A Perspective on DoD Manufacturing Policy and Technical Maturity Issues Challenging Affordability

13th Annual NDIA System Engineering Conference

LOCKHEED MARTIN

Dr. Michelle Atchison

Corporate Engineering and Technology

28 Oct 2010

Challenge of Bridging TRL and MRL

- **New Imperatives to Reduce Risk while improving Acquisition Affordability**

Our Guidance

- Quadrennial Defense Review Executive Summary, February 2010
  - *Further rebalance the capabilities of America's Armed Forces to prevail in today's wars, while building the capabilities needed to deal with future threats*
  - *Further reform the Department's institutions and processes to better support the current needs of the warfighter; buy weapons that are usable, affordable and truly needed; and ensure that taxpayer dollars are spent wisely and responsibly*
  - *Preserve and enhance the All-Volunteer Force*
  - *Improve how it matches requirements with mature technologies, maintains disciplined systems engineering approaches, institutionalizes rapid acquisition capabilities, and implements more comprehensive testing*
- Quadrennial Defense Review Report Preface
  Secretary of Defense Robert M. Gates, February 2010
  - *United States needs a broad portfolio of military capabilities with maximum versatility across the widest possible spectrum of conflict*
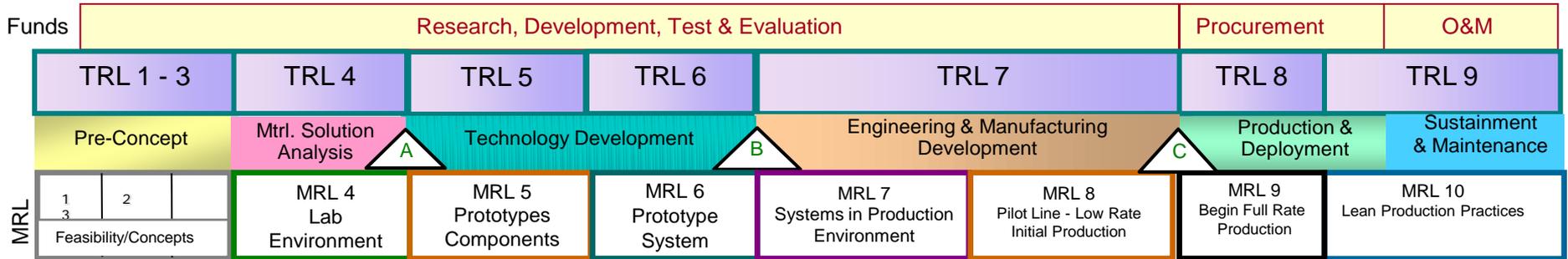
DDR&E Imperatives

1. Accelerate delivery of technical capabilities to win the current fight.

2. Prepare for an uncertain future.

3. Reduce the cost, acquisition time and risk of our major defense acquisition programs.

4. Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation.

DDR&E Key Transition / Fielding Programs
'Notional Alignment with Funding, TRLs, Acquisition Cycle, & MRLs'

Funds	Research, Development, Test & Evaluation					Procurement	O&M
	TRL 1 - 3	TRL 4	TRL 5	TRL 6	TRL 7	TRL 8	TRL 9
	Pre-Concept	Mtrl. Solution Analysis	Technology Development (A)	(B)	Engineering & Manufacturing Development (C)	Production & Deployment	Sustainment & Maintenance
MRL	1 3 / 2 Feasibility/Concepts	MRL 4 Lab Environment	MRL 5 Prototypes Components	MRL 6 Prototype System	MRL 7 Systems in Production Environment / MRL 8 Pilot Line - Low Rate Initial Production	MRL 9 Begin Full Rate Production	MRL 10 Lean Production Practices

Test Emerging Technologies for OCO — Rapid Reaction Fund (RRF)

Operational Experiments & Tech Integration for COCOMs — Emerging Capabilities (EC)

Mature DoD Laboratory Technologies (Lab Push) — Technology Transition Initiative (TTI)

COCOM / Joint/ Coalition Focused — Joint Capabilities Technology Demonstrations (JCTDs)

Mature Defense High-Impact Processes — Manufacturing Science & Technology (MS&T)

Test "Gap-FIling" Technologies for OCO — Quick Reaction Funds (QRF)
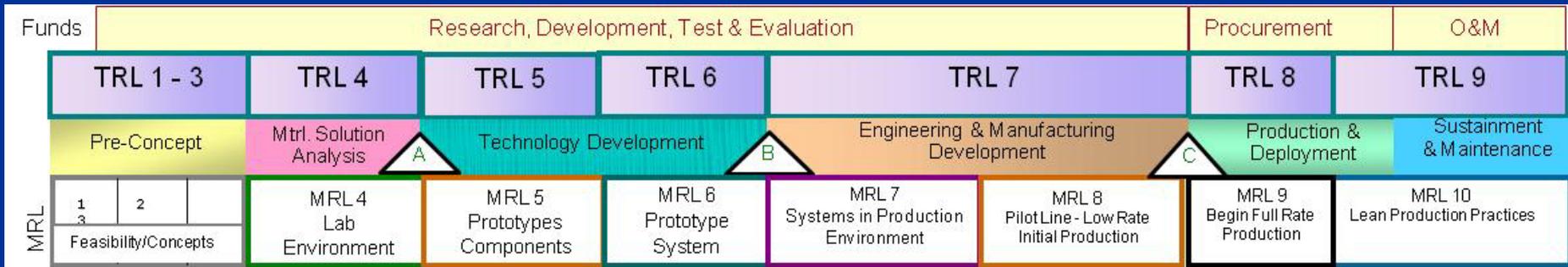
Industry "On" Ramp - Test to Procure Tech Refresh — Defense Acquisition Challenge (DAC)

Coalition Industry Mature Technology - Test to Procure — Foreign Comparative Testing (FCT)

TRL: Technology Readiness Level
MRL: Manufacturing Readiness Level
OCO: Overseas Contingency Operations

Challenge of Bridging TRL and MRL

Funds	Research, Development, Test & Evaluation						Procurement	O&M
	TRL 1 - 3	TRL 4	TRL 5	TRL 6	TRL 7		TRL 8	TRL 9
	Pre-Concept	Mtrl. Solution Analysis A	Technology Development		B Engineering & Manufacturing Development	C	Production & Deployment	Sustainment & Maintenance
MRL	1 3 2 Feasibility/Concepts	MRL 4 Lab Environment	MRL 5 Prototypes Components	MRL 6 Prototype System	MRL 7 Systems in Production Environment	MRL 8 Pilot Line - Low Rate Initial Production	MRL 9 Begin Full Rate Production	MRL 10 Lean Production Practices

- **Is accelerating TRL Development while compressing Manufacturing Readiness Level Timelines creating a wider gap for technology transition?**

- **Is there solid integration between Rapid Acquisition programs, initiatives and formal acquisition procedures?**

- **How could these be bridged?**

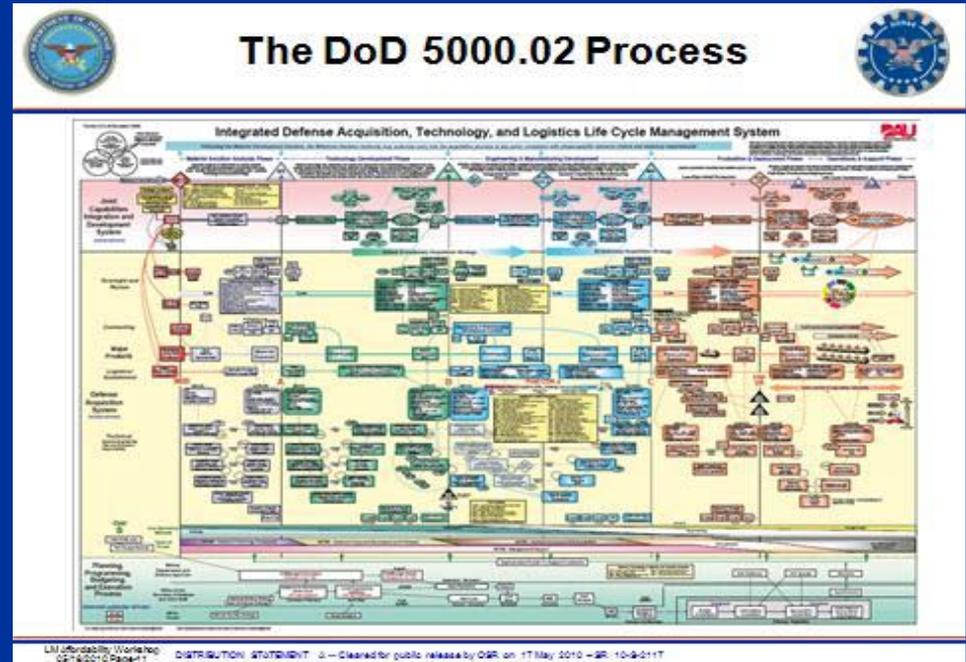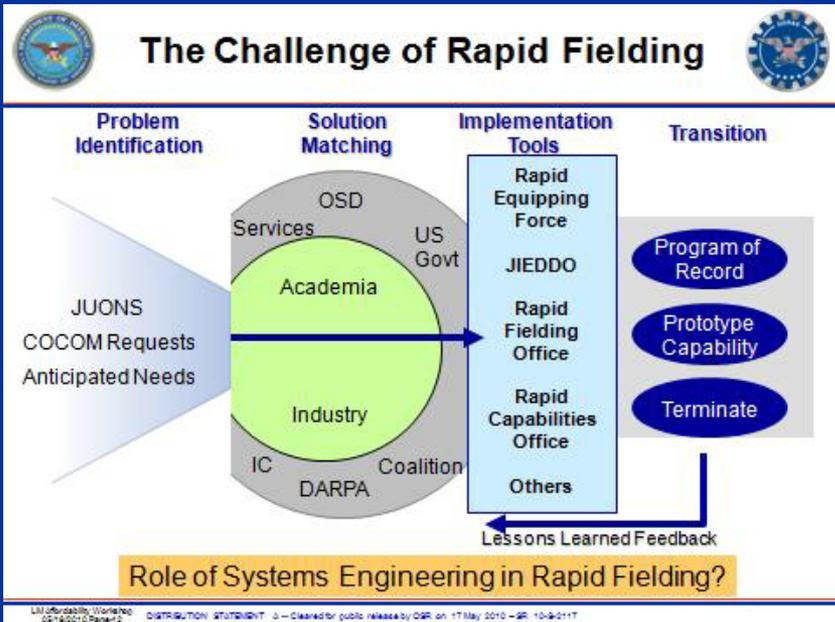# Early Decisions Impact Life Cycle Cost
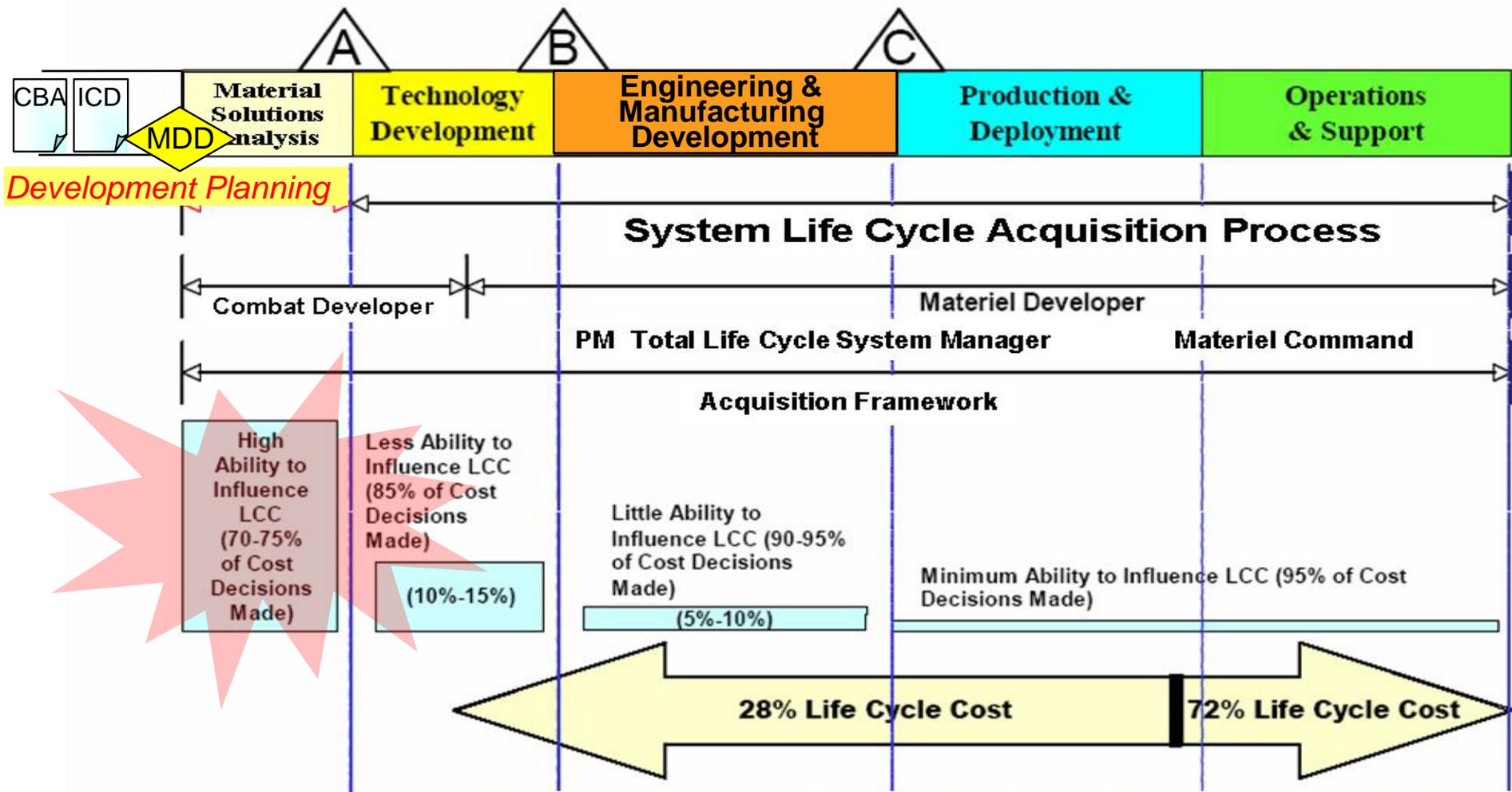
Adapted from "Pre-Milestone A and Early-Phase Systems Engineering: A Retrospective Review and Benefits for Future Air Force Systems Acquisition," Air Force Studies Board, National Research Council of the National Academies, Washington DC, 2008. Original publication: Andrews, Richard, "An Overview of Acquisition Logistics," Defense Acquisition University, Fort Belvoir, VA, 2003.
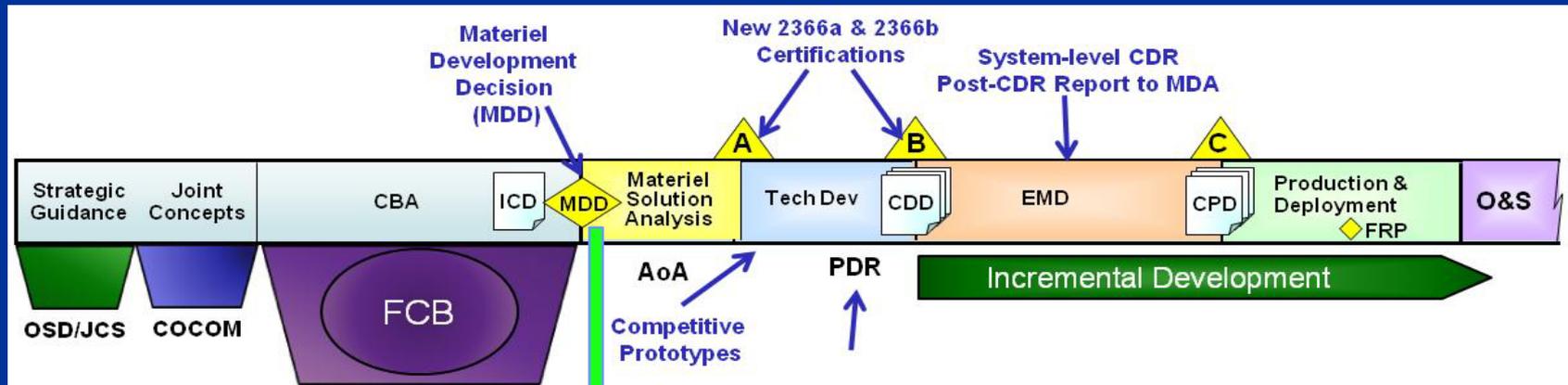
Challenge of Bridging TRL and MRL

The Challenge of Rapid Fielding

Role of Systems Engineering in Rapid Fielding?

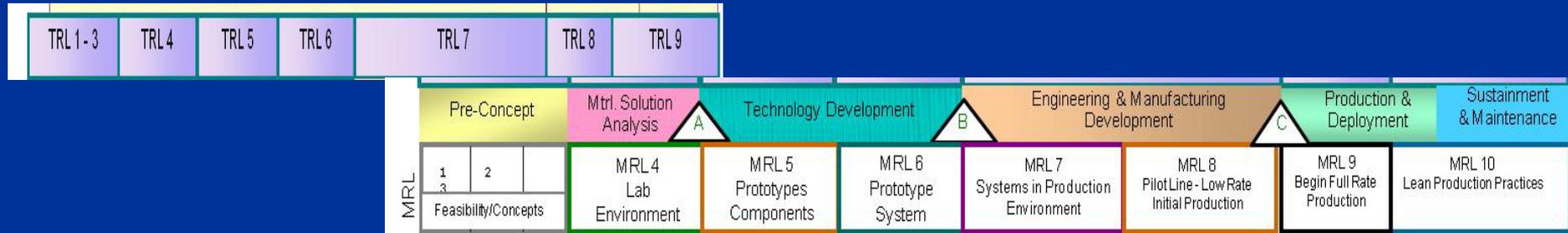**Is a formal integration of TRL and MRL guidelines needed for DoD policy and procedures?**

- **How do you practically blend rapid acquisition goals with normal established acquisition policy and procedures?**

The DoD 5000.02 Process

Expectations are being set earlier, but are the means to achieving them?

TRL 1-3	TRL 4	TRL 5	TRL 6	TRL 7	TRL 8	TRL 9

Pre-Concept		Mtrl. Solution Analysis	Technology Development		Engineering & Manufacturing Development		Production & Deployment	Sustainment & Maintenance
MRL	1 2 3 Feasibility/Concepts	MRL 4 Lab Environment	MRL 5 Prototypes Components	MRL 6 Prototype System	MRL 7 Systems in Production Environment	MRL 8 Pilot Line - Low Rate Initial Production	MRL 9 Begin Full Rate Production	MRL 10 Lean Production Practices

Materiel Development Decision (MDD)

New 2366a & 2366b Certifications

System-level CDR Post-CDR Report to MDA

Strategic Guidance	Joint Concepts	CBA	ICD	MDD	Materiel Solution Analysis	Tech Dev	CDD	EMD	CPD	Production & Deployment FRP	O&S

OSD/JCS   COCOM   FCB

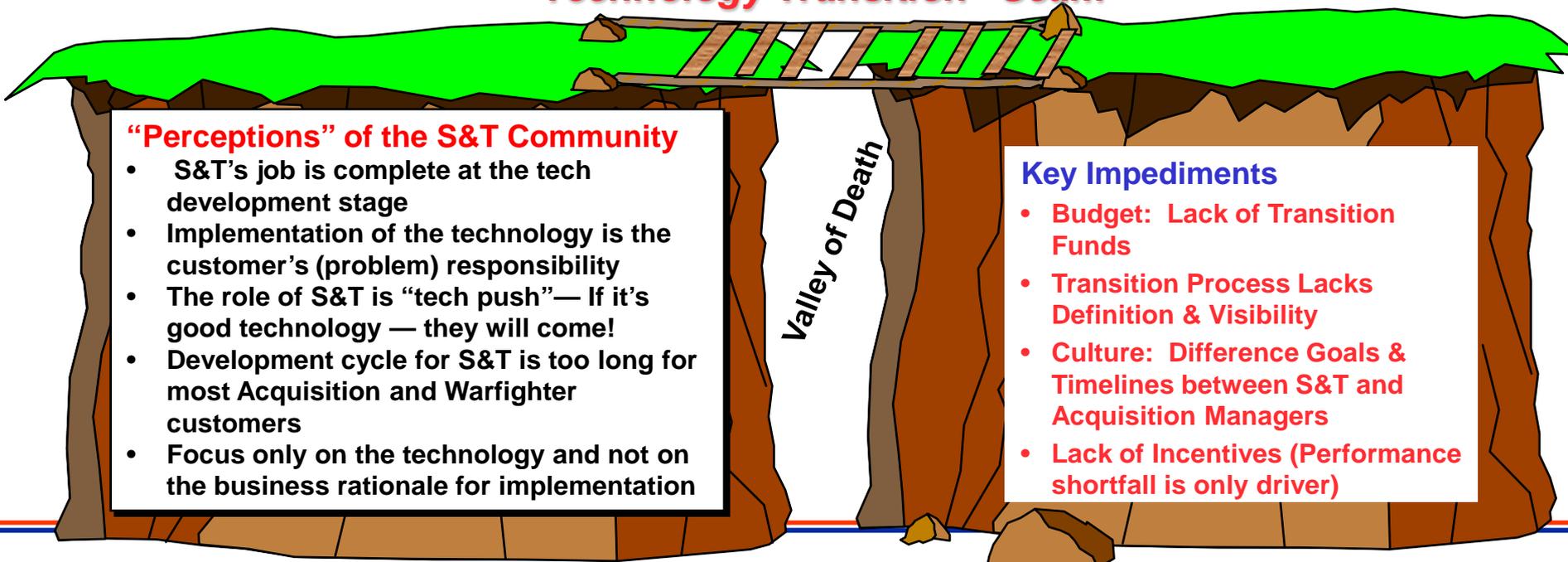AoA   PDR   Incremental Development

Competitive Prototypes

MDD is the lever to provide greater technical and engineering foundation for initiating an acquisition

The Challenge of Technology Transition

RDT&E

S&T

| 6.1 Basic Research | 6.2 Applied Research | 6.3 Adv Tech Dev | 6.4 Adv Comp Devel & Prototypes | 6.5 Engr/Manuf Development | 6.7 Op System Dev |

Tech Base

Managed by Labs

Managed by System Program Offices
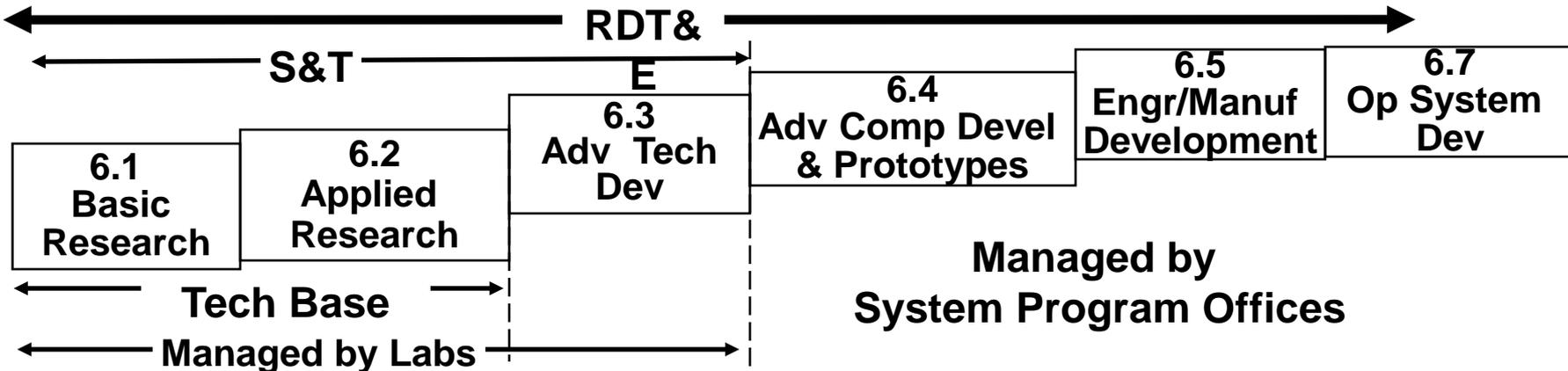
Technology Transition "Seam"

Valley of Death

"Perceptions" of the S&T Community
- S&T's job is complete at the tech development stage
- Implementation of the technology is the customer's (problem) responsibility
- The role of S&T is "tech push"— If it's good technology — they will come!
- Development cycle for S&T is too long for most Acquisition and Warfighter customers
- Focus only on the technology and not on the business rationale for implementation

Key Impediments
- **Budget: Lack of Transition Funds**
- **Transition Process Lacks Definition & Visibility**
- **Culture: Difference Goals & Timelines between S&T and Acquisition Managers**
- **Lack of Incentives (Performance shortfall is only driver)**

Challenge: Bridging TRL and MRL

- **New Imperatives to Reduce Risk while improving Acquisition Affordability**

    - **Accelerate TRL Development while Compress Manufacturing Timelines**

    - **Reduce Overall Risks to transitions**

    - **Normalize Rapid Acquisition**

Long-term Implications

- **Are decreasing budget coupled with pressre to preserve industry margins driving need for a different business model for technology investment?**
  - **Where are the incentives?**
  - **Is it better to have fewer programs with less risk?**

- **Are we running the risk of depleting investment in revolutionary and disruptive technologies?**

- **Does technology that has been field tested or demonstrated need to go completely through the acquisition process to be normalized or can it be fast tracked?**

Summary

- **Does your organization addressed how to bridge TRL and MRL processes?**

- **Do you map your IRAD to TRL or MRL metrics?**

- **Is the new affordability or value chain assessment formulas part of your review process ?**