Update of the Acquisition Modeling and Simulation Master Plan

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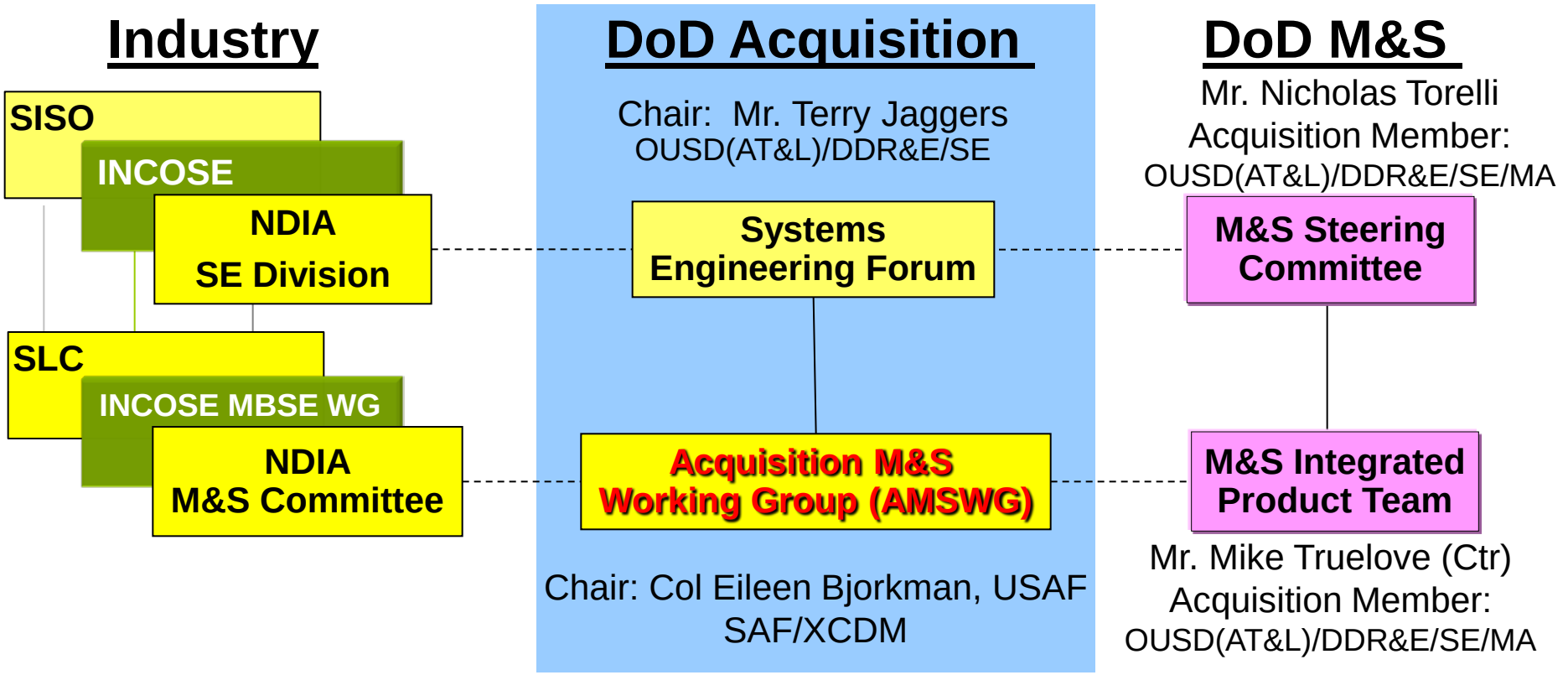
Acquisition M&S Governance Structure



AMSWG Charter (SE Forum, 2006)

- Assist PMs and acquisition professionals by improving the utility of M&S . . .
- Address common concerns, improve info flow, align technical initiatives, pursue cross-cutting issue resolution . . .
- Represent the acquisition community in DoD M&S deliberations . . .

Current AMSMP

Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
Provide necessary policy and guidance	Enhance the technical framework for M&S	Improve model and simulation capabilities	Improve model and simulation use	Shape the workforce
1-1 M&S management	2-1 Product development metamodel	3-1 Acquisition inputs to DoD M&S priorities	4-1 Help defining M&S strategy	5-1 Definition of required M&S competencies
1-2 Model-based systems engineering & collaborative environments	2-2 Commercial SE standards	3-2 Best practices for model/sim development	4-2 M&S planning & employment best practices	5-2 Harvesting of commercial M&S lessons
1-3 M&S in testing	2-3 Distributed simulation standards	3-3 Distributed LVC environments	4-3 Foster reuse	5-3 Assemble Body of Knowledge for Acqn M&S
1-4 M&S planning documentation	2-4 DoDAF utility	a) Standards	a) Business model	5-4 M&S education & training
1-5 RFP & contract language	a) DoDAF 2.0 Systems Engineering Overlay	b) Sim/lab/range compliance	b) Responsibilities	a) DAU, DAG & on-line CLMs
1-6 Security certification	b) Standards for depiction & interchange	c) Event services	c) Resource discovery	b) Conferences, workshops & assist visits
	2-5 Metadata template for reusable resources	3-4 Central funding of high-priority, broadly-needed models & sims	4-4 Info availability	5-5 MSIAC utility
		a) Prioritize needs	a) Scenarios	
		b) Pilot projects	b) Systems	
		c) Expansion as warranted	c) Threats	
			d) Environment	
			4-5 VV&A	
			a) Documentation	
			b) Risk-based	
			c) Examination	
			4-6 COTS SE tools	
			4-7 M&S in acqn metrics	

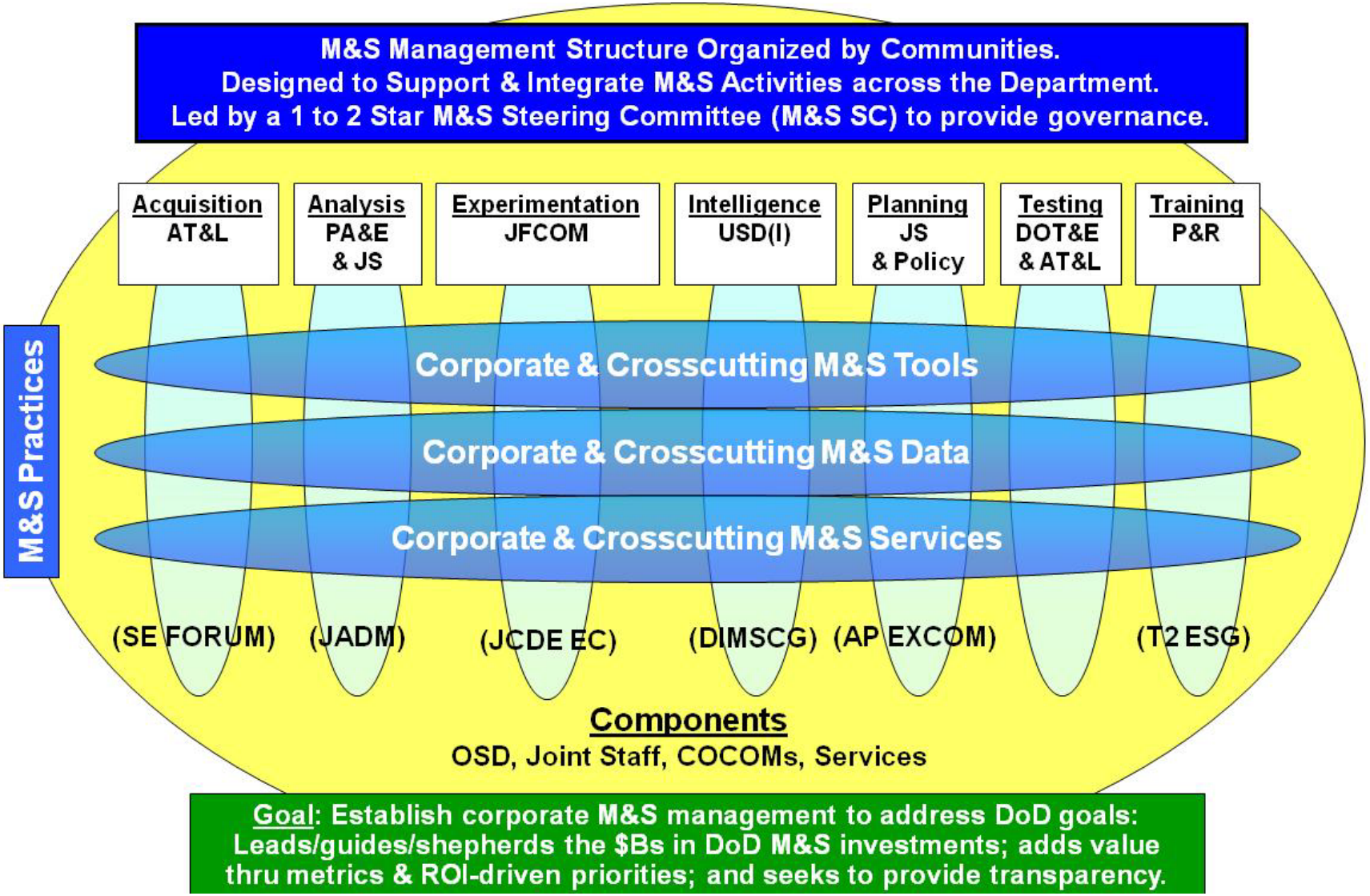
Key

Broader than Acqn

Circumstance

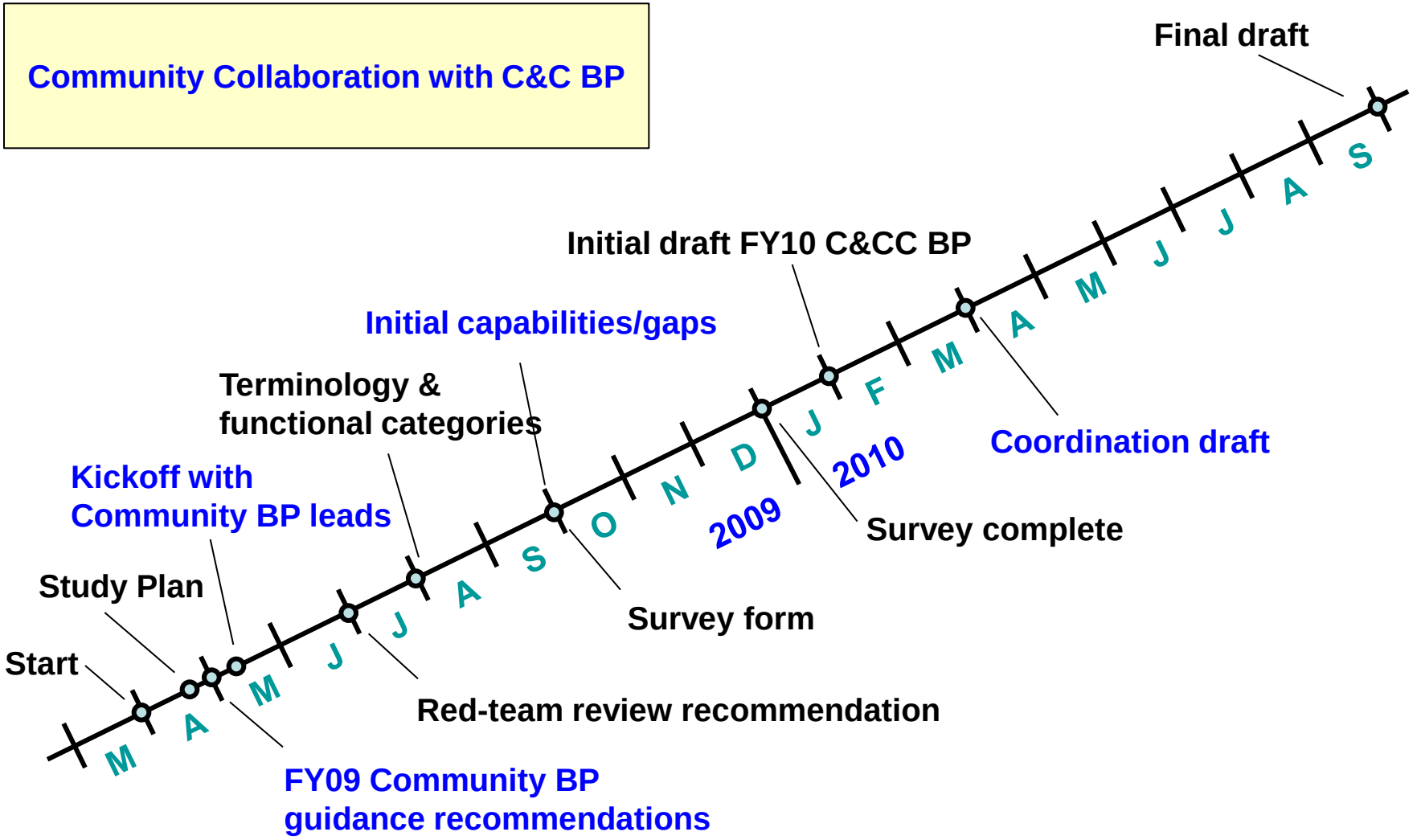
- **Acquisition Modeling and Simulation Master Plan (AMSMP)**
  - Signed out April 17, 2006
  - Forty actions designed to:
    - Foster widely-needed M&S capabilities beyond the reach of individual programs
    - Better enable acquisition of effective joint capabilities and systems-of-systems
    - Empower program and capability managers by removing systemic M&S obstacles, identifying new options for approaching tasks, and helping support widely-shared needs.
    - Promote coordination and interface with M&S activities of the DoD Components.
- **M&S Steering Committee requires that each community develop and maintain a business plan**
- **Update required for 2010 to feed development of DoD's Common and Cross-Cutting Business Plan**

DoD Modeling & Simulation Governance



C&C BP Target Timeline

Community Collaboration with C&C BP



Our Contribution

- **Description of the "To-Be" State – Vision**
- **Description of the "As-Is" State – Capabilities**
  - Tools
  - Data
  - Services
- **Capability Gaps**
- **Initiatives / Actions**

- **Acquisition Community M&S Business Plan**

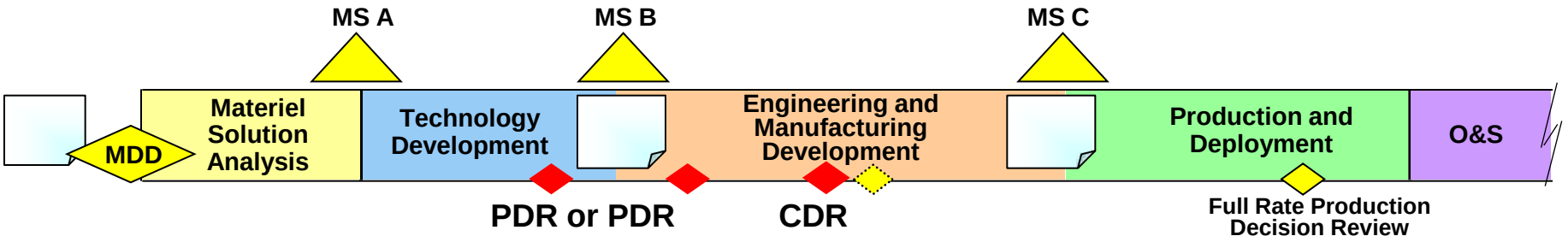
Update AMSMP

- **Completed by end of CY2009**
- **Current AMSMP is our departure point**
  - Maintain objectives
  - Most actions will carry-over, update as required to reflect progress, policy change, results of studies, etc
  - Completed actions will be replaced by their follow-on actions
  - New actions will be added to reflect change in business, policy and technology
- **Structure will change**
- **Heavy reliance on the Acquisition Modeling and Simulation Working Group (AMSWG)**

End Result

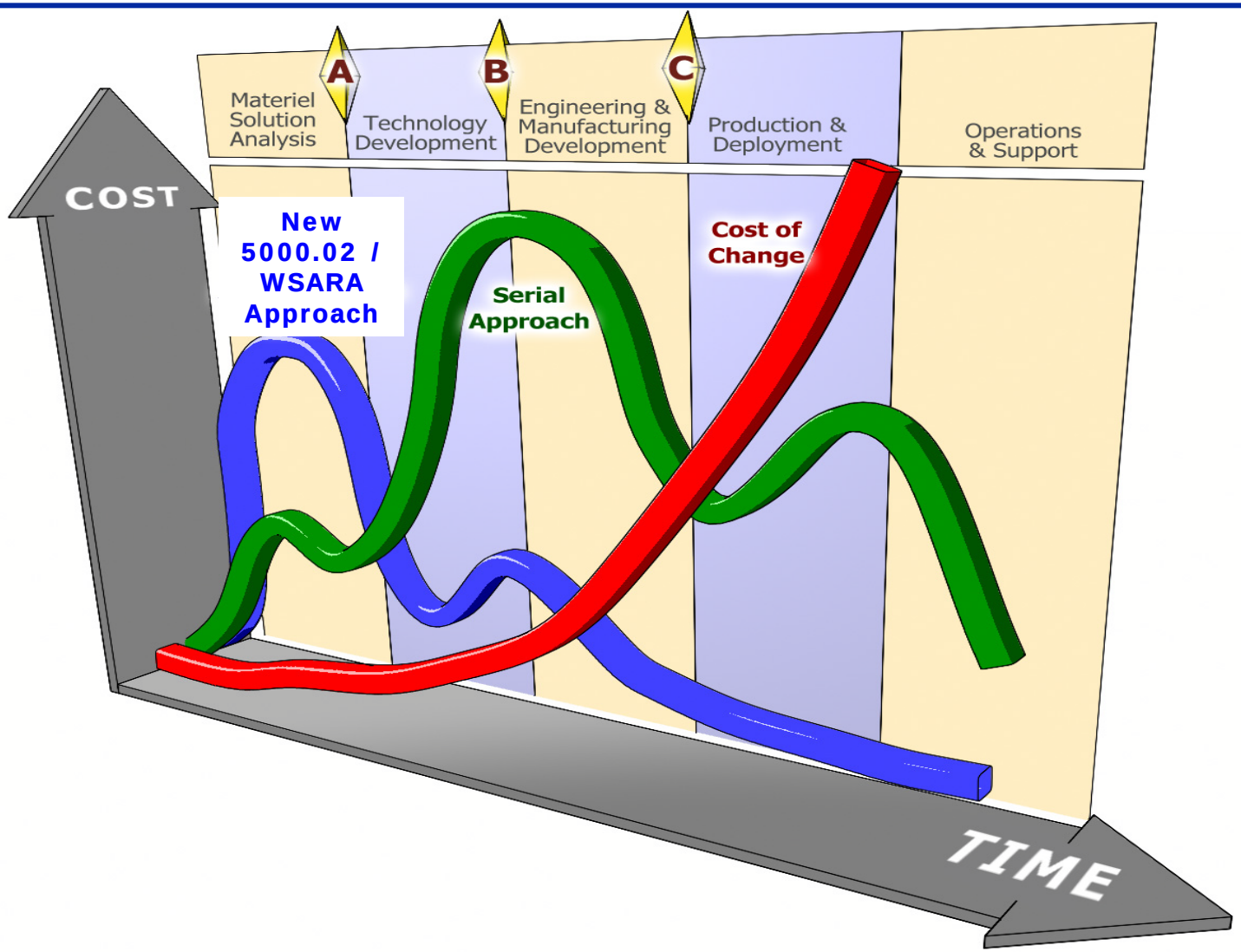
- **Provide cogent guidance for choosing projects and influencing other acquisition community M&S**
  - Metrics for selecting appropriate, cost-effective projects traceable to requirements
  - Defined interfaces to other projects and activities
  - Aligning influence on other acquisition M&S
- **Enable systematic integration and evaluation of components as they are produced & assembled**
- **Allows for visible progress assessment against the vision, holding ourselves accountable**
- **Provide mechanism for iterating requirements, needed actions, and the plan accordingly**
- **Provide guidance for influencing policies and other's activities**

M&S Activities During Acquisition



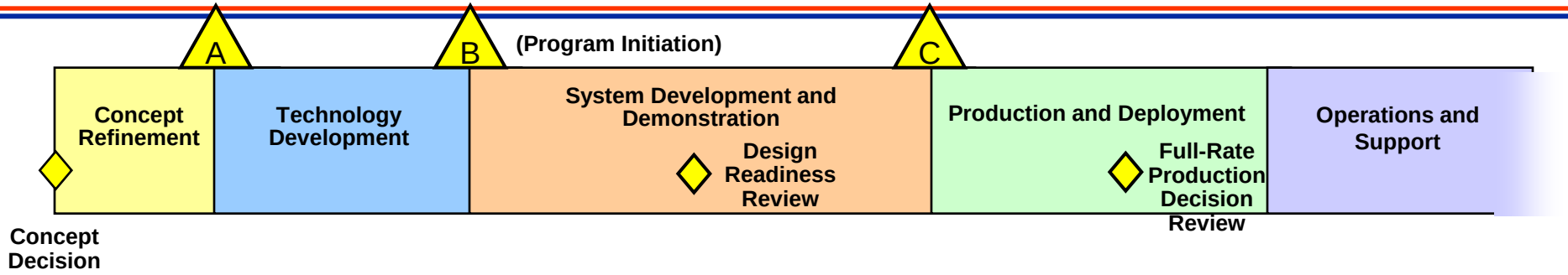
Materiel Solution Analysis	Technology Development	Engineering and Manufacturing Development	Production and Deployment	O&S
Develop M&S requirements (SEP) Model and data discovery (SEP) Develop M&S Configuration Management Strategy (SEP) Assign Lifecycle Maintenance Responsibilities of Data and Models (SEP, RFP) Define role of M&S throughout the lifecycle Review and identify appropriate standards for M&S reuse and interoperability (SEP, RFP) Develop/Modify Required M&S Accredit applicable M&S capabilities Publish descriptions of M&S capability developed in this phase. Asses required data ownership/use rights and accessibility (development RFP, materiel RFP)	Develop M&S requirements (SEP) Influence Acquisition Strategy to address modeling and simulation requirements and use. Document role of M&S in testing and initiate identification of required M&S assets Initiate discussion of requirements for use of M&S in operational test w/OT community (TEMP) Update SEP based on evolving M&S requirements Develop/modify required M&S including virtual prototype Accredit applicable M&S capabilities Publish descriptions of M&S capability developed in this phase. Review data and ownership rights (materiel RFP)	Develop M&S requirements (SEP) Develop/modify required M&S Accredit applicable M&S capabilities Publish descriptions of M&S capability developed in this phase. Review data and ownership rights (LRIP RFP)	Identify opportunities for M&S reuse for operations (e.g. training, decision support, etc) Develop/modify required M&S Accredit applicable M&S capabilities Publish descriptions of M&S capability developed in this phase. Review data and ownership rights (Full Rate RFP)	Capture data to strengthen M&S for operational use and feedback to other programs. Reuse/repurpose M&S for operational use (e.g., training, decision support, etc)

Early Involvement (Pre-Milestone A) Will Reduce Total Ownership Cost

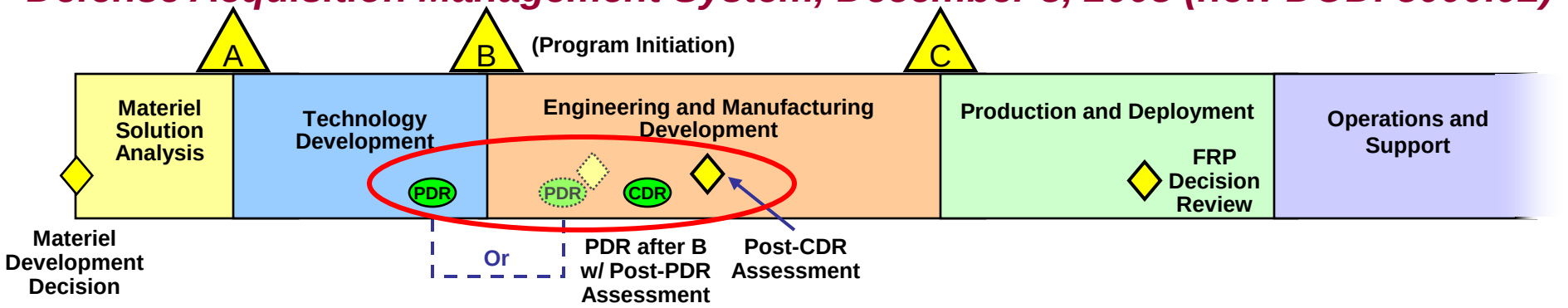


Acquisition Lifecycle Comparisons

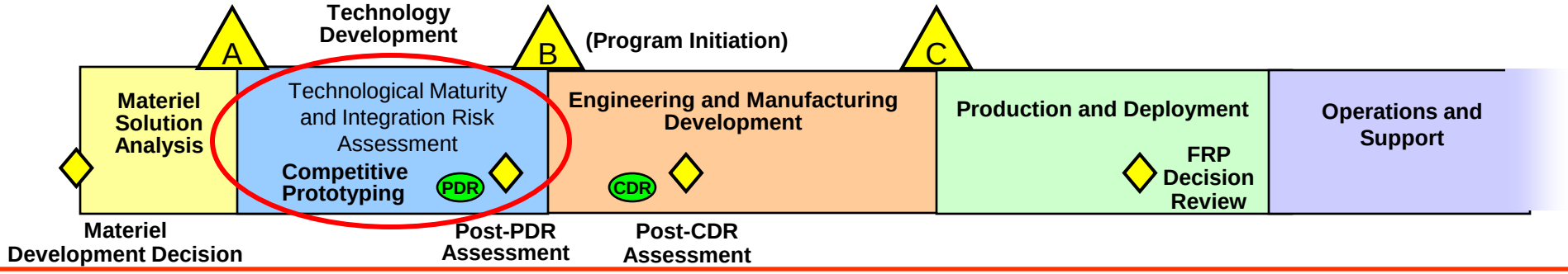
Defense Acquisition Management System, May 12, 2003



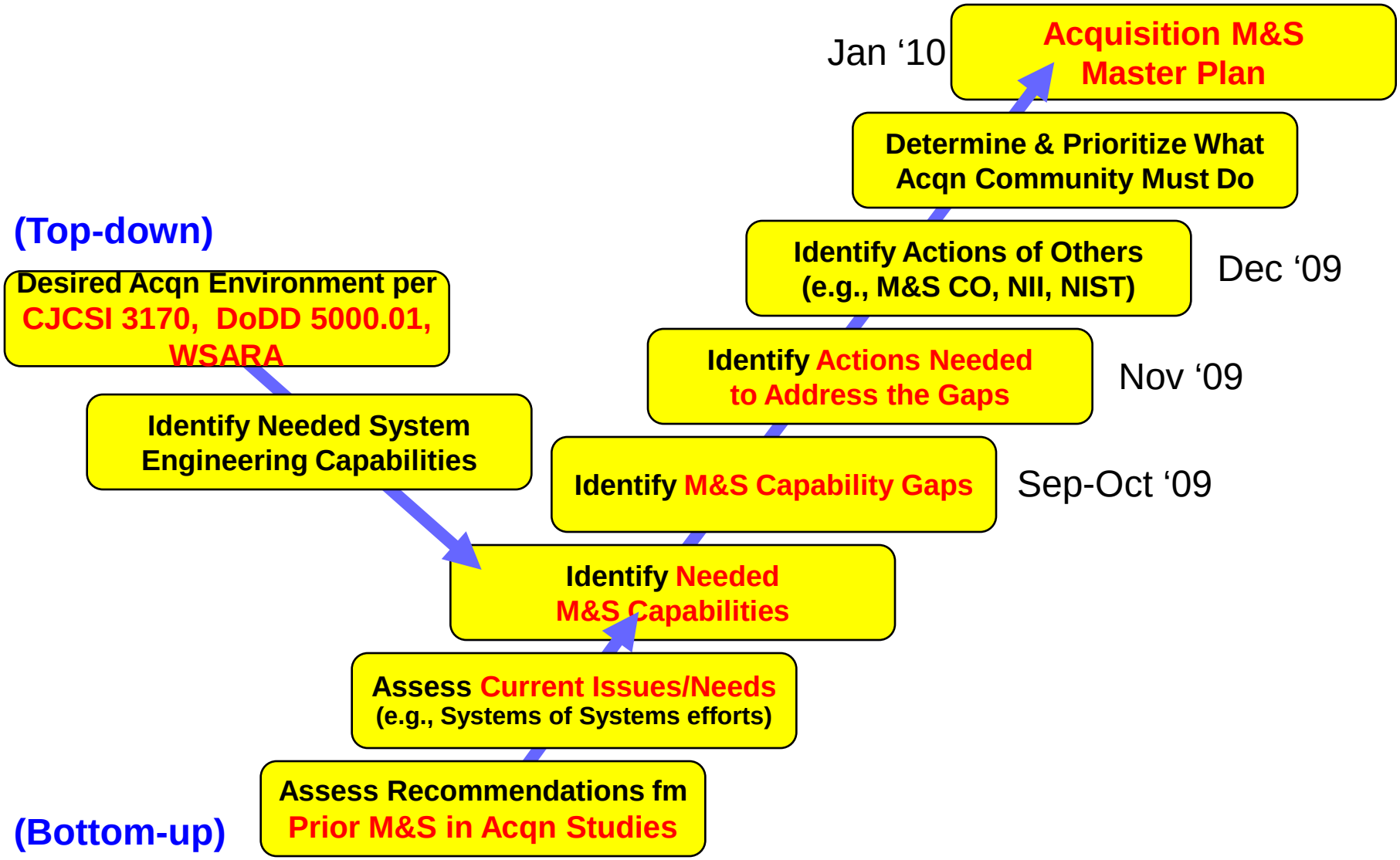
Defense Acquisition Management System, December 8, 2008 (new DODI 5000.02)



Defense Acquisition Management System, May 22, 2009 (WSARA)



Acquisition M&S Master Plan Update Process



Policy/Guidance Reference Documents

1.DoD Directive 5000.1, “The Defense Acquisition System,” May 12, 2003
2.DoD Directive 5000.59, “DoD Modeling and Simulation (M&S) Management,” August 8, 2007
3.Chairman of the Joint Chiefs of Staff Instruction 3170.01G, "Joint Capabilities Integration and Development System," March 1, 2009
4.DoD 5025.1-M, "DoD Directives Systems Procedures," October 28, 2007
5.DoDD 8320.2, “Data Sharing in a Net-Centric Department of Defense,” December 3, 2004
6.DoD 5000.59-M, "Glossary of Modeling and Simulation Terms," January 15, 1998
7.Defense Acquisition University, "Glossary of Acquisition Acronyms and Terms," July 2005
8.“Defense Acquisition Guidebook, Version X.Y,” November 1, 2006
9.DoD Instruction 5000.2, “Operation of the Defense Acquisition System,” Dec 8, 2008
10.“Federal Acquisition Regulation,” March 31, 2008
11.DoD Instruction 8500.2, “Information Assurance (IA) Implementation,” February 6, 2003
12.“DoD Architecture Framework,” April 23, 2007
13.DoDI 5000.61, “DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A),” May 13, 2003
14. Revision to T&E Policy; Memorandum; December 22, 2007
15. DoD M&S Human Capital Strategy (DRAFT)
16. Implementing a Life Cycle Management Framework; DTM; July 31, 2008
17. Weapons Systems Acquisition Reform Act; May 22, 2009

Needed Systems Engineering Capabilities

SE1	Early, continuing systems engineering from an SoS/FoS capabilities perspective; seamless transition from JCIDS to acquisition
SE2	Lifecycle-wide exploration of the maximum available trade space, including time-phased requirements and technology insertion
SE3	Collaboration among multiple organizations, Service & contractors for all key enterprise-level SE decisions
SE4	Comprehensive, accurate, early assessment of designs; avoidance of costly fixes for problems discovered late in the acquisition process
SE5	Tighter decision cycles (faster design-assessment process)
SE6	More effective & efficient testing, including in a SoS/FoS environment
SE7	Appropriate reuse of all resources -- information, software tools, expertise, facilities, ranges, etc -- across programs & organizations

M&S Processes for Better Systems Engineering

MS1	Use of a model-based engineering approach
MS2	Establishing M&S-enabled collaborative engineering environments
MS3	Model-Test-Model process to improve both M&S tools and testing
MS4	Harnessing M&S knowledge to formulate an effective M&S strategy
MS5	Disciplined M&S planning and employment
MS6	Efficient development/maintenance of credible M&S tools
MS7	Access/sharing of authoritative data needed for M&S representations
MS8	Inspection of M&S used and cost burden that inhibits M&S use

	A	B	C	D	E	F	G	H	I	J
1	M&S PROCESS DESCRIPTION					CAPABILITY(IES)	GAP	METRIC		
2	MS1	Use of a Model-Based Engineering (MBE) Approach				Individual acquisition programs are beginning to employ MSBE through vendor offerings.		Number of acquisition programs which have employed MSBE (up-quad). Number of unique MSBE approaches		
3	MS1.1		Published Model-Based Engineering approach(es).			Vendors of systems engineering tools have develop MSBE approaches. INCOSE MSBE Methodology Survey articulates several extant	The DoD has not adopted a particular MSBE approach(es).			
4	MS1.1.1			Approach(es) for the application of M&S to						
5	MS1.1.2			Approach(es) for the application of M&S to Systems						
6	MS1.1.3			Approach(es) for the application of M&S to Design						
7	MS1.1.4			Approach(es) for the application of M&S to Test and						
8	MS1.2		An acquisition workforce that understands the principles and value of a Model-Based Systems Engineering Approach							
9	MS1.2.1			Body of Knowledge for Model-Based Systems Engineering.		SimSummit Body of Knowledge. AFAMS BoK outline. INCOSE Systems Engineering BoK.	Current M&S BoK lacks significant content describing the principles and value of MSBE. 639 Body of Knowledge for M&S support to acquisition is			
10	MS1.2.2			Educational opportunities provided by government and academia.						
11	MS1.2.2.1				Education for acquisition program managers on the value and application of MBSE	Courseware developed under the "Educating the Acquisition Workforce" high level task -- available through Naval Part Graduate School. M&S for Acquisition Continuous Learning Module (CLM) Test and Evaluation CLM offered through the Defense Acquisition University.	Current educational opportunities lack significant MSBE content. 608 No courseware on the value of integrated architectures, nor responsibility for. 640 Acqu community managers and staffs mostly uninformed about M&S	Number of acquisition PM-track professionals and military personnel enrolled in government-sponsored courses that, as a minimum, address the value of MSBE. (up-quad)		
12	MS1.2.2.2				Education for the general acquisition professional including systems engineers.			Students enrolled in government-sponsored MSBE courses. (up-quad)		
13	MS1.2.2.3				Education for the modeling and simulation professional with particular emphasis on building capability for reuse across life-cycle, organizational and corporate boundaries.	Courseware developed under the "Educating the Acquisition Workforce" high level task -- available through several universities. Other Universities are beginning to offer degrees in modeling and simulation (e.g., Old Dominion, Georgia Tech, U. Alabama Huntsville)	Some U.S. colleges/universities offer either courseware/trainers dedicated to MSBE or apply MSBE to other academic ends. Examples include: University of Michigan offers seminars on MSBE. MIT offers a professional/short course entitled: "Systems Engineering, Architecture and Lifecycle Design: Principles, Models, Tools, and Applications." Bastan University offers courses in modeling and simulation within their Division of Systems Engineering/ College of Engineering. INCOSE maintains a directory of academic institutions that offer educational opportunities in Systems Engineering.	Number of colleges/universities offering instruction in MSBE. (up-quad)		
14	MS1.3			Personnel competence						
15	MS1.3.1				Standards of professional competence in MSBE.	Certification criteria for modeling and simulation professionals as reflected in the NTSA Certified Modeling and Simulation Professional program. Systems Engineering professional competencies are under development and are expected to be complete in	Need competent standards for professional competence using MSBE based on Systems Engineering knowledge, skills and abilities.	Standards exist.		
16	MS1.3.2				Professional certification for Civil Servants	DAWIA (Systems Engineering, Program Management), Certified M&S Professional (NTSA). Heavily influenced by M&S for DoD	Current certifications are for general modeling and simulation. No certification for MSBE competence.	Number of certified professionals both in and out of government. (up--quad). Number of weapon systems acquisitions		

MS1 | MS2 | MS3 | MS4 | MS5 | MS6 | MS7 | MS8

Ready

Gap Examples

- Body of Knowledge for M&S support to acquisition is deficient, not managed—lacks specific guidance for MBE.
- The DoD has not adopted a particular MBE approach(es).
- No DoD requirement for formal M&S planning to support acquisition (other than T&E).
- Need ability to identify competent personnel in industry offerings to the government.
- An overabundance of capabilities that essentially accomplish the same thing leads to an almost indecipherable landscape. Need to focus attention in one direction and merge capabilities from the others.
- Use of DoD-unique standards limits their user base, quality, COST tool support, and opportunities for reuse.
- The average producer of modeling and simulation capability has little knowledge of the existence, value or use of currently available discovery metadata specifications.

Business Ecosystem

"An economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. This economic community produces goods and services of value to customers, who themselves are members of the ecosystem. The member organizations also include suppliers, lead producers, competitors and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments and to find mutually supportive roles."

James F. Moore, *The Death of Competition – Leadership and Strategy in the Age of Business Ecosystems*, Harper Business, New York, 1996.

Measures to Assess an Ecosystem's Health

- **Productivity**
  - The ability of the ecosystem to continually transform technology and raw materials of innovation into lower costs and new products
- **Robustness**
  - An ecosystem's ability to survive major disruptions, such as those caused by unpredictable technological innovation and change
- **Niche Creation**
  - Ability of an ecosystem to increase meaningful diversity through the creation of valuable new functions, or niches

Iansiti, Marco and Levien, R; "Strategy as Ecology", *Harvard Business Review,* March 2004

Principles of the Ecosystem Model

- "Open system": organic systems exist in a continuous exchange with their environment, characterized by a continuous cycle of input, internal transformation (throughput), output, and feedback.
- Homeostasis: self-regulation and the ability to maintain a steady state achieved through processes that regulate and control system operation on the basis of "negative feedback" whereby deviations from some standard norm initiate actions to correct the deviation.
- Entropy/negative entropy: closed systems are entropic in that they have a tendency to deteriorate and run down. Open systems seek to sustain themselves by importing energy – they are characterized by negative entropy.
- Structure, function, differentiation, and integration: relationship between these concepts is crucial to understanding living systems as they are closely intertwined.
- Requisite variety: the internal regulatory mechanisms of a system must be as diverse as the environment with which it is trying to deal.
- Equifinality: in an open system, there may be many different ways of arriving at a given end state.
- System evolution: the capacity of a system to evolve depends on an ability to move to more complex forms of differentiation and integration.[1]
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[1] Gareth Morgan, *Images of Organization.*

2012 Revision of NAICS

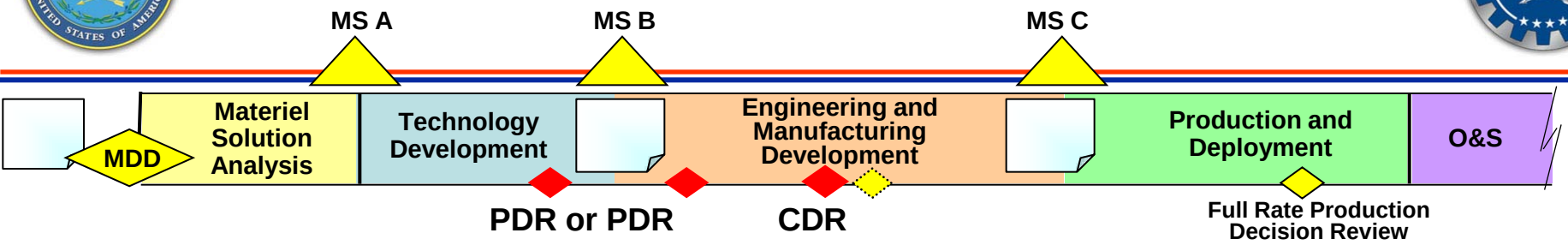
- **Office of Management and Budget (OMB) Federal Register notice soliciting proposals: Late 2008/Early 2009**
  - Released Jan 7 with proposals due April 7
- **U.S. Economic Classification Policy Committee (EPCP) review of proposals and trilateral negotiation: ongoing through 2009**
- **Federal Register notice containing ECPC recommendations to OMB: late 2009 or early 2010**
- **Federal Register notice containing OMB final decisions: May 2010**
- **2012 NAICS United States Manual manuscript submitted to OMB: June 2011**
- **2012 NAICS United States Manuals available: January 2012**

Questions?

Technical Reference Documents

1. *Final Report of the Acquisition Task Force on M&S*, 1994; Sponsor: DDR&E (Dr. Anita Jones); Chair: VADM T. Parker, USN (Ret.)
2. *Naval Research Advisory Committee Report on M&S*, 1994; Sponsor: ASN(RDA); Chair: Dr. Delores Etter
3. *Collaborative Virtual Prototyping Assessment for Common Support Aircraft*, 1995; Sponsor: Naval Air Systems Command; conducted by JHU/APL and NSMC
4. *Collaborative Virtual Prototyping Sector Study*, 1996; North American Technology & Industrial Base Organization; sponsor: NAVAIR
5. *Application of M&S to Acquisition of Major Weapon Systems*, 1996; American Defense Preparedness Association; sponsor: Navy Acqn. Reform Exec.
6. *Effectiveness of M&S in Weapon System Acquisition*, 1996; Sponsor: DTSE&E (Dr. Pat Sanders); conducted by SAIC (A. Patenaude)
7. *Technology for USN and USMC, Vol. 9: M&S*, 1997; Naval Studies Board, National Research Council; sponsor: CNO
8. *A Road Map for Simulation Based Acquisition*, 1998; Joint SBA Task Force (JHU APL lead); sponsor: Acquisition Council of EXCIMS
9. *M&S for Analyzing Advanced Combat Concepts*, 1999; Defense Science Board Task Force (Co-chairs: L. Welch, T. Gold)
10. *Advanced Engineering Environments*, 1999; National Research Council; sponsor: NASA
11. *Survey of M&S in Acquisition*, 1999 and 2002; Sponsor: DOT&E/LFT&E; conducted by Hicks & Associates (A. Hillegas)
12. *Test and Evaluation*, 1999; Defense Science Board Task Force (Chair: C. Fields)
13. *"SIMTECH 2007" Workshop Report*, 2000; Military Operations Research Society (Chair: S. Starr)
14. *M&S in Manufacturing and Defense Systems Acquisition*, 2002; National Research Council; sponsor: DMSO
15. *M&S Support to the New DoD Acquisition Process*, 2004 NDIA Systems Engineering Div. M&S Committee; sponsor: PD, OUSD(AT&L)DS
16. *Missile Defense Phase III M&S*, 2004 Defense Science Board Task Force (Chair: W. Schneider)
17. *Live, Virtual, Constructive Architecture Roadmap*, 2008, JFCOM (Lead: K Goad)
18. *Modeling and Simulation Resource Reuse Business Model*, 2008, Center for Naval Analyses (Lead: D. Shea)

M&S Activities During Acquisition



Materiel Solution Analysis	Technology Development	Engineering and Manufacturing Development	Production and Deployment	O&S
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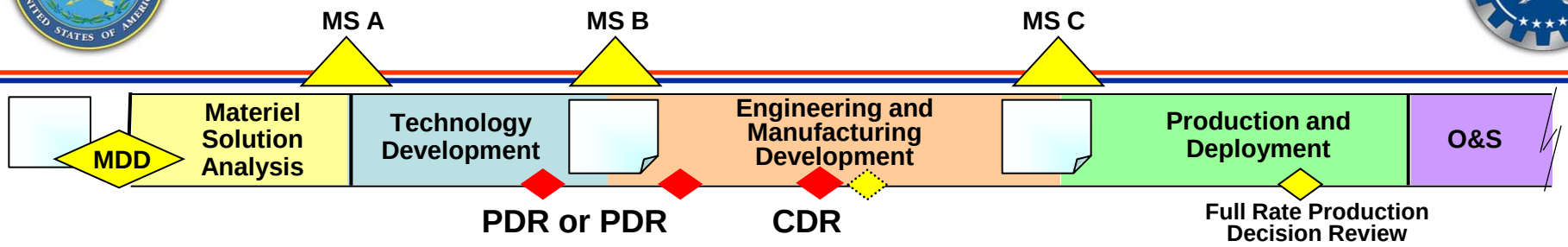
M&S Use During Acquisition



Materiel Solution Analysis	Technology Development	Engineering and Manufacturing Development	Production and Deployment	O&S
AoA Rapid virtual prototyping Exploration of alternatives and design variations CAD/CAM Promote stakeholder inspection of proposed solution, variations and alternatives Identify cost drivers and risk areas. Conduct initial manpower requirements studies.	System performance analyses (e.g., evaluate Pdet, Pcded, Pk, etc) CAD/CAM Human machine interface design Failure analyses (e.g., stress, fatigue, shock) Conduct manpower requirements studies. Evaluate cost implications Life cycle cost analyses Analyze and assess resource, readiness, and other key life cycle sustainment metrics	Evaluate performance of technology under development. Focus test and evaluation activities CAD/CAM Test and evaluation under conditions otherwise difficult/impossible to replicate (i.e., safety restrictions, environmental restrictions, cost restrictions) Predict human performance as a function of detailed design Anthropometry and biomechanics. Analyze and assess resource, readiness, and other key life cycle sustainment metrics	Design of manufacturing facilities Define production workflow Analyze and assess resource, readiness, and other key life cycle sustainment metrics	Support design and maintenance modifications Evaluate redesign efforts Analyze and assess resource, readiness, and other key life cycle sustainment metrics

NOTE: THIS LIST IS NOT COMPLETE AND GROUPING BY PHASE IN THIS WAY DOES NOT ADEQUATELY COMMUNICATE BROAD-SPECTRUM USE M&S THROUGHOUT THE ACQUISITION PROCESS

To CJCSI 3170.01G dtd. 1 Mar 2009

Mentioned/implied in the definition of the CDD (evolutionary acquisition)

Key CJCSI 3170.01E Policies

- Joint concepts-centric capabilities identification process to allow joint forces to meet the full range of military operations and challenges… AE1
- Assess existing and proposed capabilities in light of their contribution to future joint allied and coalition operations. … Produce capability proposals that consider the full range of DOTMLPF solutions AE2 in order to advance joint warfighting in a unilateral and multinational context.
- New solution sets…crafted to deliver technologically sound, testable, sustainable and affordable increments AE3 of militarily useful capability.
- The FoS and SoS solutions AE4 may also require systems delivered by multiple sponsors/materiel developers AE5
- The process to identify capability gaps and potential solutions must be supported by a robust analytical process AE6
- JCIDS implements a capabilities-based approach that…requires a collaborative process AE7 that utilizes joint concepts and integrated architectures AE8 to identify prioritized capability gaps and integrated DOTMLPF and policy approaches AE9 to resolve those gaps

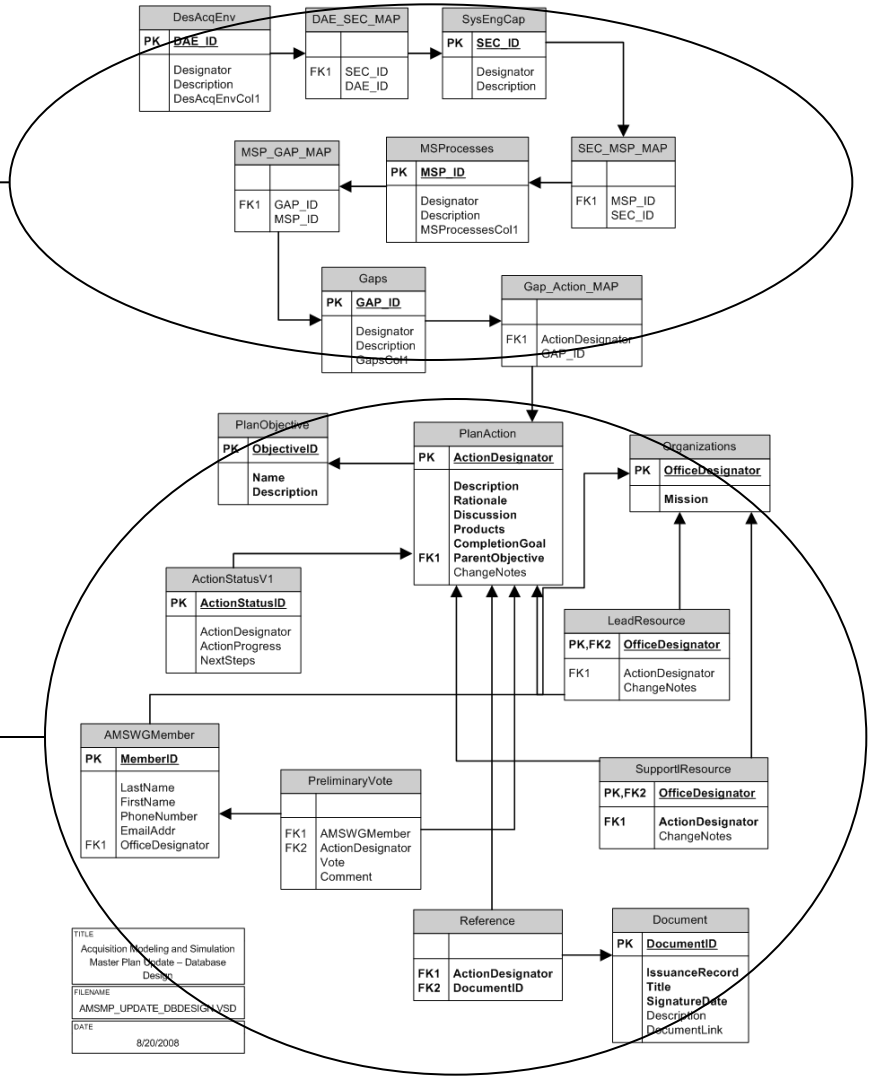
Mentioned only in the definition of "Materiel Solution"

Implied throughout

AMSMP Update Database

Systems Engineering Artifacts; Fully Traceable.

Master Plan Contents



AMSMP Traceability Map