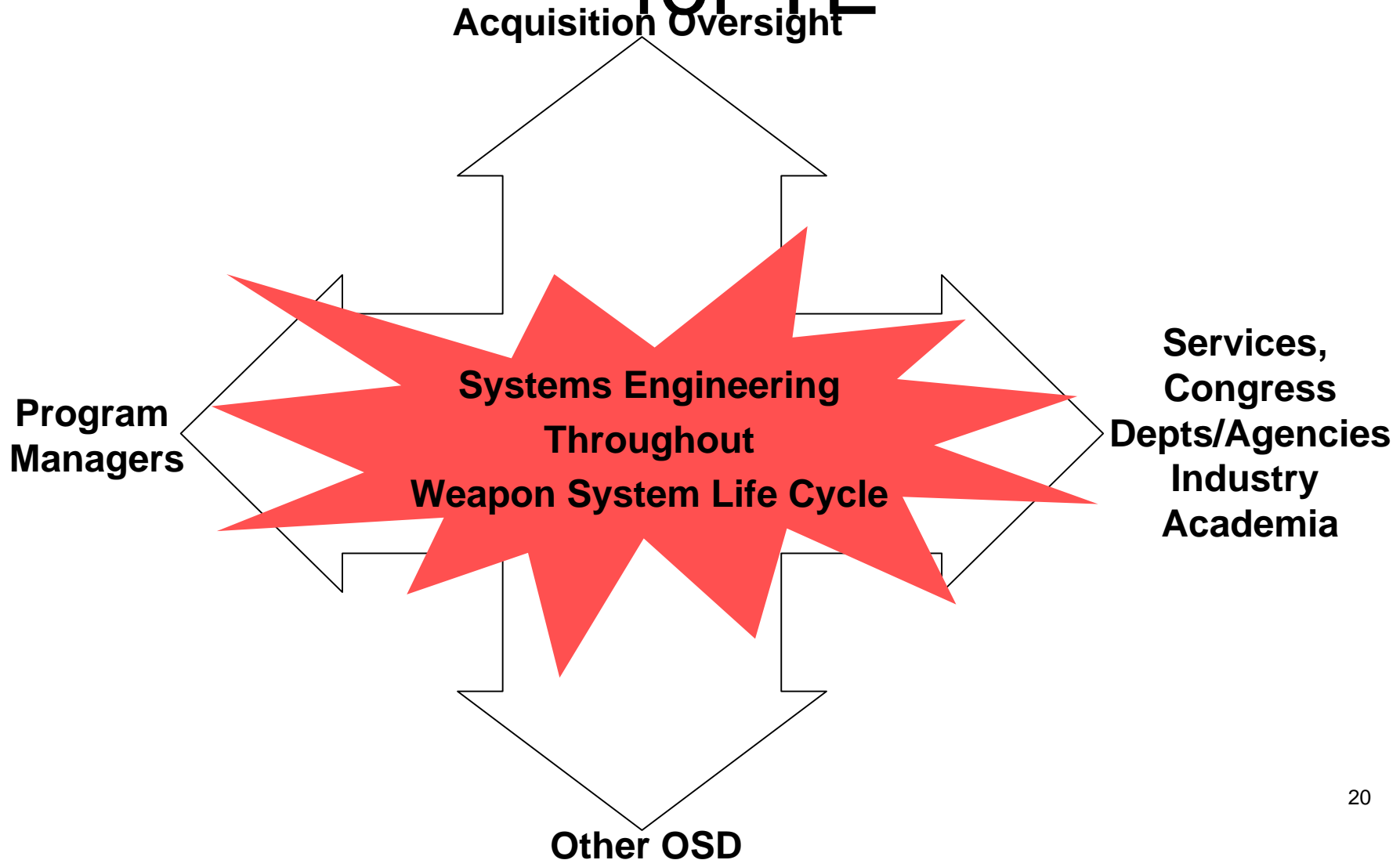
Next Two Days: Questions to Answer

- Are there any policy changes needed?
- How do we ensure that TE planning process is integrated into the SE processes?
- How do we integrate the SEP and TEMP?
- How do we ensure the tester is part of the SE process?
- How do we make T&E support verification of the SE process?
- Are there process changes needed by industry and government?
- Can we precisely define the role of T&E in the SE process?
- How do you determine when you have done enough T&E?

Opportunity?...
SE As Integrating Enabler for TE

Acquisition Oversight

Program Managers

Systems Engineering Throughout Weapon System Life Cycle

Services, Congress Depts/Agencies Industry Academia

Other OSD

Summary

- T&E is an important part of the SE process and thus important to the success of programs
- Determine an overall optimum strategy for incorporating the appropriate Test & Evaluation activities in a program's Systems Engineering activities
  - Service's/MDA's vision of appropriate/workable strategy
    - Include System of Systems (SoS) & Family of Systems (FoS)

Director, Defense Systems

- Principal advisor to the Under Secretary of Defense (Acquisition, Technology & Logistics)

  - Technical review, evaluation, and oversight of strategic and tactical programs

  - Chairs Overarching Integrated Product Teams in the Defense Acquisition Board process

  - Enables effective joint and combined operations through the development of system of systems capabilities

  - Implements policies regarding system integration and interoperability

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Capability Area Reviews

- Focus on capabilities and Systems-of-Systems
- Provides mission area context for DAB principals
- Relates acquisition process to capability and programming processes
- Identifies joint solutions and additional work to be done
- Reveals need for management, engineering, and testing across a capability area
- Helps align individual program expectations for capability and schedule
- Provides basis to set metrics and gauge progress in developing capability