Improving M&S Support to Acquisition:

A Progress Report on Development of the

Acquisition M&S Master Plan

Fred Myers, OUSD (AT&L) DS/SE
Jim Hollenbach, Simulation Strategies, Inc.,

NDIA Systems Engineering Conference
26 October 2005

Introduction

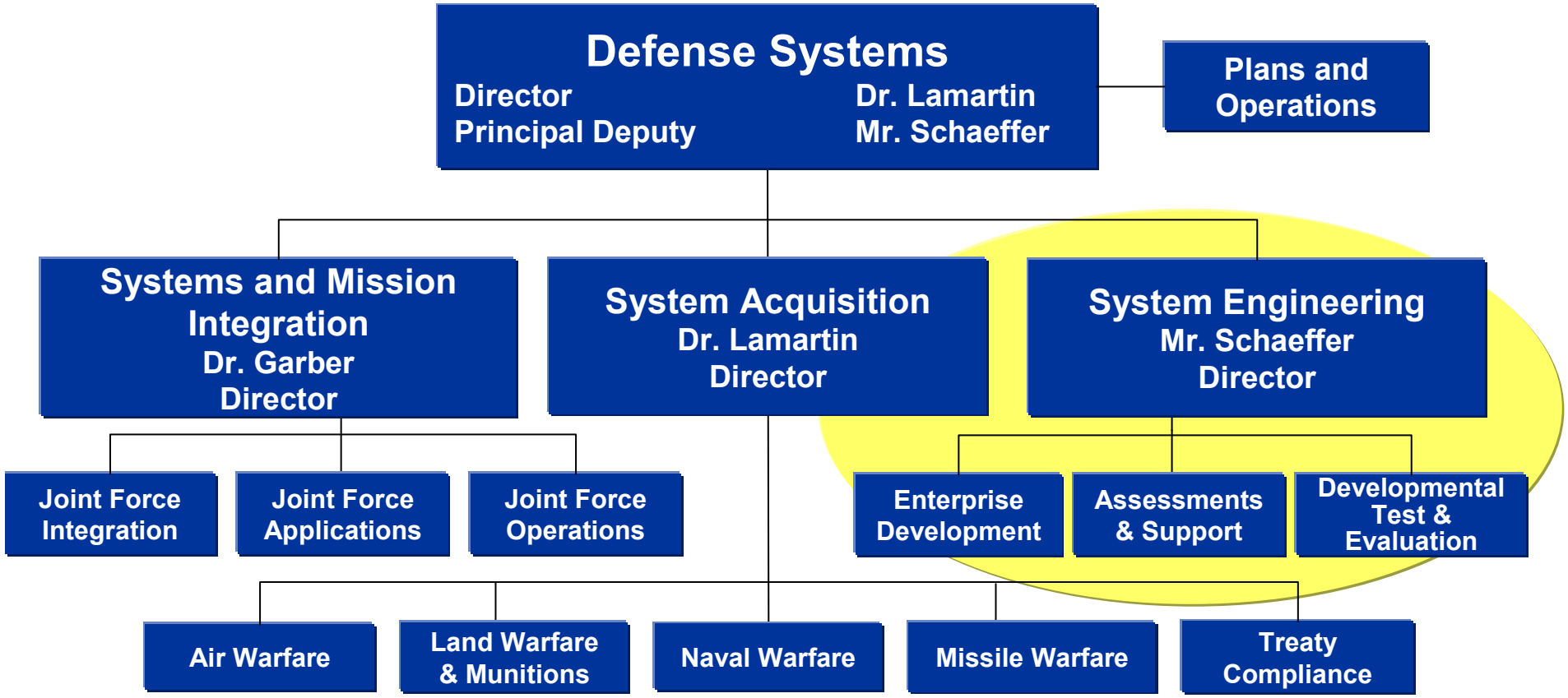
- This presentation key aspects of the emergent DoD Acquisition M&S Master Plan
  - Background
  - Process
  - Draft action set
- Questions and comments are invited here as time permits
- NDIA M&S Committee meeting 1445-1730 Thursday to answer remaining questions and discuss your change recommendations
  - All are welcome to attend

Senior Leadership Imperatives

Under Secretary of Defense for Acquisition, Technology and Logistics:

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

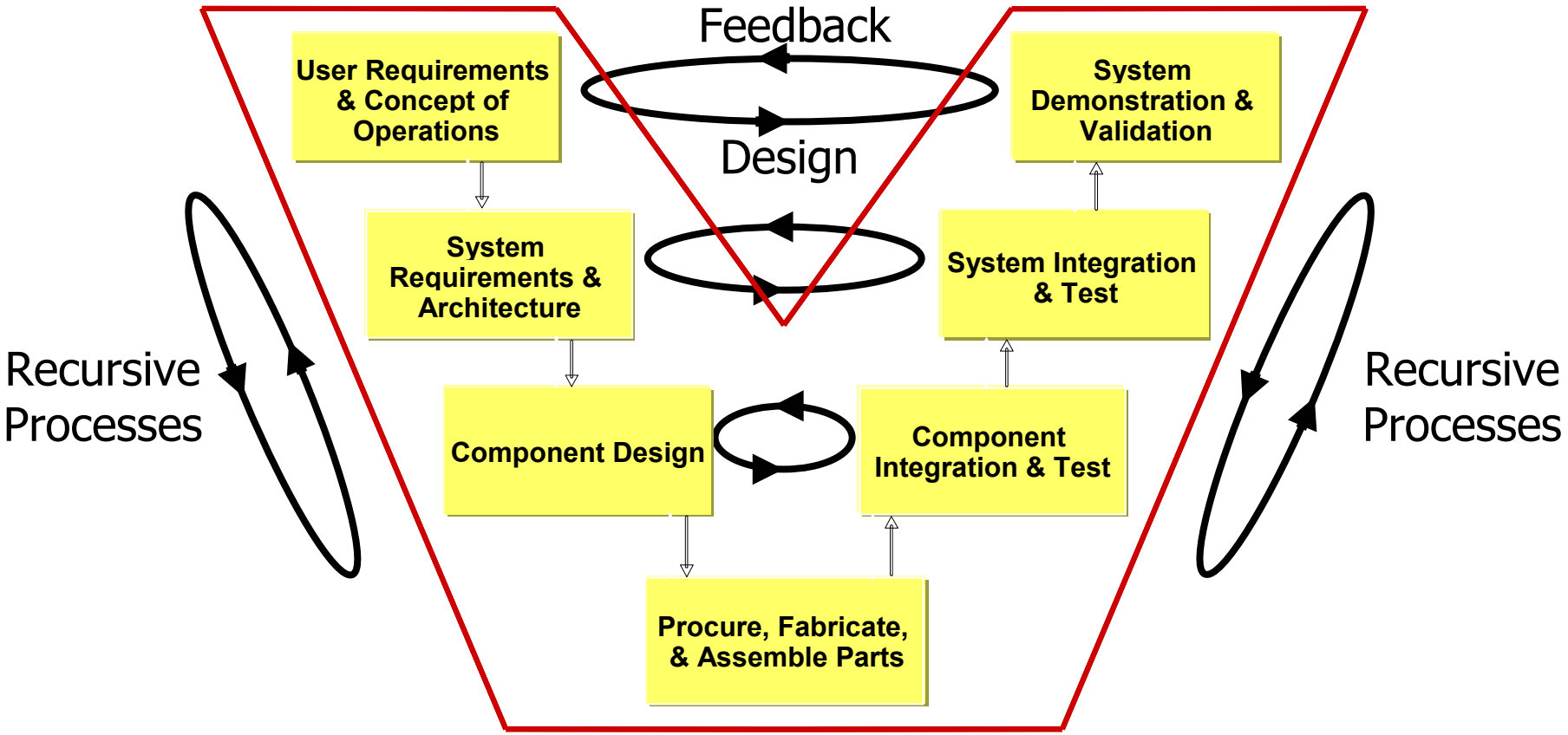
Response: Establish an SE Office
Defense Systems Directorate, OUSD(AT&L)



An integrated structure to develop capability

M&S is a Necessary Part of Acquisition

M&S is broadly useful to enable systems engineering throughout a system or S-o-S life cycle

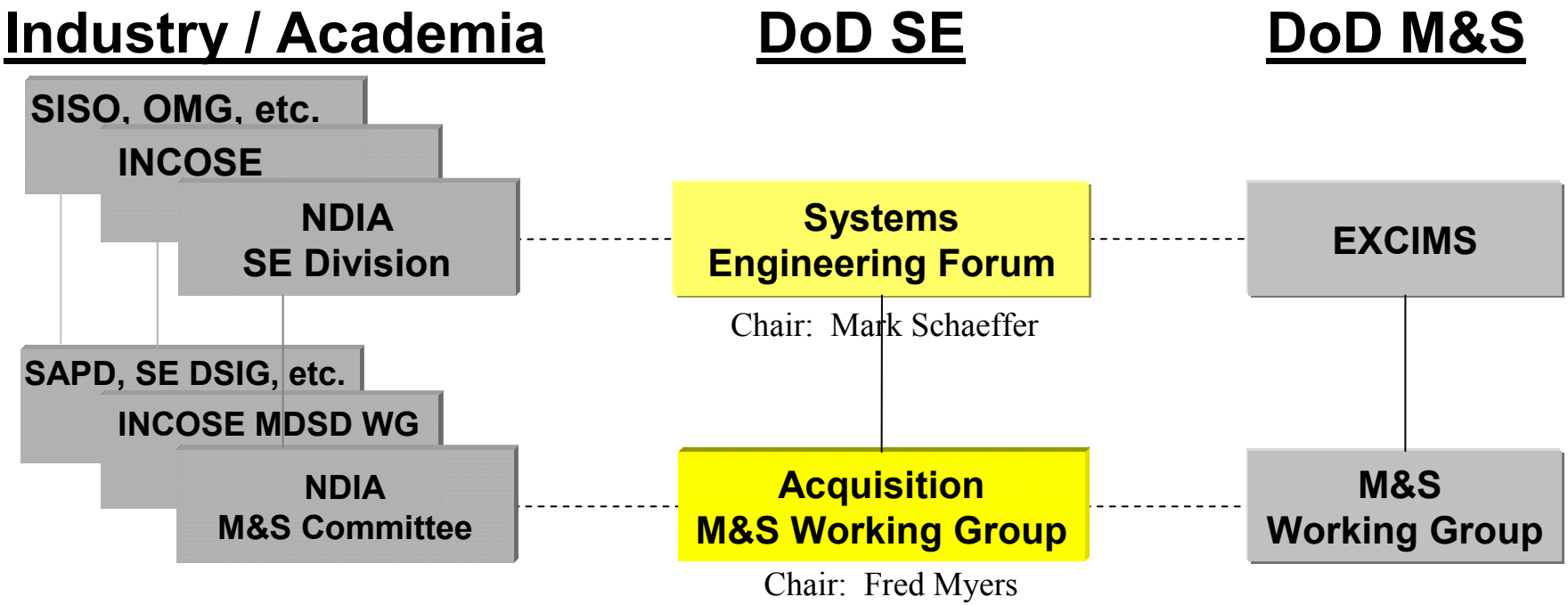


Iterative "V" process across acquisition phases

Acquisition M&S Working Group

Per AMSWG Charter, approved by SE Forum Feb 2005

…anchored in acquisition community, linked to industry and M&S



Products

Reports (e.g., "M&S Support to the New DoD Acq. Process"), standards, papers, etc.

Product

Acquisition M&S Master Plan

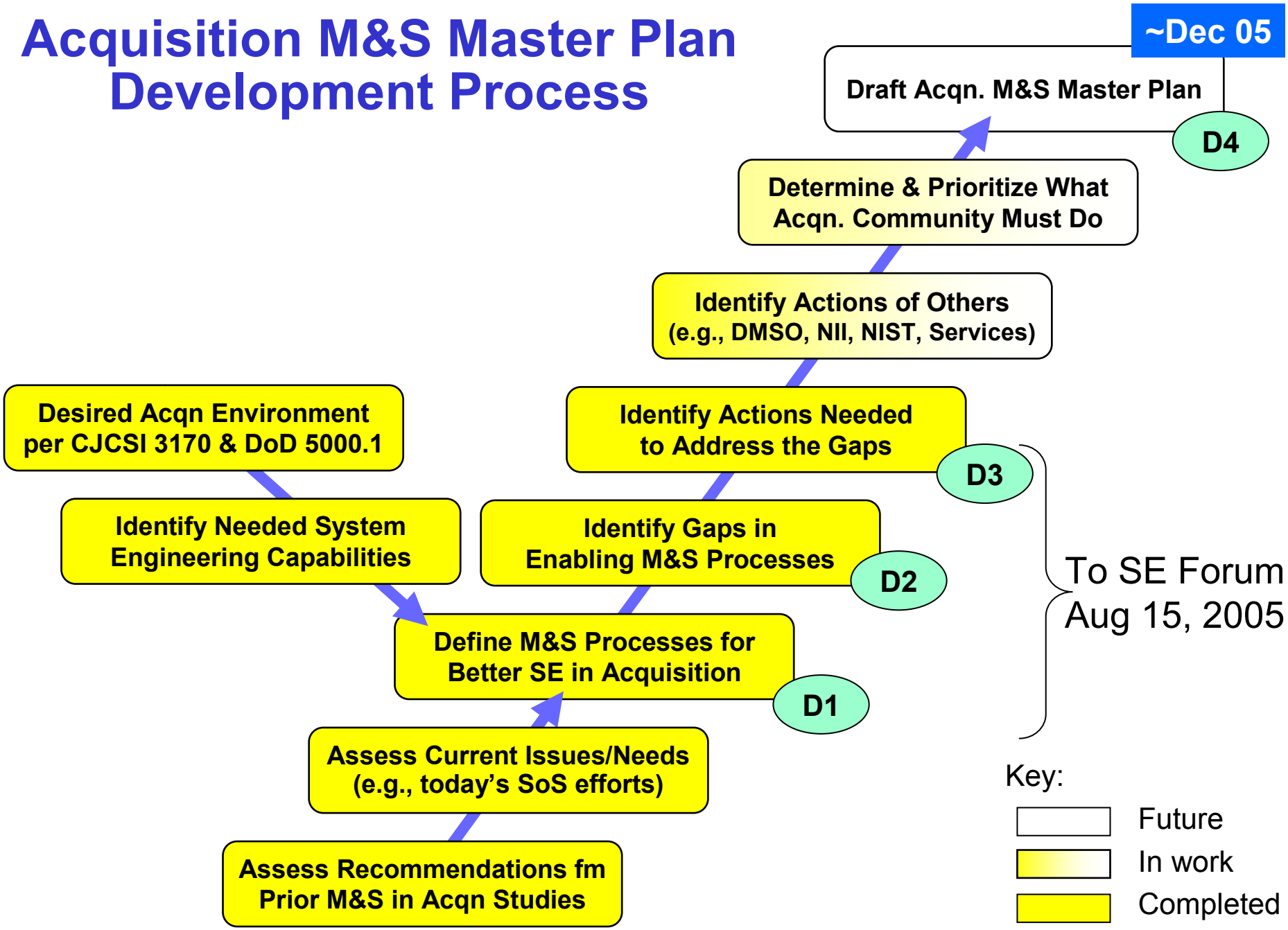
Product

DoD M&S Master Plan

Approach

- Foster widely-needed M&S capabilities that are beyond the reach of individual programs
- Address M&S issues and actions necessary to enable acquisition of effective joint capabilities (systems of systems)
- Not seek to do the job of program/capability managers; rather seek to empower them
  - By removing systemic obstacles in their path
  - By identifying new options for approaching their tasks
  - By helping meet widely-shared needs

Acquisition M&S Master Plan Development Process



A Decade of Studies on M&S Support to Acquisition

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

A Decade of Studies on M&S Support to Acquisition

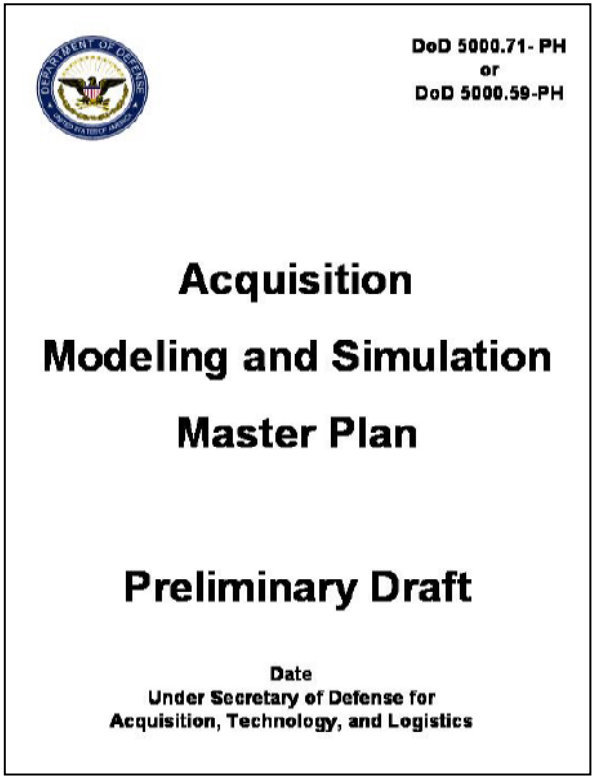
9. *M&S for Analyzing Advanced Combat Concepts*, 1999
   Defense Science Board Task Force (Co-chairs: L. Welch, T. Gold)
10. *Advanced Engineering Environments*, 1999
    National Research Council; sponsor: NASA
11. *Survey of M&S in Acquisition*, 1999 and 2002
    Sponsor: DOT&E/LFT&E; conducted by 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, USD(AT&L)DS
16. *Missile Defense Phase III M&S*, 2004
    Defense Science Board Task Force (Chair: W. Schneider)

Assessment of Current Issues/Needs

- Cooperative effort between AMSWG & NDIA M&S Committee
- AMSWG venue:
  - Air Force – Roe (Jan 05)
  - Army – Gillis, Wallace (Jan 05)
  - Navy – Vaughn (Feb 05)
  - Visits to NAWC/AD (ACETEF); Army RDECOM; AFMC (SIMAF, ICE)
- NDIA M&S Committee venue:
  - Joint SIAP Systems Engineering Organization (Aug 04)
  - Future Combat Systems (Sep 04)
  - Missile Defense Agency (Feb 05)
  - Lockheed Martin (Feb 05)
  - Raytheon (Apr 05)
  - Boeing (Apr 05)
  - Northrop Grumman (Jun 05)
  - BAE Systems (Aug 05)
- Affirmed many findings and recommendations from studies and provided new inputs as well

Content of Acquisition M&S Master Plan

- **Forward**
- **Purpose**
- **Background**
- **Vision**
- **Objectives (5)**
- **Actions (28)**
  - Action
  - Rationale
  - Discussion
  - Lead & supporting organizations
  - Products
  - Completion goal (year)
- **Execution Management**



Five Objectives

(buckets for 28 actions)

Objective 1

Provide necessary policy and guidance

Actions

1. **M&S management**
2. **Model-based systems engineering & collaborative environments**
3. **M&S in testing**
4. **M&S planning documentation**
5. **RFP & contract language**
6. **Security certification**

Objective 2

Enhance the technical framework for M&S

Actions

7. **Data standards framework**
8. **Product development metamodel**
9. **Commercial SE standards**
10. **Distributed simulation standards**
11. **DoDAF utility**
    - **DoDAF 2.0 Acqn Overlay**
    - **Standards for depiction & interchange**
12. **Metadata template for reusable resources**

Objective 3

Improve model and simulation capabilities

Actions

13. **Acquisition inputs to DoD M&S priorities**
14. **Best practices for model/sim development**
15. **Distributed LVC environments**
    - **Standards**
    - **Sim/lab/range compliance**
    - **Event services**
16. **Central funding of high-priority, broadly-needed models & sims**
    - **Prioritized needs**
    - **Pilot projects**
    - **Expansion as warranted**

Objective 4

Improve model and simulation use

Actions

17. **Help defining M&S strategy**
18. **M&S planning & employment best practices**
19. **Foster reuse**
    - **Business model**
    - **Responsibilities**
    - **Resource discovery**
20. **Info availability**
    - **Scenarios**
    - **Systems**
    - **Threats**
    - **Environment**
21. **VV&A**
    - **Documentation**
    - **Risk-based**
    - **Examination**
22. **COTS SE tools**
23. **M&S metrics**

Objective 5

Shape the workforce

Actions

24. **Definition of required M&S competencies**
25. **Harvesting of commercial M&S lessons**
26. **Assemble Body of Knowledge for Acqn M&S**
27. **M&S education & training**
    - **DAU, DAG & on-line CLMs**
    - **Conferences, workshops & assist visits**
28. **MSIAC utility**

Objective 1: Provide Necessary Policy & Guidance

(Preamble) Need to assign responsibility for management of the joint capability areas, to include systems engineering and its M&S component

1. Provide effective, persistent DoD-wide M&S management to address cross-cutting M&S issues, coordinate actions
   Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
   Products: Revised DoDD 5000.59 (M&S Management) with clearer responsibilities, revised EXCIMS membership, SOP for EXCIMS processes, a refocused DMSO
   Completion goal: 2006

2. Promote model-based systems engineering (MBSE) and M&S-enabled collaborative environments, at both the program and joint capability level
   Lead: OUSD(AT&L)/DS; **Support:** Components
   Products: Revised guidance in DAG
   Completion goal: 2007

3. Establish policy on appropriate use of M&S to plan tests, to complement system live tests, and to evaluate joint capabilities
   Co-leads: OUSD(AT&L)/DS, ODOT&E; **Support:** Components
   Products: Revised policy and guidance in DoDI 5000.2 and DAG
   Completion goal: 2006

Obj. 1: Provide Necessary Policy & Guidance (cont.)

4. Establish policy to require documented M&S planning at the joint capability & program levels as part of the Systems Engineering Plan, T&E Strategy and T&E Master Plan
   - **Co-leads:** OUSD(AT&L)/DS, ODOT&E; **Support:** Components
   - **Products:** Revised policy and guidance in DoDI 5000.2, DAG, and DOT&E TEMP Planning Guidance
   - **Completion goal:** 2006
5. Establish guidelines for M&S-related RFP language & contract provisions
   - **Lead:** OUSD(AT&L)/DS; **Support:** OUSD(AT&L)/DPAP, Components
   - **Products:** Sample language in DoD publications (e.g., DAG, SEP Preparation Guide, Contracting for Systems Engineering Guidebook) regarding M&S requirements, data rights, and the responsibilities and liabilities of parties regarding sharing and reuse
   - **Completion goal:** 2006
6. Publish practical guidelines for security certification of M&S activities falling under multiple Information Assurance Defense Accreditation Authorities
   - **Lead:** OASD(NII); **Support:** OUSD(AT&L)/DS, NSA
   - **Products:** Guidelines published in DoD 8500.2-H, per DoDI 8500.2 "Information Assurance Implementation," Feb 6, 2003
   - **Completion goal:** 2007

Objective 2: Enhance the Technical Framework for M&S

7. Establish a framework for data interchange-related standards
   Lead: OASD(NII); **Support:** OUSD(AT&L)/DS
   Products: Revised guidance in NII policy documents
   Completion goal: 2008
8. Develop a product development information metamodel & associated metadata extensions to the DoD Discovery Metadata Specification
   Lead: OUSD(AT&L)/DS; **Support:** OASD(NII), Components
   Products: Revised DDMS; revised guidance in DAG.
   Completion goal: 2008
9. Support development of open commercial systems engineering-related standards, such as OMG's Systems Modeling Language (SysML) and ISO Standard 10303 AP-233
   Lead: OUSD(AT&L)/DS; **Support:** DLA, OUSD(AT&L)/DDRE, OASD(NII)
   Products: Published standards suitable for adoption by DoD
   Completion goal: 2007
10. Establish a forum to clarify the characteristics and application of various distributed simulation standards (HLA, TENA, DIS, ALSP, SI3, etc.) and examine opportunities for convergence
    Lead: OUSD(AT&L)/DDRE **Support:** OUSD(AT&L)/TRMC & DS, ODOT&E, Components
    Products: (1) Information on strengths & weaknesses of the various standards; (2) agreement on policy and/or guidance on the use of distributed simulation standards; (3) a way ahead regarding distributed simulation standards
    Completion goal: 2007

Obj. 2: Enhance the Technical Framework for M&S (cont.)

11. Improve the utility of the DoD Architecture Framework (DoDAF) for acquisition

    11-1. Develop the Acquisition Overlay (profile) for DoDAF v2.0

    Lead: OUSD(AT&L)/DS; **Support:** OASD(NII), Components
    Products: Acquisition Overlay for DoDAF v2.0
    Completion goal: 2006

    11-2. Support development of open commercial standards for the depiction and interchange of DoDAF-compliant architectures

    Lead: OASD(NII) **Support:** OUSD(AT&L)/DS
    Products: Published standards suitable for adoption by DoD in DoDAF 2.0; revised guidance in DAG
    Completion goal: 2007

12. Establish a standard template of key characteristics (metadata) to describe reusable M&S resources

    Lead: OUSD(AT&L)/DDRE **Support:** OUSD(AT&L)/DS & TRMC, DOT&E; Components
    Products: Published standard template; usage guidance in DAG
    Completion goal: 2007

Objective 3: Improve Model & Simulation Capabilities

13. Establish a process to ensure acquisition needs are reflected in DoD M&S priorities, including S&T
    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS
    Products: Incorporate in M&S requirements process (ref: DoD M&S Master Plan) a method to capture and prioritize those acquisition needs.
    Completion goal: 2007

14. Define and foster best practices for efficient development and evolution of credible M&S tools, incorporating user-defined requirements, a systems engineering approach, and appropriate verification & validation
    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
    Products: Best practices DMSO publication, available via MSIAC, DTIC, etc.; DAG guidance to use
    Completion goal: 2008

Obj 3: Improve Model & Simulation Capabilities (cont.)

15. Enable readily-available distributed live-virtual-constructive environments, leveraging related initiatives

15-1. Establish DoD-wide standards for distributed environments

Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/TRMC & DS; ODOT&E; Components
Products: Published standard; DODI (# TBD) policy to use
Completion goal: 2008

15-2. Make candidate simulations, labs and ranges compliant with these standards

Lead: Components; **Support:** OUSD(AT&L)/DS & TRMC
Products: Toolkit of live, virtual and constructive representations ready to be employed in distributed events
Completion goal: 2009

15-3. Provide services to help plan and conduct distributed events

Lead: Components; **Support:** OUSD(AT&L)/TRMC & DDRE, DISA
Products: Fee-based technical services to help users (e.g., PMs, Capability Managers, OTAs) plan and conduct distributed events
Completion goal: 2009

Obj 3: Improve Model & Simulation Capabilities (cont.)

16. Centrally fund and manage the development and maintenance of high-priority, broadly-needed M&S tools

    16-1. Identify and prioritize broadly-needed M&S tools
    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS; Components
    Products: Prioritized list of common M&S tool needs
    Completion goal: 2007

    16-2. Conduct one or more pilot projects to develop new M&S tools or update existing ones to meet these needs
    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
    Products: Proof of concept for managing the development/evolution of M&S tools to meet broadly-shared needs
    Completion goal: 2009

    16-3. Expand the scope of central M&S tool management as warranted by pilot project results and the list of common M&S needs
    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
    Products: Optimal means to meet common needs for M&S tools
    Completion goal: 2011

Objective 4: Improve Model & Simulation Use

17. Provide potential acquisition M&S users the knowledge needed to formulate an effective M&S strategy via ready access to M&S expertise and information about M&S capabilities and gaps, reusable resources, lessons-learned, etc.

    Lead: OUSD(AT&L)/DS; **Support:** OUSD(AT&L)/DDRE

    Products: Revised guidance in DAG; improved knowledge base in MSIAC; assist visits (e.g., by OUSD(AT&L)/DS)

    Completion goal: 2007

18. Define best practices for disciplined M&S planning & employment
    - Rigorous analysis of M&S requirements and alternative solutions, selection of best course
    - Efficient configuration management, initialization, execution and post-run analysis
    - Cautions against inappropriate use; approaches to maximize cost-effective reuse across lifecycle

    Lead: OUSD(AT&L)/DS, **Support:** OUSD(AT&L)/DDRE, Components

    Product: Revised best practices guidance in DAG and MSIAC

    Completion goal: 2007

Obj. 4: Improve Model & Simulation Use (cont.)

19. Facilitate the sharing of reusable resources

19-1. Establish a DoD-wide business model for compensating providers of reusable M&S resources (e.g., information, software, services)

Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, OUSD(P&R), OUSD(C)/PA&E, Components

Product: Documented business model; revised policy and/or guidance in DoD 5000 series and DAG

Completion goal: 2007

19-2. Establish DoD policy and/or guidance regarding responsibilities to share, protect and properly use information and M&S tools

Co-Leads: OASD(NII) and OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS & DPAP, OUSD(P&R), OUSD(C)/PA&E, Components

Product: Revised policy and/or guidance in various issuances (e.g., DoD 5000 series, DAG, contracting guidance)

Completion goal: 2007

19-3. Enhance the means (e.g., directory service, registries, bulletin boards) to discover existence of reusable M&S resources and contact information

Lead: OUSD(AT&L)/DDRE **Support:** OUSD(AT&L)/DS, OUSD(P&R), OUSD(C)/PA&E, Components

Product: Functional means, with appropriate resources and incentives, and a continuous improvement process

Completion goal: 2007

Obj. 4: Improve Model & Simulation Use (cont.)

20. Define the types of information DoD organizations shall make available to others with a valid need to know and the processes to obtain them (per reuse business model)

    20-1. Scenario data
    Lead: OUSD(AT&L)/DDRE **Support:** OCJCS(J8), OUSD(C)/PA&E, DIA, Components
    Product: Approved scenarios and process to obtain
    Completion goal: 2007

    20-2. System-related data
    Lead: OUSD(AT&L)/DS; **Support:** Components
    Product: Authoritative system data (characteristics and performance, interactions, interfaces, logistic support, etc.) and process to obtain
    Completion goal: 2007

    20-3. Threat data
    Lead: DOD MSEA for Threat Data; **Support:** OUSD(AT&L)/DDRE & DS, Components
    Product: Authoritative threat data and process to obtain
    Completion goal: 2007

    20-4. Natural environment data
    Lead: DoD Natural Environment MSEAs; **Support:** OUSD(AT&L)/DDRE & DS, Components
    Product: Authoritative natural environment data and process to obtain
    Completion goal: 2007

Obj. 4: Improve Model & Simulation Use (cont.)

21. Foster cost-effective VV&A

21-1. Require DoD-wide standardized documentation of VV&A

Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
Products: Revised policy in DODI 5000.2 and 5000.61; revised guidance in DAG
Completion goal: 2007

21-2. Develop risk-based methodology and associated guidelines for VV&A expenditures

Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
Products: Updated DMSO VV&A Best Practices documents/web site; guidance in DAG
Completion goal: 2006

21-3. Examine a program's VV&A when M&S informs major acquisition decisions and unambiguously state the purpose, key assumptions and significant limitations of each model/simulation when results are presented.

Lead: OUSD(AT&L)/DS **Support:** DoD Components
Products: Guidance & training for oversight personnel; updates to DAG Chaps 4 & 9
Completion goal: 2006

Obj. 4: Improve Model & Simulation Use (cont.)

22. Assess the use of COTS systems engineering tools (modeling environments) for collaborative architecture development
    Lead: OUSD(AT&L)/DS**; Support:** OASD(NII), Components
    Products: Revised guidance in DAG; enhanced M&S body of knowledge for dissemination
    Completion goal: 2006
23. Define and capture meaningful metrics for M&S utility in acquisition
    Lead: Navy; **Support:** OUSD(AT&L)/DS, Components
    Products: Metric definitions in DAG; methods to capture and submit data in DAG; data from individual projects in MSIAC, Body of Knowledge, etc.
    Completion goal: 2007

Objective 5: Shape the Workforce

24. Define required M&S competencies for the acquisition workforce
    Co-Leads: DAU and OUSD(AT&L)/DS; **Support:** OUSD(P&R), OUSD(AT&L)/DDRE, OUSD(C)/PA&E, Components
    Product: Identified lead FIPT; workforce qualification requirements; management process & structure
    Completion goal: 2008
25. Harvest lessons from commercial sector activities in the use of M&S to support product development
    Lead: OUSD(AT&L)/DS; **Support:** OUSD(AT&L)/DDRE, Components
    Products: Lessons collected at a defined site (TBD); annual update to best practices in DAG of lessons from industry that should be considered by PMs in planning for M&S
    Completion goal: Recurring; initial in 2007
26. Assemble and evolve the M&S Body of Knowledge (information set) relevant to acquisition
    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, Components
    Product: Information base available to potential M&S users (e.g., PMs, CMs, OTAs); source material for education and training
    Completion goal: Recurring; initial in 2007

Obj. 5: Shape the Workforce (cont.)

27. Drawing on the M&S Body of Knowledge, educate and train the workforce to achieve required M&S competencies

    27-1. Provide M&S knowledge via an expanded set of DAU courses, the Defense Acquisition Guide, and on-line CLMs

    Lead: DAU; **Support:** OUSD(AT&L)/DS & DDRE, Components

    Product: Expanded set of DAU courses, improved M&S guidance in the Defense Acquisition Guide, on line Continuous Learning Modules; a better educated workforce

    Completion goal: 2009

    27-2. Provide M&S knowledge via conferences, workshops, and assist visits

    Lead: OUSD(AT&L)/DS; **Support:** DAU, OUSD(AT&L)/DDRE, Components

    Product: Annual outreach program; a better educated and trained workforce

    Completion goal: Recurring; initial in 2006

28. Improve the knowledge and expertise available through the MSIAC to make it of greater utility to the acquisition community

    Lead: OUSD(AT&L)/DDRE; **Support:** OUSD(AT&L)/DS, OUSD(P&R), OUSD(C)/PA&E, Components

    Product: Plan of action with coordinated MSIAC CONOPS & staffing requirement; list of knowledge shortfalls that MSIAC will take on; success criteria & process to bring MSIAC up to criteria

    Completion goal: 2008

Next Steps

- Broadly vet actions (DoD, Industry)
  - Fine-tune actions, lead & support, products, etc.
- Finalize Acquisition M&S Master Plan
  - Acqn M&S Working Group consensus
  - SE Forum approval (Dec 2005)
  - Informal DoD coordination
  - Formal coordination as a DoD issuance?
  - USD(AT&L) approve plan
- Implement plan, monitor action completion
- Assess impact (metrics)

Discussion

- Questions and comments are invited here as time permits
- NDIA M&S Committee meeting 1445-1730 Thursday to answer remaining questions and discuss your change recommendations
  - All are welcome to attend

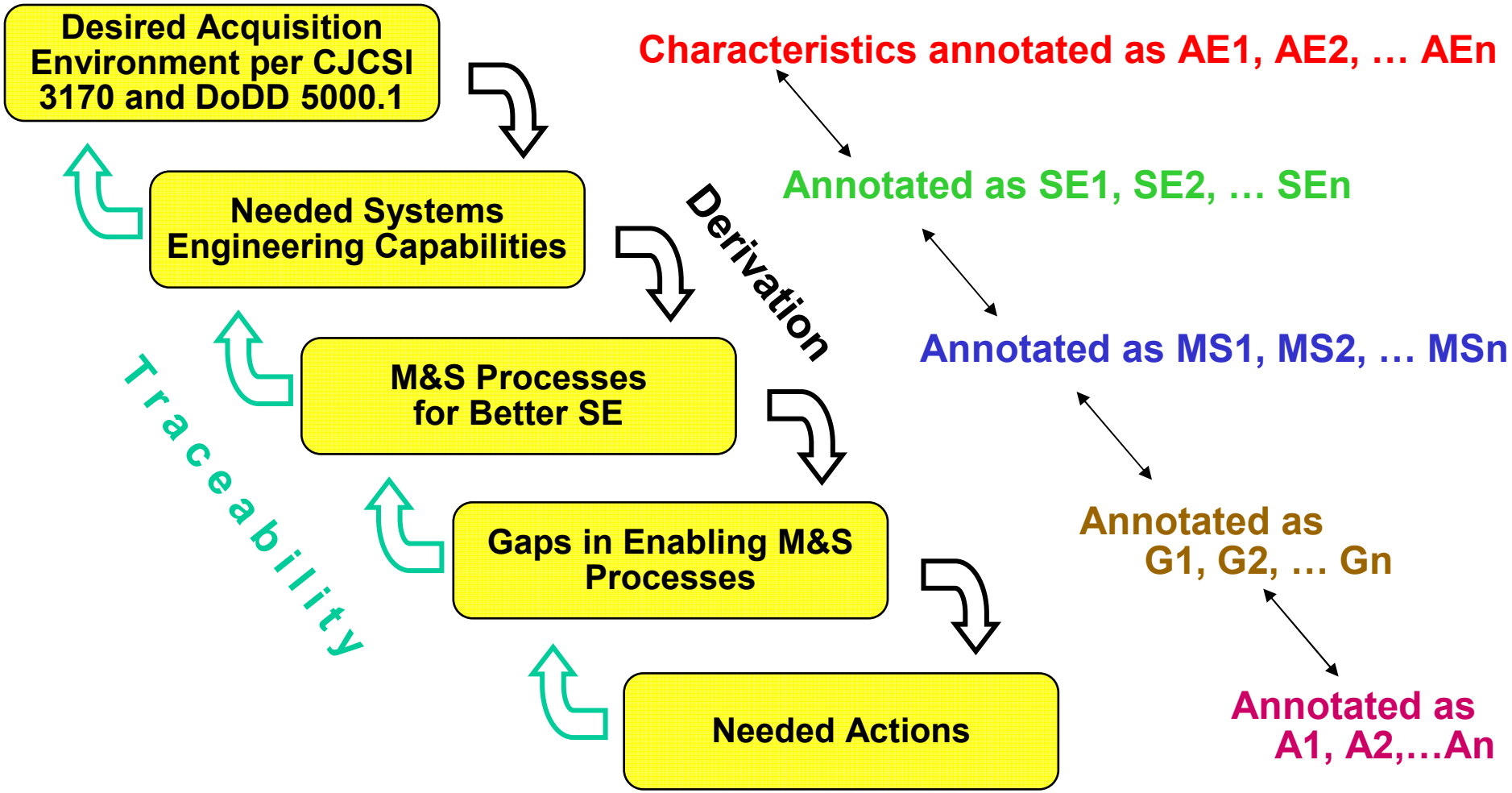
BACKUP

AMSWG Participants

Allen, John	DOT&E
Amick, Karl *	OSD(AT&L) LP&P
Anderson, William	SEI
Anthony, Marvin	NAVSEA 06P
Atkinson, Kenn	DMSO
Badolato, Anthony *	SAF/ACE
Bailey, Bruce (ctr)	DMSO
Ball, David P.	Army G37/BCSE
Barnabe, Dennis	NSA
Bilmanis, John (ctr)	Army G3/BC
Bounker, Paul	RDECOM TARDEC
Burris, William	TRMC
Butterworth, Robert *	DOTE
Campbell, David	OSD(ATL)/DTRMC
Cianciolo, Lawrence	DCMA
Clark, Doug (ctr) *	DMSO
Digman, Emmanuel	NSA
Duesterhaus, Dave	DOT&E
Eadie, J Marc *	NSWCPC(SOCOM AE)
Elliott, Steve	OUSD(AT&L) DS/MW
Espinosa, William	OPNAV N091
Falkey, Mark *	JNIC/SY COLEMAN
Flow, Rob * Feinberg, Jerry (ctr)	OASD (PA&E) CAIG MSIAC
Friedenthal, Sanford	LMC
Furness, Zach (ctr)	MITRE
Gill, Jim *	DDFP/JTAMDO/CSC
Gillis, John (ctr)*	ASA(ALT) RDA M&S
Glasow, Jerry	DMSO
Goerger, Niki *	USMA
Goode, Francine *	NSA
Halayko, Bob Hardy, Dwayne *	OUSD(P&R) OUSD(AT&L)DS
Hollenbach, Jim (ctr)	OUSD(AT&L) DS/SE
Hutchings, Charles	NAVSEA
Johnston, Jerald	JHU/APL
Keener, Jim	IWS 1B% (NSWCDD)
Kelly, Doug	DIA
Kline, Tom	PEO IWS
Lackner, Bob	PEO IWS IC/ ANTEON
Long, James	Vitech Corp
Long, Vicki	HQAFMC/XRA
Mackoy, Rebecca	TRADOC
Manthei, Jerry	CNO N091/N912
Mathis, Thomas	RDECOM/SOSI Camber
Matzner, John	Army G-3/5/7/Alion
McDonnell, Joe (ctr)	RDECOM
Merrill, Bruce	NSA
Mitchell, Jeff	JHU/APL
Montoya, Matt	JHU/APL
Myers, Fred *	OUSD(ATL)DS
Nunez, Patrick	RDECOM TARDEC
Parmele, Truman	OASD/NII
Pikul, Ronald	ASN RDA
Pittenger, Bill *	DISA/MITRE
Placanica, John *	NGA
Preissman, Dan	NAVAIR
Prill, Mark *	NASA/ESMD
Prosnik, George *	DAU
Roe, James W	AF AFMC/XRA
Sas, Robert	NCEE
Schmidt, Karl	NGA/LMC
Shah, Nehal *	ASN(RDA) CHENG
Solosky, Tom *	DCMA
Suter, Richard	OUSD (AT&L) (T&E)
Swift, Lloyd ctr	ASN(RDA) CHENG
Tillery, Gordon (ctr)	OUSD(AT&L) DS/SE
Tirres, Carlos *	DTRMC
Truelove, Michael(ctr)	OUSD (AT&L) DS/SE
Vaughn, Barbara	ASN RDA CHENG
Walker, Oral	PMUA MSMO
Wallace Jim Walsh, John *	Army G37/BCSE OUSD(P&R)
Wright, Susan	OSD DOT&E
Znachko, Carrall	SAF/AQIZ

* Indicates SE Forum Representatives that are AMSWG Voting Members

Top-Down Derivation/Cross-Check



Desired Acquisition Environment:

Key CJSCI 3170.01E Policies

- AE1 *Joint concepts-centric capabilities identification process to allow joint forces to meet the full range of military operations and challenges…*
- AE2 *Assess existing and proposed capabilities in light of their contribution to future joint allied and coalition operations. … Produce capability proposals that* AE3 *consider the full range of DOTMLPF solutions in order to advance joint warfighting in a unilateral and multinational context.*
- *New solution sets…crafted to deliver technologically sound, testable,* AE4 *sustainable and affordable increments of militarily useful capability.*
- AE5 *The FoS and SoS solutions may also require systems delivered by multiple sponsors/materiel developers.* AE6
- *The process to identify capability gaps and potential solutions must be supported by a robust analytical process* AE7
- *JCIDS implements a capabilities-based approach that…requires a* AE8 *collaborative process that utilizes joint concepts and integrated* AE9 *architectures to identify prioritized capability gaps* AE10 *and integrated DOTMLPF and policy approaches to resolve those gaps* AE11

Desired Acquisition Environment:

DoDD 5000.1 Acquisition Policies

"The primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price."

Governing policies:

- *Flexibility, Responsiveness (time-phased capabilities, evolutionary acquisition), Innovation, Discipline, Streamlined Effective Management*
- *Armaments Cooperation; Collaboration; Competition; Cost and Affordability; Cost Realism; Cost Sharing; Financial Management; Independent OTAs; Information Assurance; Information Superiority; Integrated T&E; Intelligence Support; Interoperability; Knowledge-Based Acquisition; Legal Compliance; Performance-Based Acquisition; Performance-Based Logistics; Products Services and Technologies [seek most cost-effective solution over the system's life cycle], Professional Workforce, Program Information [complete, current, tailored]; Program Stability; R&D Protection; Safety; Small Business Participation; Software Intensive Systems; Streamlined Organizations; Systems Engineering; Technology Development and Transition; Total Systems Approach*
- *Oct 04 policy memo: Technical reviews … shall be event-driven*

Necessary Systems Engineering Capabilities

(which M&S can affect; derived from Desired Acquisition Environment)

SE1. Early, continuing systems engineering from an SoS/FoS capabilities perspective; seamless transition from JCIDS to acquisition **(AE1-3,5,9-11,16,20,21,25,27)**

SE2. Lifecycle-wide exploration of the maximum available trade space, including time-phased requirements and technology insertion **(AE1-5,7,10,11,13,16,19,23-27)**

SE3. Collaboration among all stake holders (multiple gov't and contractor organizations) for key enterprise-level SE decisions **(AE6-8,10,18,22,25,27)**

SE4. Rapid assessment of concept/design alternatives **(AE2,4,7,10,14,16,19,25,28)**

SE5. Comprehensive, accurate, event-based assessment of technical baselines; avoidance of costly fixes for problems discovered late **(AE2-4,7,9,10,12-17,19,20,22,24-26,28)**

SE6. Focused, effective & efficient testing; including at the capability level **(AE1,2,4,5,9-11,13,15,19-22,25)**

SE7. Appropriate reuse of all resources – information, software tools, expertise, facilities, ranges, etc. – across programs & organizations **(AE4,14,15,19,24,25)**

D1

M&S Processes for Better Systems Engineering

(derived from Needed Systems Engineering Capabilities)

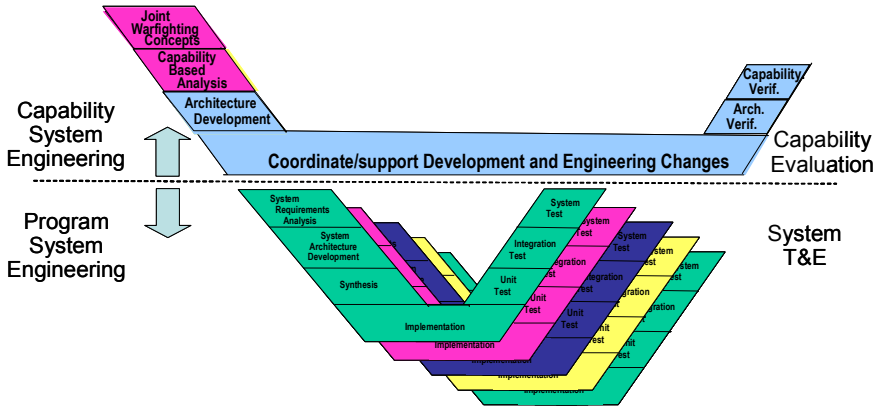
MS1. Use of a model-based systems engineering approach **(SE1,2,4,5)**

(Emerging concept under INCOSE, OMG, etc.; growing suite of COTS SE tools)

- SE tool modeling environments to analyze requirements, develop architecture, and specify constraints; views linked to, and generated from, an underlying database
- Embedded simulation to verify the architecture and assess its merits
- Automated generation of documents/reports

MS2. Establishing M&S-enabled collaborative engineering environments **(SE1,2,3,4,5,6)**

- Shared, authoritative information
- Interoperable modeling environments for architecting/design
  - Models as communication means
- Models & simulations to assess
  - Option to immerse warfighters, etc.
- Distributed live-virtual-constructive environments for integration, verification, and test



MS3. Model-Test-Fix-Model process across the life-cycle **(SE4,5,6)**

- Better test planning, more effective tests
- Increased M&S validity; credible surrogates; reuse savings

D1 M&S Processes for Better Systems Engineering

MS4. Harnessing M&S knowledge to formulate an effective M&S strategy (SE2,3,4,5,7)

- Ready access to M&S expertise and information about capabilities and gaps (M&S holes), reusable resources, lessons-learned, etc.

MS5. Disciplined M&S planning & employment (SE2,4,5,7)

- Rigorous analysis of M&S requirements, alternatives, best course
- Efficient configuration/initialization, execution and post-run analysis
- Avoid inappropriate use; maximize cost-effective reuse across lifecycle

MS6. Efficient development/evolution of credible M&S tools (SE2,3,5,7)

- A systems engineering approach with appropriate V&V

MS7. Access/sharing of authoritative, understandable data needed for M&S representations (SE2,3,4,5,7)

- Reducing a major time and cost burden that inhibits M&S use

MS8. Inspection of M&S used to inform acquisition decisions (SE2,5,7)

- Examine capabilities and limitations (VV&A) of M&S
- During lead-up to program/technical reviews, OTRRs, DABs, etc.

D2

Gaps

1. Management

G1. Robust but confused landscape of M&S activities; no clearly designated leadership or effective coordinating mechanism **(MS1-8)**

- Current EXCIMS ineffective; little coordination for capabilities/SoS/FoS

G2. Inadequate constancy of purpose because time to fix problems >> tour length; "DoD has an attention deficit disorder" **(MS2-7)**

G3. Gov't acquisition guidelines don't promote M&S use or reuse **(MS1-6)**

G4. No DoD requirement for formal M&S planning to support acquisition (other than T&E) **(MS1-5)**

G5. No contractual guidelines regarding M&S and the data it needs **(MS1-8)**

G6. Gov't typically doesn't give contractors meaningful M&S guidance **(MS1,2,6,8)**

G7. Most DoD M&S takes a project, vice an enterprise, approach **(MS2,3,6,7)**

G8. No consensus on value of integrated architectures, nor responsibility for **(MS1,2)**

G9. Managing distributed collaboration is very hard **(MS1-8)**

G10. Public law precludes OT based solely on M&S, but no clear guidance on use for SoS/FoS T&E **(MS2,3,5,6,8)**

D2

Gaps

2. Architecture/standards/technical framework

G11. No standard modeling notation (like UML v2.0) for capturing full range of information critical to system engineering (e.g., structure, behavior, requirements hierarchy/traceability, test cases, verification results) **(MS1,2,6,7)**

G12. No standard for interchanging systems engineering information (same examples as above) **(MS1,2,6,7)**

G13. No conceptual framework (like Open System Interconnect protocol stack) for data interchange **(MS1,2,3,6,7)**

G14. Lack of agreement on a common distributed simulation standard increases complexity and cost, limits simulation interoperability **(MS2,5,6)**

G15. DoDAF v1.0 is difficult to use for architecting due to lack of data-centricity and executability; some products of marginal value **(MS1,2,6,7)**

G16. Use of DoD-unique standards limits their user base, quality, COTS tool support, and opportunities for reuse **(MS1,2,5,6)**

D2

Gaps

3. Model/simulation capabilities & use

G17. Many M&S tool gaps and deficiencies **(MS1,2,3,5,7)**

- What's modeled (e.g., urban warfare, comm networks, threats, system sustainment)
- Fidelity, granularity, interoperability
- Only limited consensus on common models to be used across a domain

G18. No good way to develop and maintain widely-needed M&S tools that cut across programs **(MS5,6)**

- Not incorporating mods by other organizations into "street version," etc.

G19. M&S developers, not M&S users, tend to drive M&S development **(MS6)**

G20. In general, architecture development (modeling) is lagging, not collaborative, and not exploiting COTS SE tools (modeling environments) **(MS1,2)**

G21. No readily-available distributed M&S infrastructure (e.g., JDEP) **(MS2,5)**

G22. Hard to get security certification for multi-organization (company/ Service) distributed simulation **(MS2,3,5,6)**

G23. Hard to get approval and security certification for M&S involving multiple compartmented programs (SAPs) **(MS2,3,5,6,7)**

D2

Gaps

4. Trustworthiness/VV&A

G24. Post-development model validation expensive and slow **(MS2,3,5,8)**

G25. VV&A often weak or non-existent; documentation inconsistent **(MS2,3,5,8)**

- Plans to use M&S to avoid testing costs often rejected due to poor/no validation

G26. VV&A usually not enforced and also not examined during program reviews **(MS2,3,5,6,8)**

G27. Models and sims often not updated to reflect empirical evidence (e.g., test results) **(MS2,3,5,8)**

D2

Gaps

5. Sharing/reuse and protection of tools & information

G28. Little reuse; only 7% of models & sims used on >1 program **(MS2,5,6)**

G29. Concurrent engineering requires an integrated process, data sharing and a coherent tool set, but <20% of programs have such a collaborative environment **(MS2,7)**

G30. Hard to discover reusable resources (software, info, services) **(MS2,4,5,7)**

- M&S repositories are not integrated, lack an effective search capability, and are mostly empty
- MSIAC knowledge/expertise is lacking

G31. Insufficient info (metadata) to evaluate data/reuse candidates **(MS2,4,5,7)**

G32. Hard to obtain reusable resources **(MS2,4,5,7)**

- Industry to gov't: To protect proprietary info & competitive advantage
- Gov't to industry: Contractual liabilities associated with GFE/GFI
- Gov't to gov't: Concerns about misuse; cost to deliver and guide

G33. No incentives to encourage reuse **(MS2,3,5,6)**

- Negative incentives include cost to make reusable, workload assisting users, vulnerability to criticism

[plus approval and security certification gaps 22 & 23 listed under M&S use]

D2

Gaps

6. Research/S&T/tech base

G34. Conceptual foundation of M&S weak **(MS5,6)**

- E.g., theoretical understanding of modern warfare, human behavior, relating M&S at different granularities, dealing with uncertainty, agent-based modeling and generative analysis

G35. Little acquisition community input to DoD S&T management regarding needed M&S-related research **(MS2,5,6)**

7. Business model, metrics & ROI, funding and incentives

G36. No business model for how M&S capabilities should be developed, used and maintained **(MS1-8)**

G37. Metrics are critical to keep interest and funding up, but metrics regarding M&S use and cost-effectiveness are inadequate **(MS1-8)**

- M&S funding difficult to identify; most embedded within other PEs

G38. Too little funding **(MS2-7)**

D2

Gaps

8. Workforce Shaping

G39. Body of knowledge for M&S support to acquisition is deficient, not managed **(MS1,2,4-6,8)**

G40. Acqn community managers and staffs mostly uninformed about M&S capabilities and limitations **(MS1-8)**

- Weak acquisition personnel understanding of commercial M&S activities ("We don't get out enough")
- Not enough M&S experts (no career path [except Army], no formal education or training)

G41. M&S developers lack understanding of modeling best practices, abstraction techniques, context dependencies, etc. **(MS3,6)**

G42. M&S users often not adequately trained **(MS1,2,4,5,8)**

G43. Insufficient M&S education options **(MS2,4,5,6,8)**