

# Execution of the Acquisition M&S Master Plan Progress Report



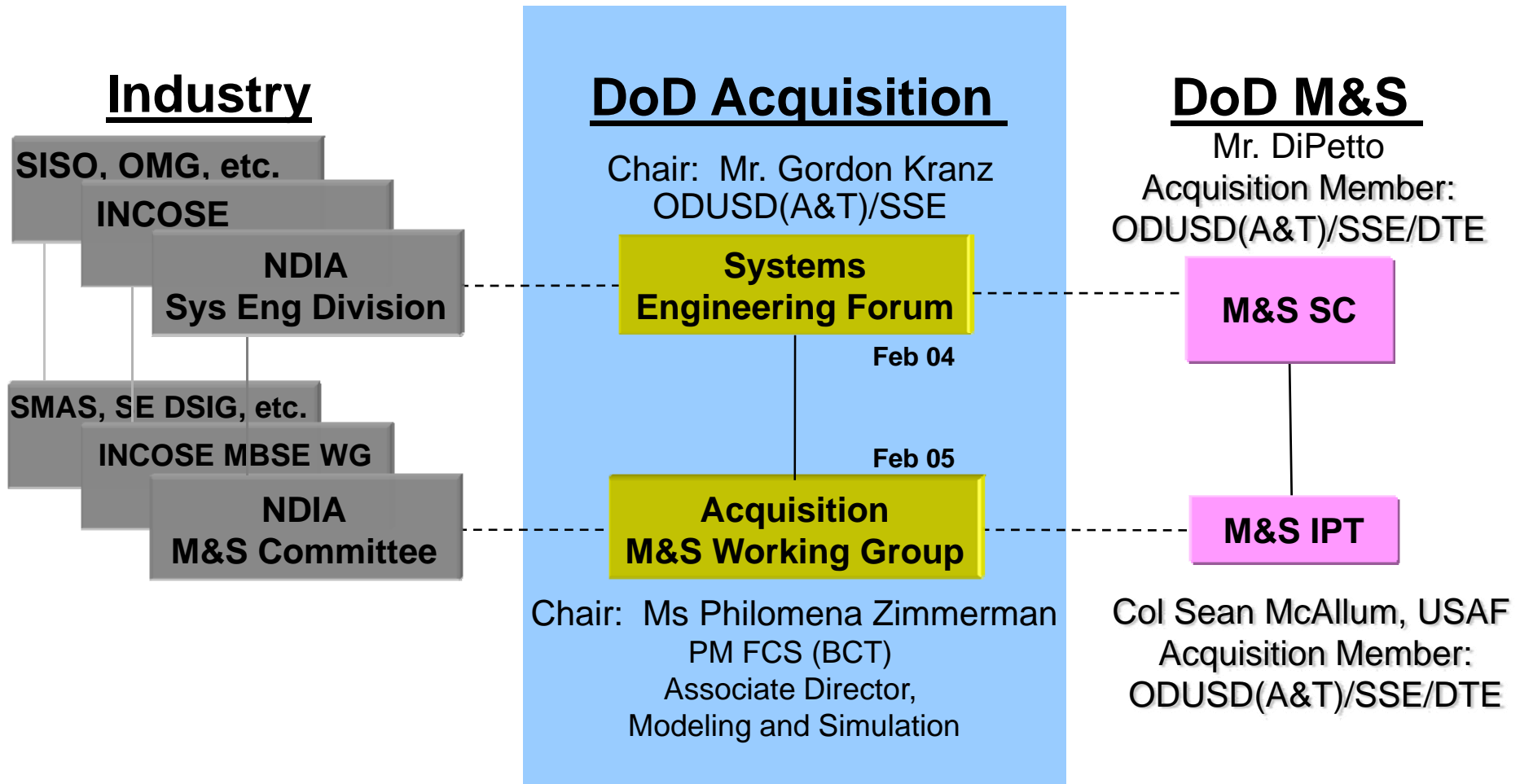
NDIA Systems Engineering Conference  
San Diego, California  
20-23 October 2008

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# Outline

- ❑ AMSMP Development (Review)
- ❑ AMSMP Execution
  - Funding approach
  - Progress overview
- ❑ Future Plans
- ❑ Q&A/Status of Individual Actions

# Acquisition M&S Governance Structure



**AMSWG is anchored in acquisition community and linked to industry and the DoD M&S community**

# Acquisition Modeling & Simulation Master Plan

## ❑ Purpose

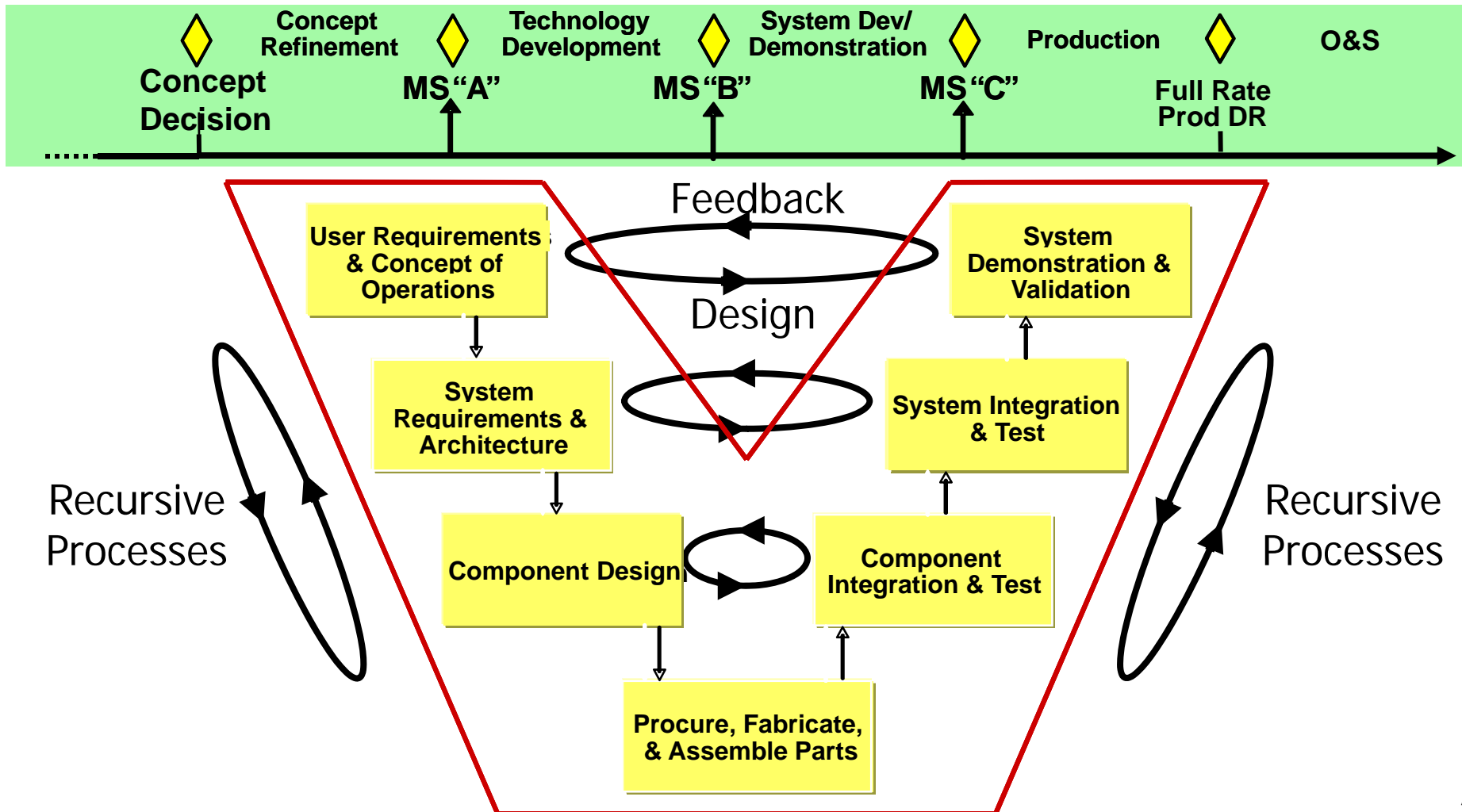
*“Improve M&S support to the DoD acquisition process...”*

## ❑ Vision

*“Optimally employ responsive, trustworthy, and cost-effective M&S capabilities to support defining, developing, testing, producing and sustaining America's capabilities that support the spectrum of DoD missions.”*

# Acquisition M&S

- ❑ Definition: M&S used to help define, design, develop, test, produce, operate, and sustain defense systems and systems-of-systems
- ❑ Scope: Across the acquisition life cycle



# Potential M&S Benefits

- ❑ M&S can improve design (designs are models), integration, and evaluation
  - Accurately track complex relationships and micro-level interactions
  - Present macro-level measures of merit to decision makers
  - Earlier, more accurate understanding of a system, lowering risk
- ❑ Means to deal with the challenges of acquiring capabilities/systems of systems, with attendant dramatic increases in trade space and complexity
  - Track the many more entities, variables, interactions, etc.
  - Provide a shared understanding across vast development enterprises
- ❑ M&S can speed the design-evaluation cycle, saving time and money
- ❑ Provides a more defensible analytical underpinning for decisions
- ❑ Credible M&S surrogates for systems and forces can cost-effectively...
  - flesh-out the battlespace for live tests of individual systems
  - provide the only practical way to assess SoS capabilities as they evolve

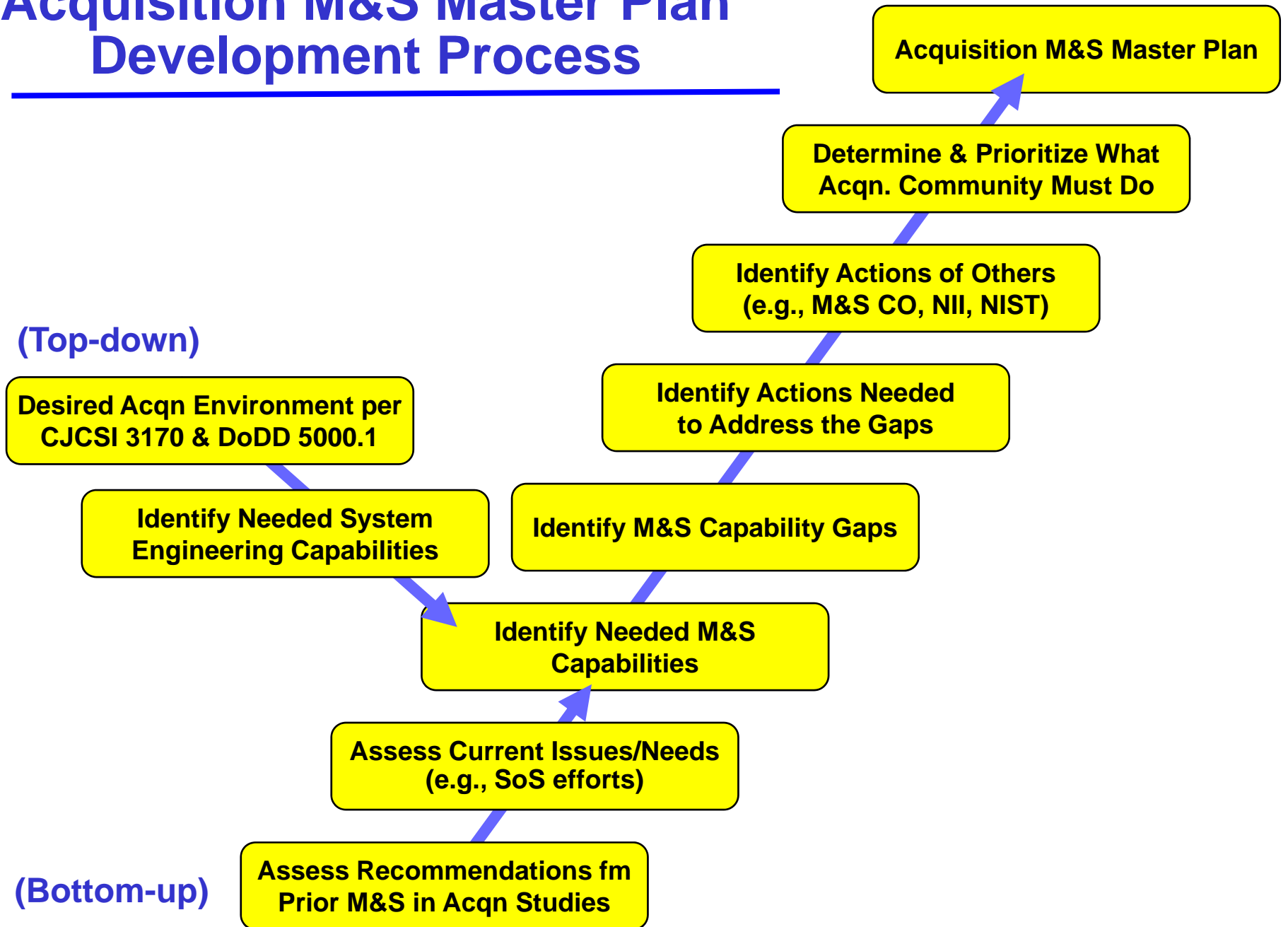
# AMSMP Strategy

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- ❑ Not try to do the job of program/capability managers; rather, seek to empower them by
  - Removing systemic obstacles in their path
  - Identifying new options for approaching their tasks
- ❑ 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 joint capabilities (systems of systems)
- ❑ Lay out tasks as a Work Breakdown Structure (WBS)
  - Discrete tasks with identified leads and explicit deliverables
  - Easier to resource, schedule, and manage
  - Each contributes to better M&S support to acquisition

# Acquisition M&S Master Plan Development Process

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# Assessment Highlights

- ❑ Widespread use of M&S in acquisition, but usually stove-piped
- ❑ Many M&S representation gaps and deficiencies
- ❑ Acquisition staffs mostly uninformed about M&S capabilities and limitations
- ❑ No requirement to document planned M&S support to acquisition
- ❑ No effective business model for developing, using, and maintaining broadly-needed M&S capabilities
- ❑ Weak contractual guidelines for M&S and data needs
- ❑ Lack of agreed standards for sharing info and interoperating M&S tools
- ❑ Hard to discover reusable M&S tools and data, insufficient info to evaluate reuse candidates, and lack of reuse incentives = little reuse
- ❑ Virtual ranges (Live-Virtual-Constructive simulation environments) aren't readily available
- ❑ VV&A often poor or non-existent; weak documentation & examination

# Acquisition M&S Master Plan Structure

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Department of Defense

## Acquisition Modeling and Simulation Master Plan

Issued by the  
DoD Systems Engineering Forum  
April 17, 2006

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- **Foreword**
- **Introduction**
  - Purpose
  - Vision
  - Scope
- **Objectives (5)**
- **Actions (40)**
  - Action
  - Rationale (why it's needed)
  - Discussion (implementation guidance)
  - Lead & supporting organizations
  - Products (what is expected)
  - Completion goal (year)
- **Execution Management**

<http://www.acq.osd.mil/sse/as/guidance.html>

# Five Objectives, 40 Actions

## Objective 1

Provide necessary policy and guidance

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

## Objective 2

Enhance the technical framework for M&S

- 2-1 Product development metamodel
- 2-2 Commercial SE standards
- 2-3 Distributed simulation standards
- 2-4 DoDAF utility
  - a) DoDAF 2.0 Systems Engineering Overlay
  - b) Standards for depiction & interchange
- 2-5 Metadata template for reusable resources

## Objective 3

Improve model and simulation capabilities

- 3-1 Acquisition inputs to DoD M&S priorities
- 3-2 Best practices for model/sim development
- 3-3 Distributed LVC environments
  - a) Standards
  - b) Sim/lab/range compliance
  - c) Event services
- 3-4 Central funding of high-priority, broadly-needed models & sims
  - a) Prioritize needs
  - b) Pilot projects
  - c) Expansion as warranted

## Objective 4

Improve model and simulation use

- 4-1 Help defining M&S strategy
- 4-2 M&S planning & employment best practices
- 4-3 Foster reuse
  - a) Business model
  - b) Responsibilities
  - c) Resource discovery
- 4-4 Info availability
  - a) Scenarios
  - b) Systems
  - 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 benefit metrics

## Objective 5

Shape the workforce


- 5-1 Definition of required M&S competencies
- 5-2 Harvesting of commercial M&S lessons
- 5-3 Assemble Body of Knowledge for Acqn M&S
- 5-4 M&S education & training
  - a) DAU, DAG & on-line CLMs
  - b) Conferences, workshops & assist visits
- 5-5 MSIAC utility

### Key

Broader than Acqn

Partially broader

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# Funding Approach

## Prioritized options to accomplish AMSMP actions

1. Accomplish via sweat equity
  - e.g., OUAD(A&T)/SSE M&S Cell (resource limited)
2. Compete for M&S Steering Committee funds (if > acqn)
  - only DoD-wide M&S Program Element
3. Compete for OSD funding “targets of opportunity”
  - e.g., study funds, end-of-year sweep
4. Submit as SBIR topics (just beginning)
5. Team with other organizations
  - e.g., NII & NAVAIR on Information Assurance (Action 1-6)
6. POM initiative (none so far, but under discussion)

# Some Recent Funding Successes (1 of 4)

- ❑ Successfully competed for M&S SC funds for these projects, currently underway with SSE/DT&E oversight
  - 07-1-001f **Integrated Natural Environment Authoritative Representation Process** (AMSMP Action 4-4d)  
Deliverable: Environmental Scenario Generator that provides better and more rapid generation of weather, space, and terrain representations  
Program Manager: Col Mark Zettlemoyer, USAF (MSCA)  
Performer: SAIC  
**\$2.3M**
  - 07-1-002f **M&S Resource Reuse Business Model** (AMSMP Action 4-3a)  
Deliverable: Recommended business model (including policy, incentive structure, and procedures) for the reuse of M&S resources and a campaign plan for implementation  
Program Manager: Mr. Chris DiPetto (was Lt Col White)  
Performer: Center for Naval Analysis (Dr. Dennis Shea, et. al.)  
**\$800K**

# Some Recent Funding Successes (2 of 4)

➤ 07-1-004f **Educating the M&S Workforce** (AMSMP Actions 5-1 and 5-3)

Deliverables:

- Required workforce M&S competencies
- Learning architecture to define content, instructional delivery methods, and scope

Program Manager: ODASN(RDA)/CHENG (W. Zimmerman)

Performer: Naval Postgraduate School, other academic partners,

**\$3.2M**

➤ 07-1-005f **VV&A Standardization** (AMSMP Action 4-5a)

Deliverables:

1. VV&A standardized documentation template
2. VV&A documentation tool to assist users
3. Policy and guidance updates

PM: Director, Navy Modeling and Simulation Office (K. Charlow)

Performer: SPAWAR

**\$550K**

# Some Recent Funding Successes (3 of 4)

## ➤ 060-TR-01 Live Virtual Constructive Architecture Roadmap (AMSMP Actions 2-3 and 3-3a)

Deliverables:

- Functional requirements for Live-Virtual-Constructive simulation environments
- Capabilities & limitations of various distributed simulation architectures in use across DoD (DIS, ALSP, HLA, TENA, CTIA)
- Comparative analyses of the architectures, middleware, business models, and standards management
- Analysis of alternatives
- Recommended roadmap

Oversight: P&R and DUSD (A&T)/SSE/DT&E

Program Manager: JFCOM (Mr. Ken Goad)

Performer: JFCOM, IDA, JHU APL, PEO-STRI

**\$1.4M**



# Some Recent Funding Successes (4 of 4)

□ Successfully competed for OSD Study Funds for:

➤ **Study on Best Practices for M&S Tool Development**  
(AMSMP Action 3-2)

Deliverables:

- Bibliography identifying sound practices
- Draft and final version of best practices for M&S tool development

Program Manager: Col Sean McAllum, USF, ODUSD(A&T)/SSE/DT&E

Performer: JHU APL

**\$350K**

➤ **Study on Management of Broadly-needed M&S tools**  
(AMSMP Action 3-4)

Deliverables:

- Best practices for managing broadly needed M&S tools
- Recommended actions to improve DoD management of such tools

Program Manager: Col Sean McAllum, USF, ODUSD(A&T)/SSE/DT&E

Performer: JHU APL

**\$500K**

# Execution Progress Overview

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- 1-5 RFP & contract language
- 1-6 Information assurance

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Shape the workforce

- 5-1 Definition of required M&S competencies
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# Future Plans (FY09/10)

- ❑ Continue cooperatively executing the AMSMP
- ❑ Update AMSMP to reflect accomplishments, fact of life changes, and newly-identified needs (e.g, Virtual Battlespace Center for OSD acqn decisions). Make vision more specific.
- ❑ Ensure programs know about and can access deliverables
- ❑ Provide direct assistance to programs
  - At the request of SSE/Assessment and Support, have already conducted M&S review of Joint Light Tactical Vehicle and FCS
- ❑ Continue to educate and learn via outreach
  - Conferences and workshops, both defense & commercial
- ❑ Support development of useful standards
  - SISO, W3C Data Semantics WG, OMG, etc.
- ❑ Pursue additional resources (both people and \$)

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  - Will gladly discuss individual actions of interest

# AMSMP Execution Progress Overview

## Objective 1

Provide necessary policy and guidance

## Objective 2

Enhance the technical framework for M&S

## Objective 3

Improve model and simulation capabilities

## Objective 4

Improve model and simulation use

## Objective 5

Shape the workforce

### 1-1 M&S management

1-2 Model-based systems engineering & collaborative environments

1-3 M&S in testing

1-4 M&S planning documentation

1-5 RFP & contract language

1-6 Information assurance

### 2-1 Product development metamodel

2-2 Commercial SE standards

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a) DAU, DAG & on-line CLMs  
b) Conferences, workshops & assist visits

5-5 MSIAC utility

Separate presentation

# **Status of Individual Actions**

**Caveat: Did not rate down progress for  
lateness, unless stalled**

# Objective 1: Provide Necessary Policy & Guidance

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1-1. Provide effective, persistent DoD-wide M&S management to address cross-cutting M&S issues, coordinate actions

**Lead:** OUSD(AT&L) **Support:** OUSD(AT&L)/DS(SSE), OUSD(P&R), OUSD(C)/PA&E, etc.

**Products:** Revised DoDD 5000.59 (M&S Management), revised senior leadership management; and improved policies for M&S management. revised senior leadership management; and improved policies for M&S management.

**Completion goal:** 2006

- **New DoD M&S management structure in place; effectiveness questioned**
- **New DoD Directive finally released Aug 07, with promise of a follow-on DoDI to define key responsibilities and processes. SOP now proposed as substitute.**
- **No acquisition community leadership role on M&S SC (Training & Analysis do)**
- **Current project selection process does not fund only cross-cutting efforts, misusing M&S PE**

## Next Steps:

- **Continue to argue for an SSE leadership role on M&S SC**
- **Advocate within M&S governance structure for a DoDI on M&S management**
- **Continue to propose an alternative approach to “C&CC Business Plan”**



# Objective 1: Provide Necessary Policy & Guidance

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1-2. 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(SSE); **Support:** Components

**Products:** Revised guidance in DAG

**Completion goal:** 2007

- **Current DAG mentions collaborative environments 14 times, simulation-based testing once, SBA twice, and MBSE not at all.**
- **Programs/companies often claim collaborative environments, but only partial**
- **MBSE a prominent part of INCOSE's SE Vision 2020**
- **Increasing industry use of MBSE concept & tools**
- **SSE submitted new DAG language May 07, but DAG revision stalled**

**Next steps:**

- **Continue advocacy for submitted DAG language; revise submittal if rejected**
- **Investigate possibility of a CLM on MBSE**

# Objective 1: Provide Necessary Policy & Guidance

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1-3. Establish policy and guidance 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:** 2007

- **DoDI 5000.2 is excellent at the program level, but not at the capability level**
- **Better discussion in SSE's latest DAG submission, but need more specificity**
- **JMETC launched, but many challenges ahead, including policy**
- **Services are getting more active (e.g., NAVAIR M&S Enterprise Initiative)**

## Next steps:

- **NDIA M&S Cmte participate in DT&E Cmte effort; check for progress**
- **Track JMETC policy development, respond appropriately**
- **Continue working with NAVAIR M&S Enterprise to develop guidance**
- **Draft expanded policy and guidance, vet with the various stakeholders**
- **Submit additional changes to DAG (both T&E and M&S portions)**

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

1-4. 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(SSE), ODOT&E; **Support:** Components

**Products:** Revised policy and guidance in DoDI 5000.2, DAG, and DOT&E TEMP Planning Guidance

**Completion goal:** 2007

- **AMSWG (SSE) submitted revised language to DoD 5000.2, DAG language and SEP Preparation Guide**
- **Partial acceptance of SEP language; DoDI 5000.2 and DAG updates stalled**
- **No action thus far regarding TEMP Planning Guidance**

**Next steps:**

- **Continue working with NAVAIR M&S Enterprise to develop guidance**
- **Draft/submit language for TEMP Planning Guidance**

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

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1-5. Establish M&S-related guidelines for solicitations, source selections, and contracting.

**Lead:** OUSD(AT&L)/DS(SSE); **Support:** OUSD(AT&L)/DPAP, ODOT&E, 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:** 2007

- Solicited inputs from AMSWG members and industry (through NDIA M&S Cmte)
- AMSWG (SSE) submitted DAG language regarding source-selection criteria
- Presentation at Oct 07 NDIA Systems Engineering Conference
- **Action completion is overdue (2007) due to M&S Cell resource constraints**

**Next steps:**

- Further refinement and vetting of proposed guidance
- Synthesize best language & submit to DAG (update), SEP Preparation Guide, and Contracting for Systems Engineering Guidebook

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

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1-6. Ensure practical guidelines for information assurance certification and accreditation of M&S federated networks falling under multiple Designated Accreditation Authorities (DAAs)

**Lead:** OASD(NII); **Support:** OUSD(AT&L)/DS(SSE), OUSD(I), NSA

**Products:** Proven, practical guidelines published in DAG and DoD 8500.2-H, per DoDI 8500.2 "Information Assurance Implementation," Feb 6, 2003

**Completion goal:** 2007

- **NII has published DoDI 8500.2, but AMSWG questions adequacy**
- **AMSWG-NII discussions held in 2007; NAVAIR procedures identified as a candidate to provide the additional specificity needed**
- **Awaiting delivery of NAVAIR procedures for (a) NII evaluation of compliance with 8500.2. (b) NII evaluation of suitability for revising 8500.2, and (c) AMSWG evaluation of suitability for inclusion in DAG**

### **Next steps:**

- **Follow-up with NAVAIR to ensure submission of their procedures**
- **Conduct three evaluations mentioned above**
- **Draft, vet, and submit DAG language**

## **Objective 2: Enhance the Technical Framework for M&S**

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2-1. Develop a product development information metamodel & associated metadata extensions to the DoD Discovery Metadata Specification

**Lead:** OUSD(AT&L)/DS(SSE); **Support:** OASD(NII), Components

**Products:** Revised DDMS; revised guidance in DAG.

**Completion goal:** 2008

- JSF has developed a metamodel specification and provided it to M&S CO
- We requested, and M&S CO provided, Scudder assistance to work with JSF to evolve/refine its metamodel
- Working group has decided key issues and expects to publish a revised version shortly

### **Next steps:**

- JSF to complete revised metadata specification
- Coordinate with M&S CO to vet more broadly (likely PA&E interest) and make this a DoD or (preferably) commercial standard
- Submit into DoD Standardization Program process

## Objective 2: Enhance the Technical Framework for M&S

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2-2. Support development of open commercial and non-proprietary standards for (model-based) systems engineering, such as OMG's Systems Modeling Language (SysML) and ISO Standard 10303 AP-233

**Co-leads:** OUSD(AT&L)/DS(SSE); DoD CIO **Support:** OASD(NII), DLA, OUSD(AT&L), **Products:** Standards suitable for use by DoD

- Action is complete for SysML and AP-233, but DoD awareness is lacking
- SysML v1.0 issued as an "available standard;" v 1.1 minor revision late 2008
- Increasing usage & teaching of SysML; major subject at INCOSE, NDIA
- Navy M&S Standards Steering Group has proposed SysML as a standard
- AP-233 SE data interchange standards being released incrementally
- COTS System Engineering tools are incorporating SysML and AP-233
- Nothing yet submitted to DoD Standardization Program and DISR

### Next steps:

- Track SysML and AP-233 implementations, publicize results
- Investigate DoD Standardization Program process; submit SysML and AP-233
- Identify any needs for additional standards

## Objective 2: Enhance the Technical Framework for M&S

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2-3. Establish a forum to clarify the characteristics and application of various distributed simulation standards (ALSP, DIS, HLA, SI3, TENA, etc.) and examine opportunities for convergence

**Lead:** OUSD(AT&L) **Support:** OUSD(AT&L)/TRMC & DS(SSE), 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

- **M&S SC-funded LVC Architecture Roadmap in 2007, due out late 2008**
- **SE Forum is interested, has taken one briefing**
- **M&S Cell (Hollenbach) participating in this project, tracking progress and coordinating related M&S SC actions (HLA Way Ahead)**

### Next steps:

- **Continue to participate; await final report**
- **Help shape M&S SC response**



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

2-4. Improve the utility of the DoD Architecture Framework (DoDAF) for acquisition

2-4(a) ~~Develop Systems Engineering 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~~

2-4(b) Support development of open commercial standards for the depiction and interchange of DoDAF-compliant architectures

Lead: OASD(NII) Support: OUSD(AT&L)/DS(SSE)

Products: Published standards suitable for adoption by DoD in DoDAF 2.0; revised guidance in DAG

Completion goal: 2007

- 2-4(a): DoDAF Overlay concept has been dropped, so this action is OBE
- 2-4(b): OMG's UPDM (UML Profile for DoDAF/MODAF) nearly finalized, NII has embraced UPDM as an element of DoDAF 2.0 development
- SE Forum considering the value and impact of DoDAF
- ASD(NII) is attempting to make DoDAF v2.0 more useful for acquisition
- Acquisition Community participation in DoDAF WG curtailed

Next steps:

- Increase involvement in DoDAF WG
- Submit UPDM to DoD Standardization Program / DISR Online
- Advocate use of UPDM for architecture data exchange

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

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2-5. Establish a standard template of key characteristics (metadata) to describe (**discover**) reusable M&S resources

**Lead:** OUSD(AT&L) **Support:** OUSD(AT&L)/DS(**SSE**) & TRMC, OASD(NII), ODOT&E, Components

**Products:** Published standard template; usage guidance in DAG

**Completion goal:** 2007

- **M&S CO M&S COI Discovery Metadata project addresses this**
- **M&S Cell has coordinated with M&S CO to ensure no cross-threads with Action 2-1 (Product Development Metadata Specification)**
- **Version 1.0 published, being evaluated by users (e.g., MSRR, JDS, JRSG) who are providing feedback to refine it**

**Next steps:**

- **Draft, vet and submit DAG entry when final product is available**

# Objective 3: Improve Model & Simulation Capabilities

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3-1. Establish a process to ensure acquisition needs are reflected in DoD M&S priorities

**Lead:** OUSD(AT&L) **Support:** OUSD(AT&L)/DS(SSE), ODOT&E, DOD CIO, Components

**Products:** A method to capture and prioritize acquisition needs.

**Completion goal:** 2007

- **AMSWG has successfully obtained M&S SC funding for several projects**
- **AMSWG has started an effort to pursue SBIR opportunities**
- **AMSWG till does not have an effective voice in other venues that affect M&S capability, such as other S&T and DARPA**

**Next steps:**

- **Continue to pursue M&S SC and SBIR funding opportunities**
- **Investigate DoD S&T planning process to identify entry points**
- **Build list of acquisition M&S S&T needs**

## Objective 3: Improve Model & Simulation Capabilities

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3-2. 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); **Support:** OUSD(AT&L)/DS(SSE), ODOT&E, DOD CIO, Components

**Products:** Best practices publication, available via MSIAC, DTIC, etc.; DAG guidance to use

**Completion goal:** 2008

- **Have obtained OSD study funds for the definition portion of this task**
- **SOW written**
- **Contracting with JHU APL to develop this best practice**

**Next steps:**

- **Assess JHU APL deliverable**
- **Foster its use (via Action 5-4)**

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

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3-3. Enable readily-available distributed live-virtual-constructive environments, leveraging related initiatives

3-3(a) Establish DoD-wide standards for distributed environments

**Lead:** OUSD(AT&L); **Support:** OUSD(AT&L)/TRMC & DS(SSE); ODOT&E; DOD CIO, Components

**Products:** Published standard; DODI (# TBD) policy to use

**Completion goal:** 2008

3-3(b) Make candidate simulations, labs and ranges compliant with these standards

**Lead:** Components; **Support:** OUSD(AT&L)/DS(SSE) & TRMC, ODOT&E

**Products:** A larger collection of simulations, labs, and ranges ready to be employed in distributed events

**Completion goal:** 2010

3-3(c) Ensure availability of services to help plan and conduct events

**Lead:** Components; **Support:** OUSD(AT&L), OUSD(AT&L)/TRMC, DISA

**Products:** Fee-based technical services to help users (e.g., PMs, Capability Managers, OTAs) plan and conduct distributed events

**Completion goal:** 2009

- **LVC Architecture Roadmap and JFCOM Joint Composable Object Model projects underway**
- **Virtual Battlespace Center Defense Science Board Task Force in work**
- **No funding yet available to do the rest**

**Next steps:**

- **Await LVC Architecture Roadmap, support implementation as appropriate**
- **Pursue POM initiative**

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

3-4. Centrally fund and manage the development of high-priority, broadly-needed M&S tools

3-4(a) Identify and prioritize broadly-needed M&S tools

**Lead:** OUSD(AT&L); **Support:** OUSD(AT&L)/(SSE); ODOT&E, DOD CIO, Components

**Products:** Prioritized list of common M&S tool needs

**Completion goal:** 2007

3-4(b) Conduct one or more pilot projects to develop new M&S tools or update existing ones to meet these needs

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

**Products:** Proof of concept for managing the development/evolution of M&S tools to meet broadly-shared needs

**Completion goal:** 2008

3-4(c) 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); **Support:** OUSD(AT&L)/DS(SSE), ODOT&E, Components

**Products:** Capability to provide broadly-needed M&S tools in a more responsive and cost-effective way.

**Completion goal:** 2011

- **AMSWG submitted 3-4(b) pilot proposal to M&S SC, but it wasn't funded**
- **Funding obtained to have JHU APL identify best practices for managing broadly needed M&S tools and recommend DoD actions**

**Next steps:**

- **Assess JHU APL deliverables, pursue actions as appropriate**

## Objective 4: Improve Model & Simulation Use

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4-1. 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); **Support:** OUSD(AT&L)/DS(SSE)

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

**Completion goal:** 2008

- Revised guidance submitted to DAG
- SSE M&S Cell assisting as able, but resource limited, not widely advertised
- Navy coming on line, but no action from other Components
- 5-1 Education project Identified M&S Bodies of Knowledge that offer useful information

### Next steps:

- Advertise and expand assist visits. SSE has made this a 2008 priority.
- Based on our experience, promote similar efforts by other Components
- Improve MSIAC expertise regarding M&S in acquisition (Action 5-5)

## Objective 4: Improve Model & Simulation Use

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### 4-2. Define and disseminate best practices for disciplined M&S planning & employment

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

**Product:** Revised best practices guidance in DAG and MSIAC

**Completion goal:** 2007

- High-level discussion included in “M&S for Systems Engineering” CLM
- Expanded discussion submitted in recent DAG revision
- M&S Planning and Employment Best Practices solicitation completed Apr 07
- NAVAIR M&S Enterprise is developing recommendations
- **Action completion is overdue (2007) due to M&S Cell resource constraints**

#### Next steps:

- **Continue working with NAVAIR M&S Enterprise to develop guidance**
- **Synthesize best practice, conduct AMSWG & NDIA reviews**



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

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### 4-3. Facilitate the sharing of reusable resources

4-3(a) Establish a DoD-wide business model for compensating providers of reusable M&S resources (e.g., information, software, services)

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

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

**Completion goal:** 2007

- **M&S SC-funded M&S Resource Reuse Business Model study underway, will report out late 2008**
- **Study will identify key issues and recommend significant changes**
- **LVCAR will also address business model issues**
- **An effective business model is not yet established**

#### Next steps:

- **No further action needed yet; awaiting study outcome**
- **LVC Architecture Roadmap may have an impact**
- **Take action to implement study & LVCAR recommendations as appropriate**

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

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### 4-3. Facilitate the sharing of reusable resources

4-3(b) Establish DoD policy and/or guidance regarding responsibilities to share, protect and properly use M&S information, tools, and data

**Co-Leads:** OASD(NII), OUSD(AT&L), USD(I); **Support:** OUSD(AT&L)/DS(SSE) & 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:** 2008

- **Drafted and submitted DAG language, but not yet included in DAG**
- **M&S Resource Reuse Business Model project may make recommendations on this subject**

#### Next steps:

- **Receive Business Model study report, take action as appropriate**
- **Draft language for contracting guide**
- **(DODI 5000.2 change may not be needed)**

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

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### 4-3. Facilitate the sharing of reusable resources

4-3(c) Enhance the means (e.g., directory service, registries, bulletin boards) to discover the existence of reusable resources required for M&S and contact information

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

**Product:** A better way to discover reusable resources. Re-orientation and integration of various DoD M&S resources repositories.

**Completion goal:** 2007

- **DDR&E-directed M&S CO project to develop a “M&S Resource Catalog” is underway**
- **We see a viable business model as a prerequisite**

**Next steps:**

- **Track M&S CO project, support as able**

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

4-4. Define the types of information DoD organizations shall make available to others with a clearance and valid need to know and the processes to obtain them (per reuse business model). The process to obtain information should include an efficient mechanism for industry to request government data with specific "need to know" outside a specific contract environment.

### 4-4(a) Scenario data

**Lead:** OUSD(AT&L) **Support:** OCJCS(J8), OUSD(C)/PA&E, DIA, Components

**Product:** Approved scenarios and process to obtain

**Completion goal:** 2007

### 4-4(b) System-related data

**Lead:** OUSD(AT&L)/DS(SSE); **Support:** ODOT&E, Components

**Product:** Process to obtain authoritative system data (characteristics and performance, interactions, interfaces, logistic support, etc.) documented in the DAG and appropriate OASD (NII) policy documents.

**Completion goal:** 2008

### 4-4(c) Threat data

**Lead:** DIA; **Support:** OUSD(AT&L); OUSD(AT&L)/DS(SSE), ODOT&E, and Components

**Product:** Authoritative threat data and process to obtain

**Completion goal:** 2007

### 4-4(d) Natural environment data

**Lead:** DoD Natural Environment MSEAs (MSCAs); **Support:** OUSD(AT&L), OUSD(AT&L)/DS(SSE), Components

**Product:** Authoritative natural environment data and process to obtain

**Completion goal:** 2007

# Action 4-4 Assessment

- Acquisition Support Division of DIA has briefed AMSWG and NDIA M&S Cmte on its support to acquisition programs
- MSIC has briefed NDIA M&S Cmte on TMAP program and provided instructions on how to request TMAP models
- Draft DAG language discusses threat data sources and traceability
- No method exists “for industry to request government data with specific ‘need to know’ outside a specific contract environment”
- M&S SC-funded Environmental Scenario Generator project underway
- **No progress in sharing U.S. system data**
- Joint Rapid Scenario Generation (JRSG) and Joint Data Alternatives (JDA) projects advertise they will address all the Action 4-4 info needs; time will tell

## Next steps:

- Monitor JRSG and JDA projects as resources permit
- Investigate data sharing policies of OSD, JCS, and other Components
- Investigate JSC, PAE, & Service scenario data availability & access
- Draft additional DAG language on all data types (interim prior to JRSG /JDA)
- Continue to build on Nov 07 PA&E-Boeing-NDIA M&S Cmte discussion
- Examine benefits of establishing a DoD Virtual Battlespace Center

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

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### 4-5. Foster cost-effective VV&A

**4-5(a)** Require DoD-wide standardized documentation of VV&A

**Lead:** OUSD(AT&L); **Support:** OUSD(AT&L)/DS(SSE), ODOT&E, Components

**Products:** Revised policy in DODI 5000.2 and 5000.61; revised guidance in DAG

**Completion goal:** 2007

- **AMSWG-sponsored, M&S CO-funded project completed**
- **Documentation has been established as a MILSPEC 3022; commercial (SISO) standard to follow**
- **Tool to manage documentation is in beta testing**
- **AMSWG concern that draft M&S SC's "DoD M&S Strategic Vision" call for "practical verification, validation, and accreditation guidelines that vary by application area" (emphasis added) will undermine VV&A.**
- **PA&E resisting this requirement in DoDI 5000.61 revision**

#### Next steps:

- **Publicize standard and supporting tool**
- **Fight to have DoDI 5000.61 to maintain a consistent DoD policy and require documentation per MILSPEC**
- **Establish a commercial standard under SISO**

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

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### 4-5. Foster cost-effective VV&A

**4-5(b)** Develop risk-based methodology and associated guidelines for VV&A expenditures

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

**Products:** Updated DoDI 5000.61; revised policy and guidance in DoDI 5000.2 and DAG

**Completion goal:** 2007

- **M&S CO project underway, with promise it will address this issue**
- **NAVAIR M&S Enterprise developing M&S VV&A and risk management guidance**

#### Next steps:

- **Assess M&S Enterprise guidance**
- **Obtain update on M&S CO progress developing risk-based VV&A guidelines, support and take action as necessary**

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

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### 4-5. Foster cost-effective VV&A

**4-5(c)** 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(SSE) **Support:** DoD Components

**Products:** Guidance & training for oversight personnel; updates to DAG Chaps 4, 9

**Completion goal:** 2007

- Submitted DAG language on VV&A examination, but DAG update stalled
- SSE M&S Cell has given initial briefing to OUSD(A&T)/SSE/AS
- Navy may be addressing this; no other Component activities underway

#### Next steps:

- Broaden teaching on VV&A examination
- M&S Cell support SSE/AS to accomplish this during OSD program reviews
- Other AMSWG members take action within their Components



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

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4-6. Assess the use of COTS systems engineering tools (modeling environments) for collaborative architecture development

**Lead:** OUSD(AT&L)/DS(SSE); **Support:** OASD(NII), Components

**Products:** Revised guidance in DAG; enhanced M&S body of knowledge for dissemination

**Completion goal:** 2007

- **SysML and AP-233 already proving utility in COTS tools (market success)**
- **UPDM nearing finalization, can help with CADM and DARS weaknesses**
- **NIST “Systems Engineering Tool Interoperability Plug-fest” underway**
- **No inter-program use of COTS tools for architecture development thus far**

**Next steps:**

- **Investigate use of SE tools for collaborative architecture development**
- **Propose as a SBIR topic**

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

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### 4-7. Define and capture meaningful metrics for M&S utility in acquisition

**Co-Leads:** OUSD(AT&L), Dept. of the Navy **Support:** OUSD(AT&L)/DS(SSE),  
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

- One of the top 5 acquisition M&S projects for M&S SC FY08 funding, but didn't make the cut
- Aegis Technologies conducted a study for M&S CO, but results not yet released

#### Next steps:

- Assess adequacy of M&S CO/AEgis Technologies' product
- Take further action as appropriate

# Objective 5: Shape the Workforce

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## 5-1. Define required M&S competencies for the acquisition workforce

**Co-Leads:** DAU and OUSD(AT&L)/DS(SSE); **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

- “Educating the M&S Workforce” project underway with Navy and M&S SC funding
- Academic institutions have begun to leverage this work
- Participated in beta version of GMU course “M&S in Acquisition Lifecycle”

### Next steps:

- Receive final deliverables from M&S SC-funded project
- Monitor and assess effectiveness of emerging courses (e.g., GMU)
- Otherwise support implementation as appropriate

## Objective 5: Shape the Workforce

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5-2. Harvest lessons from commercial sector activities in the use of M&S to support product development

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

**Products:** Annual update to best practices in DAG and lessons from industry that should be considered by PMs in planning for M&S

**Completion goal:** Recurring; initial in 2007

- SSE participating in conferences, workshops, and literature review involving commercial industry use of M&S, capturing relevant points
- Increasing industry adoption of “Simulation-Based Design (SBD)”
- Action complete, but follow-on expansion needed

**Next steps:**

- Collect and consolidate findings, feed into Action 5-3 BoK
- Submit as SBIR topic

## Objective 5: Shape the Workforce

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5-3. Assemble and evolve the M&S Body of Knowledge (information set) relevant to acquisition

**Lead:** OUSD(AT&L); **Support:** OUSD(AT&L)/DS(SSE), 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 2006

- Action completed in 2007 as part of ongoing education project
- Several BoKs have been discovered
- Education project has synthesized a consolidated BoK, as has SimSummit
- Knowledge is still being developed (e.g., best practices)

**Next steps:**

- Harmonize with SimSummit BoK?
- Establish an effective configuration management process
- Make additional inputs as they are discovered or become available

## Obj. 5: Shape the Workforce (cont.)

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5-4. Educate and train the workforce to achieve required M&S competencies

5-4(a) 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), OUSD(AT&L)/DS(SSE), 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

- CLM on “M&S for Systems Engineering” released, has >3900 graduates
- CLM on “M&S for Test & Evaluation” released, has >1600 graduates
- Universities and NPS are responding to “Educating the Workforce” findings and recommendations
- No change to DAU courses so far, but education project will be a catalyst

Next steps:

- Participate in prototype GMU course “M&S in the Acqn Lifecycle”
- Implement additional CLMs (Education Project expects to recommend ~10) as feasible
- Investigate status of DAG inputs

## Obj. 5: Shape the Workforce (cont.)

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5-4. Educate and train the workforce to achieve required M&S competencies

5-4(b) Provide M&S knowledge via conferences, workshops, and assist visits

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

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

**Completion goal:** Recurring; initial in 2006

- **Initial Outreach Plan approved by AMSWG; includes M&S tutorial for AS staff, DMSC, NDIA, and SISO presentations**
- **Add'l materials (e.g., best practices) in work**
- **Resource constrained**

**Next steps:**

- **Advertise and expand assist visits**
- **Hold workshops once recommended practices are in hand**

## Obj. 5: Shape the Workforce (cont.)

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5-5. Improve the knowledge and expertise available through the MSIAC to make it of greater utility to the acquisition community

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

- Only preliminary conversations with MSIAC contractor thus far
- No plan of action by MSIAC; they want AMSWG to tell them what to do

**Next steps:**

- Develop a plan of action to improve the M&S Information Analysis Center's usefulness to the acquisition community



# Backup Material

# AMSWG Membership (1 of 2)

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<b>Organization</b>	<b>SE Forum Principal</b>	<b>Organization</b>	<b>AMSWG Member</b>
ODUSD (A&T) SSE	Ms. Kristin Baldwin, Chair	ODUSD (A&T) SSE/DT&E	Michael Truelove
Army	Mr. Doug Wiltsie	ASA(ALT)	John Gillis
Navy	Mr. Carl Siel	ASN(RDA) CHENG MARCORSYSCOM	Bill Zimmerman Lan-Thanh McGough
Air Force	Mr. Terry Jagers	SAF/AQR	Maj Carol Beverly
Joint Staff J-8	Mr. Rick Westermeyer	JTAMDO	Jim Gill
PA&E		CAIG	
DOT&E	Dr. Ernest Seglie	DOT&E	Bob Butterworth
OSD (AT&L) DDR&E		M&S CO	Jim Anthony
OSD (AT&L) AR&A	Mr. Phil Rodgers		
USJFCOM	Mr. Steve Derganc		
USD(P&R)(R&T)/JAEC		R&T/JAEC	Bob Halayko
OUSD(AT&L)(TRMC)		TRMC	George Rumford
DAU	Dr. Jim McMichael	DAU SE	George Prosnik
MDA	Mr. Dennis Mays		

# AMSWG Membership (2 of 2)

Organization	SE Forum Principal	Organization	AMSWG Member
NGA	Dr. Tom Holzer	NGA	(John Placanica-Inact)
NASA	Mr. Stephen Kapurch	NASA/ESMD	(Mark Prill-Inact)
NSA	Mr. Kelly Miller	NSA	Craig Holcomb
DCMA	Ms Rebecca Davies	DCMA	Larry Cianciolo
SOCOM	Dr. Dale Uhler	SOCOM	Art Gibson
NII	Mr. Mike Kern	ASD (NII) Acq.	Bill May
OSD (AT&L)L&MR		NSWC/CSS	(Marc Eadie-Inact)
OSD (AT&L) DP&AP	Shay Assad		
DISA	Mr. Gerald Doyle		
NSSO	Mr. Jay Parness		
NRO	Mr. Vernon Grapes		
DLA	Mr. David Falvey		
NDIA	Mr. Bob Rassa	NDIA M&S Com.	Jim Hollenbach
INCOSE	Mr. David Walden		

# A Decade of Studies on M&S Support to Acquisition

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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

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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)

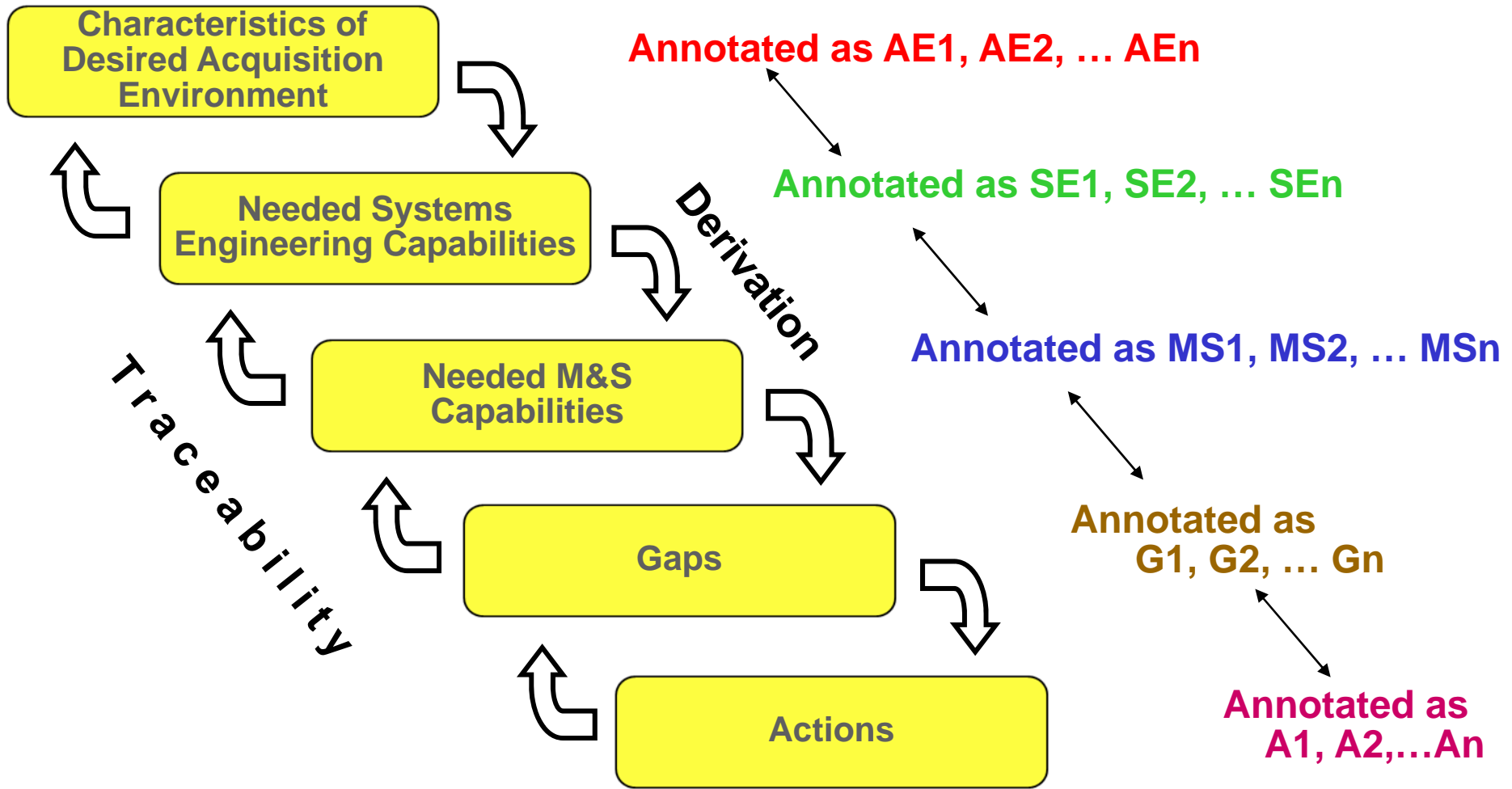
# Assessment of Current Issues/Needs

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- ❑ 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

# Top-Down Derivation/Traceability to Non-M&S Needs

CJCSI 3170 & DoDD 5000.1



# Desired Acquisition Environment: Key CJSCI 3170.01E Policies

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

<sup>AE11</sup>



# Desired Acquisition Environment: DoDD 5000.1 Acquisition Policies

“The primary objective of Defense acquisition is to acquire <sup>AE12</sup> quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a <sup>AE13</sup> timely manner, and at a <sup>AE14</sup> fair and reasonable price.” <sup>AE15</sup>

Governing policies:

- Flexibility, <sup>AE16</sup> Responsiveness (time-phased capabilities, evolutionary acquisition), Innovation, <sup>AE17</sup> Discipline, Streamlined Effective Management
- Armaments Cooperation; <sup>AE18</sup> Collaboration; Competition; <sup>AE19</sup> Cost and Affordability; Cost Realism; Cost Sharing; Financial Management; Independent OTAs; Information Assurance; Information Superiority;
- <sup>AE20</sup> Integrated T&E; Intelligence Support; <sup>AE21</sup> Interoperability; <sup>AE22</sup> Knowledge-Based Acquisition; Legal Compliance; Performance-Based Acquisition;
- <sup>AE23</sup> Performance-Based Logistics; Products Services and Technologies [seek <sup>AE24</sup> 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; <sup>AE25</sup> Systems Engineering;
- <sup>AE26</sup> Technology Development and Transition; Total Systems Approach <sup>AE27</sup>
- Oct 04 policy memo: Technical reviews ... shall be event-driven <sup>AE28</sup>

# 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)

# Needed M&S Capabilities (1 of 2)

(derived from Needed Systems Engineering Capabilities)

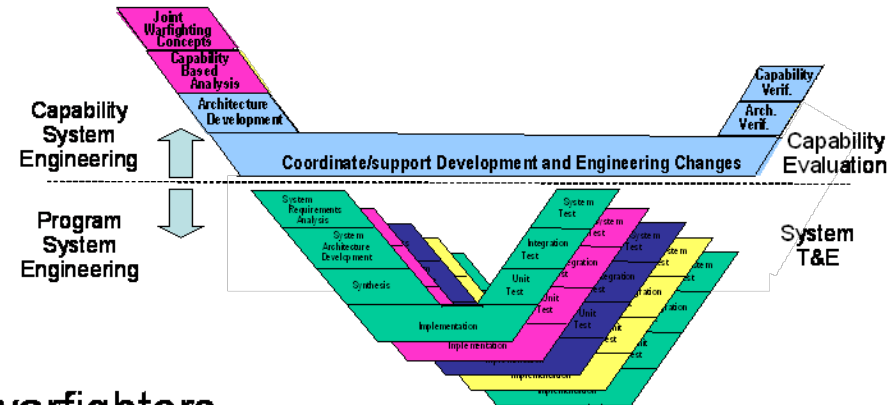
## MS1. Model-based systems engineering/design (SE1,2,4,5)

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

- Modeling environments to analyze requirements, develop system and software architectures, and perform detailed design (e.g. CAD, S/W)

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

- Interoperable M&S, data management, & manufacturing
  - M&S as a communication means
- Full range of M&S assessments
  - Models, simulations, and distributed live-virtual-constructive simulation federations, with option to immerse warfighters
- Traceability for coherence and decision analysis



## 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

## Needed M&S Capabilities (2 of 2)

- MS4.** M&S knowledge to formulate an effective acquisition strategy (SE2,3,4,5,7)
  - Ready access to M&S expertise and information about capabilities and gaps, 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 to 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.

# 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)

# 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)

# 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)

# 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)



# 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]**

# 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)

# 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)