

# **T&E for Verifying Technology Development and Maturation**

**Chris DiPetto**

**Deputy Director,**

**Developmental Test & Evaluation**

**OUSD(AT&L)/Systems & Software Engineering**

**March 13, 2007**

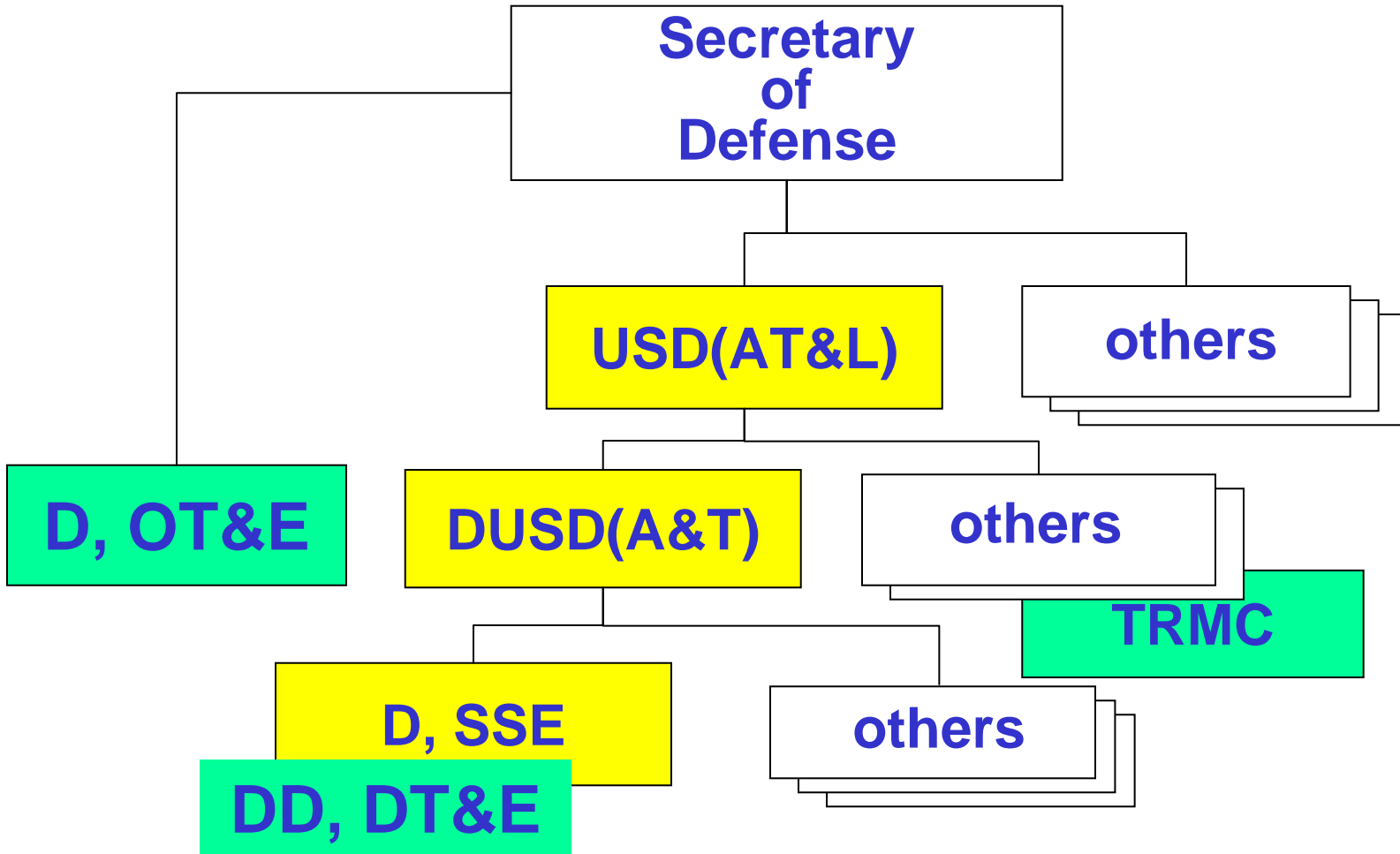


# Outline

- Intro to OSD DT&E
- DT&E Priorities
- DT&E Technology Maturity Initiative
- Plan of Action

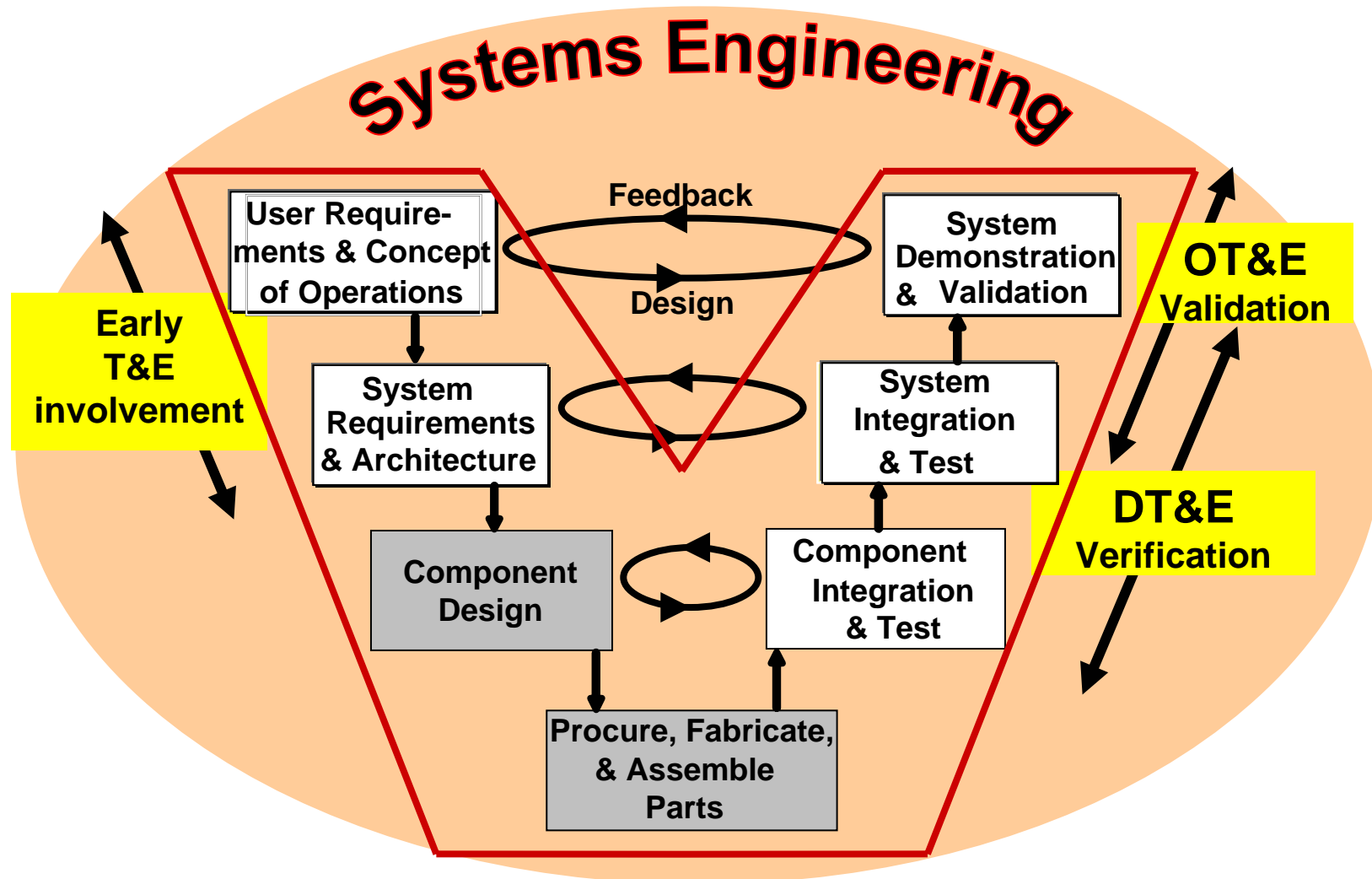


# Where am I in OSD?





# T&E Supports Systems Engineering





# What's My Role?

## Primary

- DT&E Policy & Guidance
- T&E Workforce Education

## Secondary

- Acquisition M&S
- Systems Energy Policy
- DoD Acquisition System Safety



# A New Vector for DT&E

## My Priorities...

- **Support Faster Fielding of Improved Capabilities**
- **Reduce Risk of Immature Technology in Systems Development**
- Revitalize T&E Workforce Education
- Promote Joint T&E in Live-Virtual-Constructive Environments
- Provide Effective Acquisition Policy and Practices for DT&E

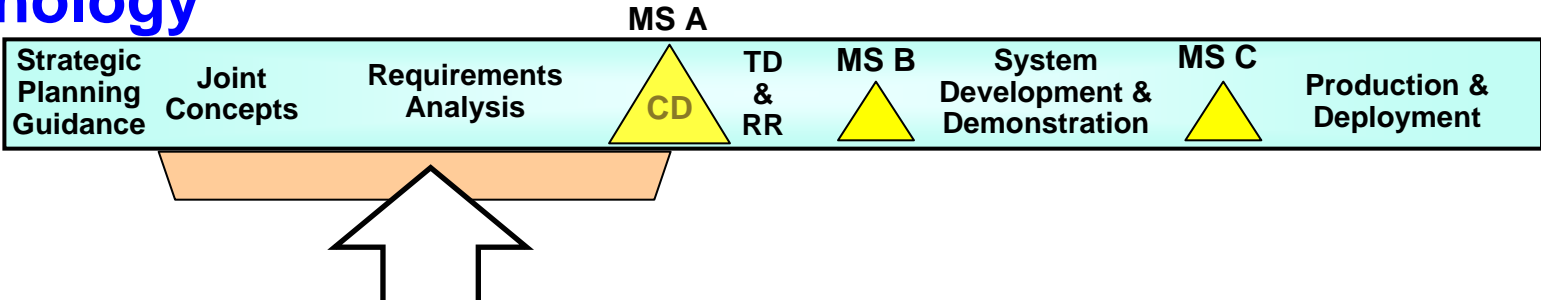


# Support Faster Fielding of Improved Capabilities

- 2006 QDR: “...a more effective acquisition system and associated set of processes.”
- Acquisition goal - cut time in half, from 10+ to 5- years
  - (1) reduce technical & programmatic risk, prior to program initiation
  - (2) change people’s mind-set; focus on trading greater capability for earlier fielding

New approach: evaluate cost, requirements, and technology alternatives - improved Concept Decision for MS A (“Big A”)

Result: start programs with firm requirements & mature technology





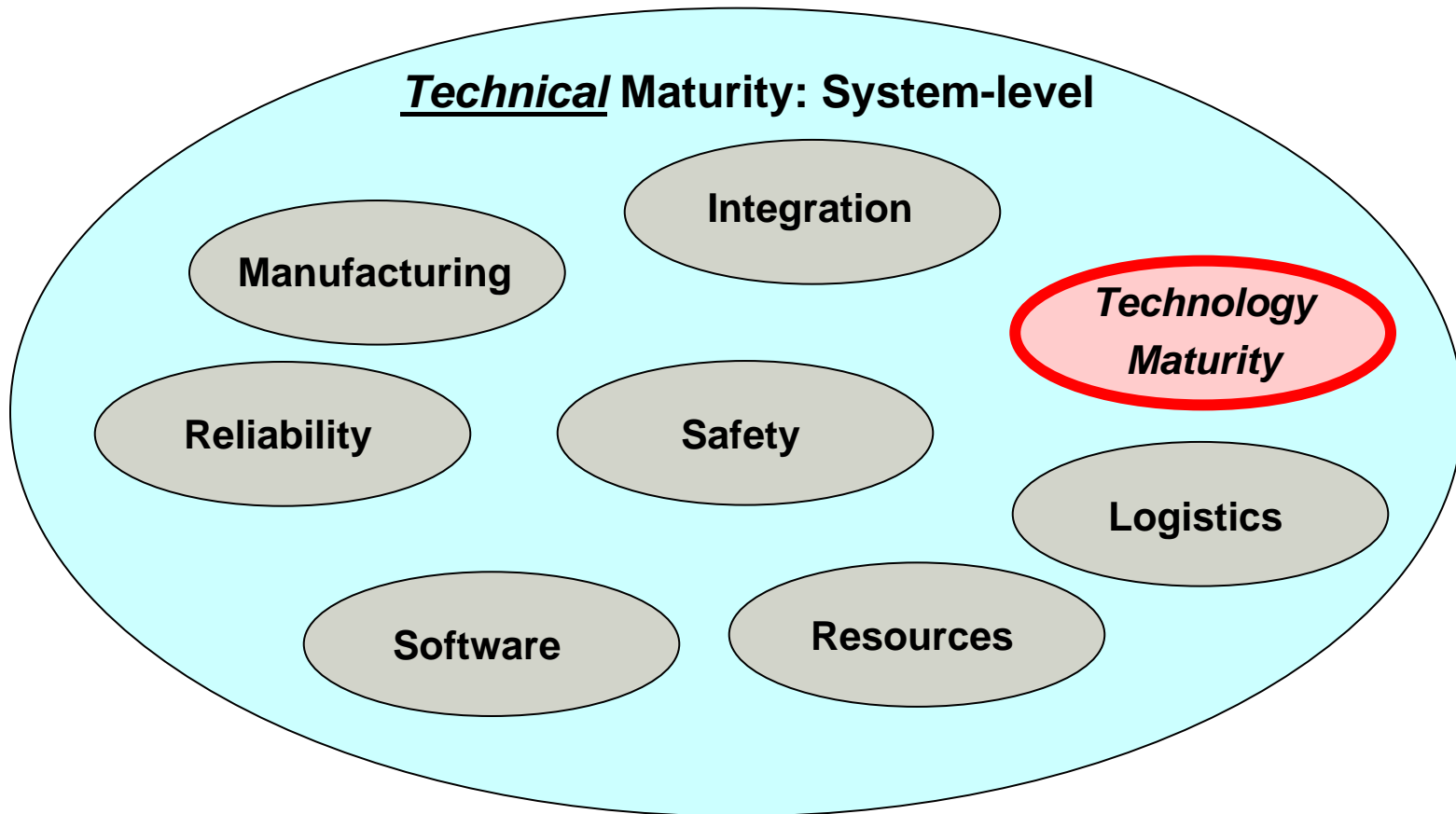
## Role for DT&E

- **Assure testable requirements in Big “A” Eval of Alt’s / CD**
- **Include in request for proposal (RFP) T&E implications for System Development and Demonstration**
- **Fully integrate T&E strategy - CT, DT, OT**
- **Efficient test data philosophy: collect once, use often**
- **Not pass-fail; learn, define, understand system’s capabilities and limitations...for fielding at predefined time**
- **Operational environment and operators in DT, soonest**
- **Mutually supporting plans:**
  - **Systems Engineering Plan**
  - **Test and Evaluation Master Plan**
  - **System development Statement-of-Work and RFP**





# Technology vs. Technical Maturity



Technology Maturity is a component- or subsystem-level issue



## Reduce Risk of Immature Technology in Systems Development

- Studies find that immature technology is a primary source of cost and schedule risk
  - GAO
  - QDR
  - DAPA
  - SSE/AS Program Support Reviews
- “Programs that started development with **immature** technologies experienced an average acquisition unit cost increase of nearly **21 percent**” (GAO-05-301, March 2005)
- FY06, PL 109-163, Section 801 requires USD(AT&L) certification, before Milestone B, that *“the technology in the program has been demonstrated in a relevant environment”*
  - Above wording equates to Technology Readiness Level (TRL) 6



# OSD Oversight Findings

- PM chose “a software architecture that depends upon COTS middleware that does not yet exist “
  - Although an alternative has been identified, no effort has been expended to pursue this solution
- “Technology maturity growth of critical Engineering Development Models lagging the plan”
  - PSR Recommendation: Initiate development of off-ramps to maximize operational performance
- “Technology Readiness Level (TRL) 6 of major subsystem at Milestone B is unlikely to be achieved; planned testing will not support accurate assessment of true maturity”
- “TRA conducted too late to influence decision process”

***Major contributors to poor program performance***



# DT&E Technology Maturity Initiative

## Purpose

- Add Technology Maturity focus into the Systems Engineering and DT&E processes to:
  - Reduce technical, cost, and schedule risk
  - Increase the rigor of SE
  - Plan for alternatives in the event of TM difficulty
  - Verify TRLs during DT&E
  - Updates will complement proposed Risk-Based Source Selection, Time-Defined Acquisition, and Concept Decision (CD) processes

## Scope

- Leverage existing acquisition review structure
- Use existing DDR&E Technology Readiness Assessment (TRA) methodology



# Technology Maturity Across System Lifecycle (as-is)

<u>Technical Review</u>	<u>Decision</u>	<u>TRL (min)</u>
Initial Technical Review	CD	1*
Alternative System Review	MS A	4*
System Requirements Review	MS B	6 ← <small>Statute, per Sec 801</small>
Systems Verification Review/ Production Readiness Review	MS C	7*

\* Guidance, not statute

Technology Maturity should be tracked  
between Milestones in Technical Reviews



# Time-Certain Acquisition *Demands* Higher Technology Maturity

## Technical Review Opportunities

Evaluation of Alternatives  
Alternative System Review (ASR)

## Decision

EOA  
CD

## TRL (min)

4-5\* } Compressed/  
4-5\* } Merged

Systems Requirements Review	MS B	6 ← <u>Statute</u> , per Sec 801
-----------------------------	------	----------------------------------

Systems Verification Review/  
Production Readiness Review

MS C

7\*

\* Guidance, not statute



# Plan of Action

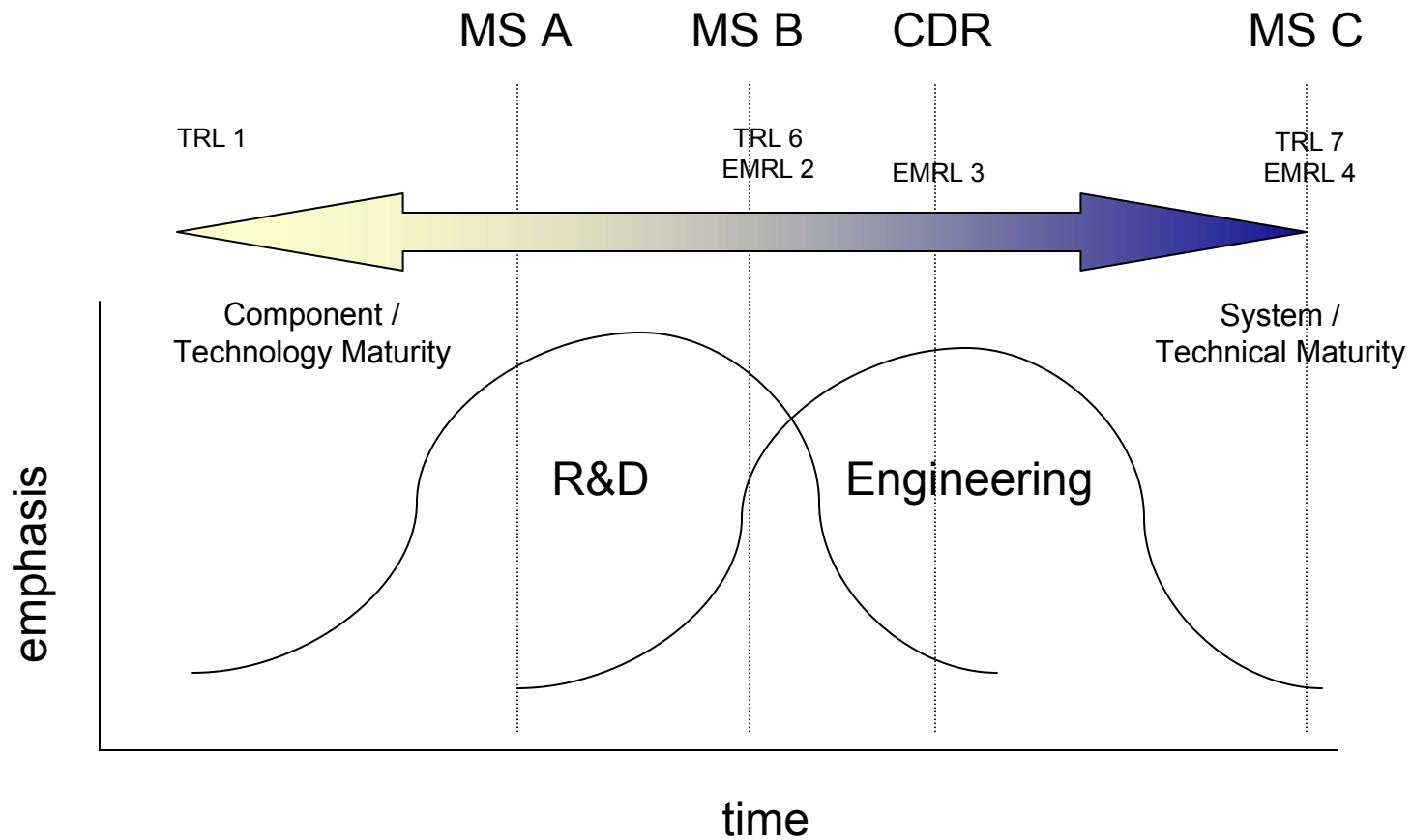
- Changes in next update to Defense Acquisition Guidebook
  - SE and T&E Chapters
- Incorporate TM in recommended formats of
  - SEP, TES, TEMP
- Increase TM emphasis in OSD Oversight
  - PSRs, AOTRs
- Add emphasis on TM to DAU SE and T&E curriculum
  - CLM on TM planning
- Publicize renewed TM emphasis to DoD, Service, and Industry organizations

Back-up





# Transition of Emphasis





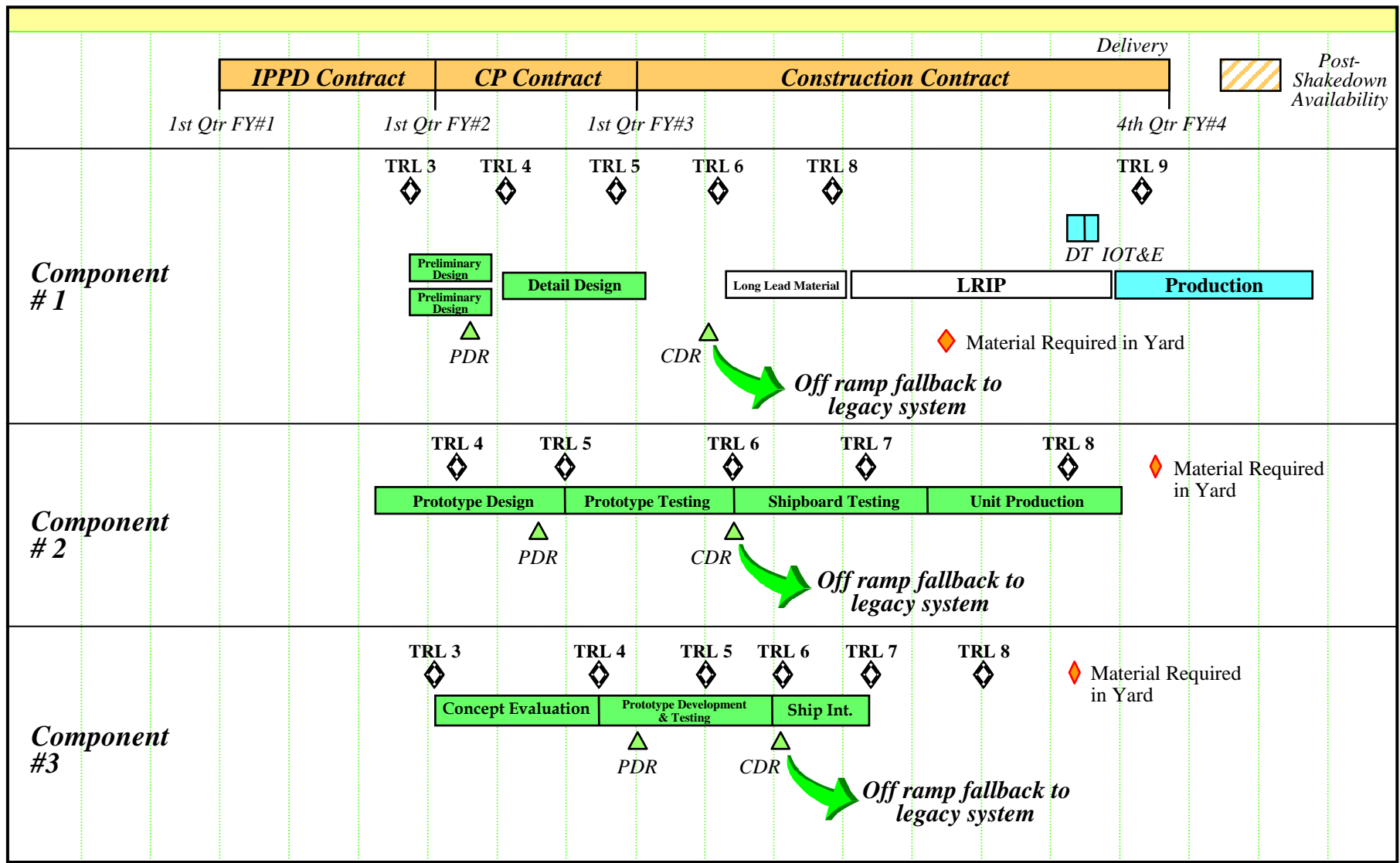
# Hardware TRL Definitions

## Decision:

- |       |   |
|-------|---|
| CD*   | 1. Basic principles observed and reported   |
|       | 2. Technology concept and/or application formulated                                     |
|       | 3. Analytical and experimental critical function and/or characteristic proof of concept |
| MS A* | 4. Component and/or breadboard validation in a laboratory environment                   |
|       | 5. Component and/or breadboard validation in a relevant environment                     |
| MS B  | 6. System/subsystem model or prototype demonstration in a relevant environment          |
| MS C* | 7. System prototype demonstration in an operational environment                         |
|       | 8. Actual system completed and qualified through test and demonstration                 |
|       | 9. Actual system proven through successful mission operations                           |

\* Guidance, not statute

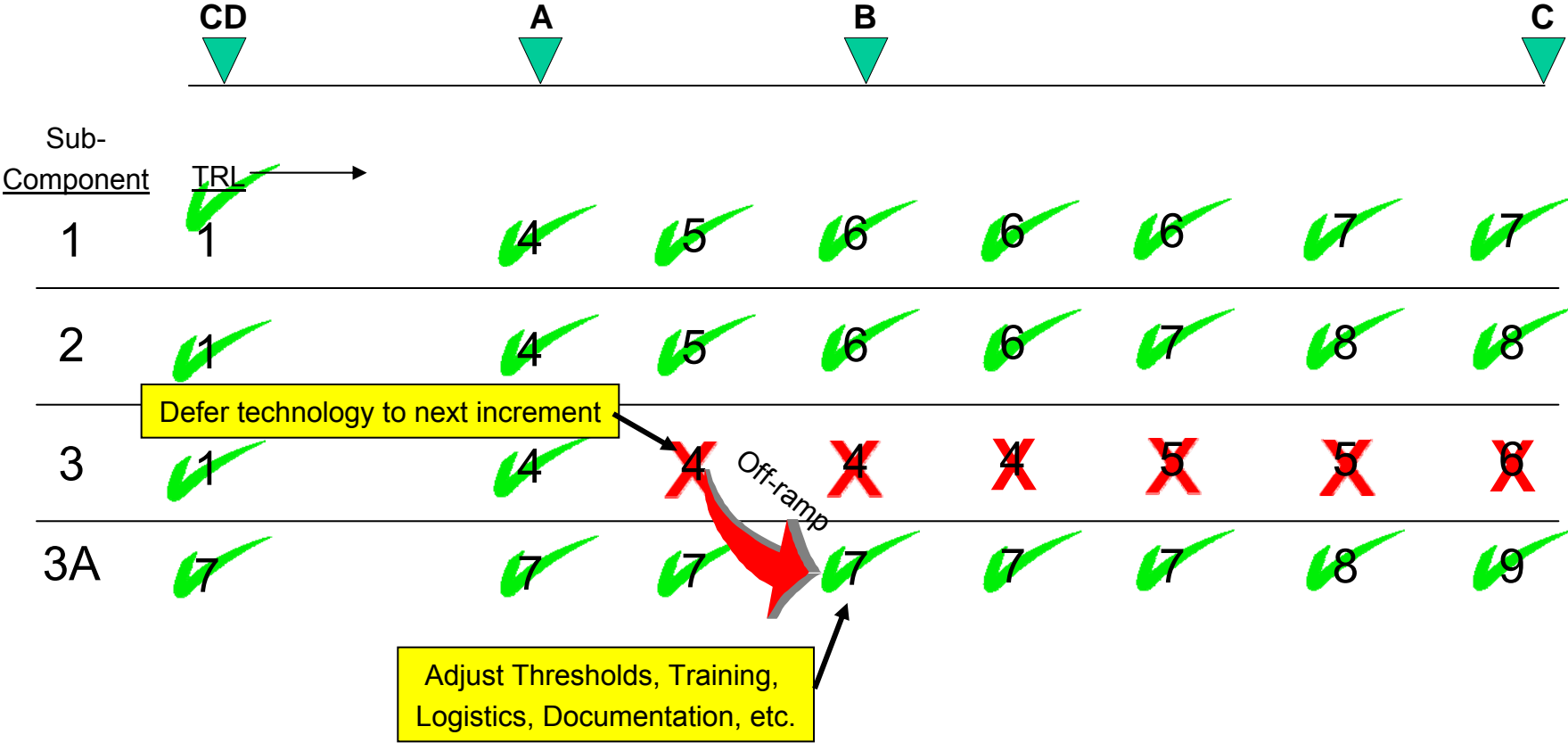
# Critical Technology “Off-Ramps”





# TRL Impact on SE

## Example of Pre-planned “Off-ramp”



Sub-component “3” does not mature at required rate. Off-ramp to mature sub-component “3A” is chosen before MS B.

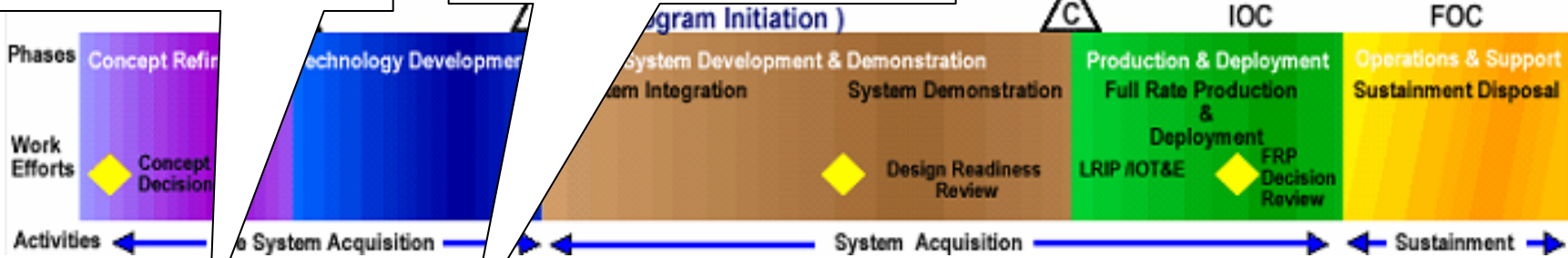


# TM Activities in SE Process

**ASR:**  
 -ID immature critical technologies w/ maturation plans  
 -ID mature alternatives w/ performance/other trades  
 -TDS

**SRR:**  
 -All critical technologies (or alternatives)  $\geq$  TRL-6  
 -Acceptable performance, balanced vs capability need, cost, schedule, etc.  
 -Support MDA cert at MS B

**← Technical Review Exit Criteria**



-ID immature critical technologies  
 -ID mature alternatives

-Assess performance w/ critical technologies  
 -Assess performance w/ mature alternatives

-Demo/Assess performance  
 -Verify TRLs  
 -Track TM progress vs plan  
 -Take Off-ramp (if req'd)

**← DT&E Role, in Preps for Technical Reviews**