

## Modeling and Simulation Syllabus

- 1) **Course name:** M&S in the Acquisition Process, Part 1
- 2) **Course coordinator / point of contact and contact information**  
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- 3) **Course description:** At the completion of this course, students will be able to describe the Pre-Acquisition M&S activities, and the M&S used in the initial phases of the Acquisition Life Cycle, using the progression of different modeling and simulation applications in use in each phase as a benchmark. They will be able to identify a particular tool and apply it appropriately to the correct point in the lifecycle and relate specific tools to the decision points that separate the acquisition phases. This course is presented at the application level.
- 4) **Educational Skill Requirements (ESR) that the course supports.** This course incorporates a number of ESR that will make students more proficient in the performances of their acquisition related duties and responsibilities. Students will be able to:
  - a) Describe the types, role and value of formal Modeling and Simulations, and their various characterizations for application to systems management, particularly with regard to design, testing, training, production, cost estimation, manning, and logistical simulations.
  - b) Know where to find organizational M&S resources to identify the number and types of models currently in use, best practices from case studies, where they originated, how they might be leveraged in support of an acquisition program.
  - c) Access the Modeling and Simulation Resource Repositories as a primary source for information about and access to DoD models, simulations, data sources, algorithms, and other M&S resources in order to facilitate reuse and avoid duplication.
  - d) Know the common terminology and high level roles and responsibilities, as well as the underlying philosophy, principles, and methodologies used in Verification, Validation and Accreditation (VV&A).
  - e) Understand the critical decisions in the acquisition lifecycle and how/what M&S is used to inform those decisions in order to reduce the time resources and risk associated with the acquisition process
  - f) Describe the role of modeling and simulation prior to the concept decision to identify and quantify capability gaps and to estimate how well new program concepts might address those gaps.
  - g) Know models and simulations used in a given phase of the acquisition process, their inputs and outputs, and their capabilities and limitations.
- 5) **Prerequisites:** Students should have completed ACQ 101, ACQ 201, and Essentials of Modeling and Simulation (MSCO on line orientation: <http://ems.dmsomil/>)

- 6) **Course maturity:** Development complete.
- 7) **Number of contact hours and pace contemplated** 42 contact hours, in 14 three-hour sessions
- 8) **Delivery** format is for classroom, face-to-face or VTC, presentation of course material.
- 9) **References and texts:**
- a) **Acquisition M&S Course Bibliography:**
- i) Committee on Modeling and Simulation for Defense Transformation, National Research Council. Defense Modeling, Simulation, and Analysis: Meeting the Challenge. Washington, D.C.: The National Academies Press, 2006.
  - ii) Committee on Modeling and Simulation Enhancements for 21<sup>st</sup> Century Manufacturing and Defense Acquisition, National Research Council. Modeling and Simulation in Manufacturing and Defense Acquisition: Pathways to Success. Washington, D.C.: The National Academies Press, 2002.
  - iii) Computer Science and Telecommunications Board. Modeling and Simulation: Linking Entertainment and Defense. Washington, D.C.: The National Academies Press, 1997.
  - iv) Department of Defense, Under Secretary of Defense for Acquisition, Technology, Deputy Director Test Systems Engineering and Evaluations, Study on the Effectiveness of Modeling and Simulation in the Weapon System Acquisition Process, Washington, DC, October 1996.
  - v) Johnson, Michael V.R., McKeon, Mark F., and Szanto, Terrence R. Simulation Based Acquisition: A New Approach. Fort Belvoir, VA: Defense Systems Management College Press, 1998.
  - vi) Modeling and Simulation Committee Study Task Report, National Defense Industrial Association, Systems Engineering Division. M&S Support to the New DoD Acquisition Process. Washington, D.C.: National Defense Industrial Association. February 2004
  - vii) NASA, Mars Climate Orbiter Mishap Investigation Board, Phase I Report, November 10, 1999
  - viii) Sabbagh, Karl. Twenty-First-Century Jet: The Making and Marketing of the Boeing 777. New York: Scribner. 1996.

- ix) Schrage, Michael. Serious Play: How the World's Best Companies Simulate to Innovate. Boston: Harvard Business School Press. 2000.

**b) Publications and Regulations**

- i) DoD Directive 5000.01, Defense Acquisition System, 12 May 2003
- ii) DoD Instruction 5000.02, Operation of the Defense Acquisition System, 2 Dec 2008
- iii) DoD Directive 5000.59, DoD Modeling and Simulation (M&S) Management, 8 August 2007
- iv) DoD 5000.59M, DoD Modeling and Simulation (M&S) Glossary, January 1998
- v) DoD Instruction 5000.61, DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A), 13 May 2003
- vi) Defense Acquisition Guidebook, Version 1.0, 17 October 2004
- vii) DoD Acquisition Modeling and Simulation Master Plan (AMSMP), 17 April, 2006
- viii) Verification, Validation and Accreditation (VV&A) Recommended Practices Guide – RPG Build 3.0, September 2006. <http://vva.dmsso.mil/>
- ix) MIL-STD-3022, Department Of Defense Standard Practice, Documentation Of Verification, Validation, and Accreditation (VV&A) For Models And Simulations, 28 January 2008
- x) Strategic Plan for Transforming DoD Training, Office of the Under Secretary of Defense for Personnel and Readiness Director, Readiness and Training Policy and Programs, 1 March 2002

**c) Joint Chiefs**

- i) CJCSI 3137.01C, The Functional Capabilities Board Process, 12 November 2004, Current as of 7 November 2007
- ii) CJCSI 3170.01G, Joint Capabilities Integration and Development System, 1 Mar 2009
- iii) CJCSM 3170.01C, Operation of the Joint Capabilities Integration and Development system, 1 May 2007

- iv) Capabilities-Based Assessment (CBA) User's Guide, Version 2, Force Structure, Resources, and Assessments Directorate, JCS J-8, December 2006

**d) Services**

- i) AR 70-1, Army Acquisition Policy, 31 December 2003
- ii) AR 5-11, Management of Army Models & Simulations, 1 February 2005
- iii) DA PAM 5-11, Verification, Validation and Accreditation of Army Models and Simulations, 30 September 1999
- iv) DA PAM 5-12, Simulation Support Planning and Plans, 2 March 2005
- v) DA Pam 70-3, Army Acquisition Procedures, 28 January 2008
- vi) SECNAVINST 5000.2C, [Operation of the Defense Acquisition System], 19 November 2004
- vii) SECNAVINST 5200.38A, Department Of The Navy Modeling And Simulation Program, 28 February 2002
- viii) SECNAVINST 5200.40 VV&A, 19 April 1999
- ix) OPNAVINST 5200.34, Navy Modeling and Simulation (M&S) Management, 28 May 2002
- x) DON M&S VV&A Implementation Handbook, Volume I VV&A Framework, 30 March 2004
- xi) AFPD 63-1 Capabilities-Based Acquisition System, 10 July 2003
- xii) AFI 63-101, Operations Of Capabilities Based Acquisition System, 29 July 2005
- xiii) AFPD 16-10 Modeling And Simulation (M&S) Management, 30 January 1995
- xiv) AFI 16-1001, Verification, Validation and Accreditation (VV&A), 1 June 1996
- xv) AFI 16-1002, Modeling and Simulation (M&S) Support to Acquisition, 1 June 2000

xvi) Department of Defense Acquisition Modeling and Simulation Master Plan, 17 April, 2006

### 10) Course learning objectives:

- a) Identify Basic M&S definitions and concepts
- b) Describe the DoD philosophy of M&S reuse.
- c) Identify the DoD and service M&S structure and organizations
- d) Describe the DoD vision for use of M&S.
- e) Describe the role of the M&S Information Analysis Center (MSIAC).
- f) Describe the purpose of the MSRRs.
- g) Identify other M&S resources.
- h) Describe the JCIDS process prior to the Material Development Decision.
- i) Identify the three types of Functional Analyses.
- j) Describe how M&S is used in each level of Functional Analysis.
- k) Identify the components of DOTMLPF
- l) Describe how M&S is used for DOTMLPF determinations.
- m) Describe primary and secondary types of M&S functions that support the Materiel Development Decision (MDD).
- n) Identify the intended use of each type of M&S supporting the MDD.
- o) Identify representative examples of each type of M&S supporting the MDD.
- p) List the inputs, outputs, capabilities and limitations of each example M&S.
- q) Define the terms “verification,” “validation,” and “accreditation.”
- r) Describe the purpose and expectations of VV&A.
- s) Identify the VV&A key players.
- t) List pertinent VV&A references for DOD and representative services.
- u) Describe the VV&A key players roles and responsibilities.
- v) Identify the documentation required in the VV&A process.
- w) Identify the four categories of VV&A techniques.
- x) Identify the principal M&S applications used during Materiel Solution Analysis.
- y) Describe representative examples of M&S used for each type of application.
- z) List the inputs, outputs, capabilities and limitations of each example M&S.
- aa) Describe primary and secondary types of M&S functions that support MS A.
- bb) Identify the intended use of each type of M&S supporting MS A.
- cc) Identify representative examples of each type of M&S supporting MS A.
- dd) Identify the principal M&S applications used during Technology Development.
- ee) Describe representative examples of M&S used for each type of application.
- ff) List the inputs, outputs, capabilities and limitations of each example M&S.
- gg) Describe primary and secondary types of M&S functions that support MS B.
- hh) Identify the intended use of each type of M&S supporting MS B.
- ii) Identify representative examples of each type of M&S supporting MS B.
- jj) Identify the principal M&S applications used during Integrated System Design.
- kk) Describe representative examples of M&S used for each type of application.
- ll) List the inputs, outputs, capabilities and limitations of each example M&S.

- mm) Describe primary and secondary types of M&S functions that support the Design Review Assessments (P/CDR-A).
- nn) Identify the intended use of each type of M&S supporting the P/CDR-A.
- oo) Identify representative examples of each type of M&S supporting the P/CDR-A.

**11) Course assessment plan:** Examination, quiz, and research paper and presentation.

**12) Topic list by hour of instruction and reference.**

- i) Lesson one: Introduction and M&S Basics
  - (1) Hour one: Overview, Orientation, and EMS Review (course notes and syllabus)
  - (2) Hour two: M&S Basics (course notes, DoD 5000.59M, DoDI 5000.61)
  - (3) Hour three: M&S Basics continued (course notes, DoD 5000.59M, DoDI 5000.61)
- ii) Lesson two: M&S Historical Perspectives
  - (1) Hour one: Historical Perspectives, Antiquity to the Modern Era (course notes and syllabus)
  - (2) Hour two: Historical Perspectives, Recent Advances (course notes and syllabus)
  - (3) Hour three: Mini case (course notes, DoD 5000.59M, DoDI 5000.61)
- iii) Lesson three: M&S Organization and Services
  - (1) Hour one: M&S Structure (DoDD 5000.59, AMSMP)
  - (2) Hour two: M&S Services (AMSMP, course notes)
  - (3) Hour three: Quiz number one (course notes and syllabus)
- iv) Lesson four: The Requirements Process and Entry into the DoD Acquisition Process
  - (1) Hour one: Functional Analyses and DOTMLPF considerations (CJCSI 3170.01G, DoDI 5000.02, Defense Acquisition Guidebook ,course notes)
  - (2) Hour two: M&S in Support of the Materiel Development Decision (CJCSI 3137.01C, CJCSI 3170.01G, CBA User's Guide, DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (3) Hour three: Practical Exercise number one
- v) Lesson five: Verification, Validation, and Accreditation
  - (1) Hour one: VV&A (DoDI 5000.61, MIL-STD-3022, VV&A RPG, course notes)
  - (2) Hour two: VV&A Roles, Responsibilities, and Documentation (DoDI 5000.61, MIL-STD-3022, VV&A RPG, course notes)
  - (3) Hour three: Mini Case: Mars Climate Orbiter
- vi) Lesson six: B777 Case Study
  - (1) Hour one: Case Lecture (course notes, Study on the Effectiveness of Modeling and Simulation in the Weapon System Acquisition Process, Sabbagh, and syllabus)
  - (2) Hour two: Student Activity (course notes and syllabus)
  - (3) Hour three: Student Presentations (course notes, DoD 5000.59M, DoDI 5000.61)

- vii) Lesson seven: Materiel Solution Process
  - (1) Hour one: Analysis of Alternatives (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (2) Hour two: M&S Applications Supporting Milestone A (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (3) Hour three: Quiz number two (course notes and syllabus)
- viii) Lesson eight: Practical application (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (1) Hour one: Practical Exercise overview (course notes and syllabus)
  - (2) Hour two: Student Activity (course notes and syllabus)
  - (3) Hour three: Student Presentations (course notes, DoD 5000.59M, DoDI 5000.61)
- ix) Lesson nine: Technology Development
  - (1) Hour one: M&S in Technology Development (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (2) Hour two: M&S in Technology Development: HSI (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (3) Hour three: M&S in Technology Development: Design and Analysis tools (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
- x) Lesson ten: Individual Topic Review and Independent Research
  - (1) Hour one: Office hours and library research
  - (2) Hour two: Office hours and library research
  - (3) Hour three: Office hours and library research
- xi) Lesson eleven: M&S Structure (DoDD 5000.59, AMSMP)
  - (1) Hour one: M&S in support of the Milestone B Decision (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (2) Hour two: M&S Supporting the Preliminary Design Review Assessment Process (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (3) Hour three:
- xii) Lesson twelve: M&S Structure (DoDD 5000.59, AMSMP)
  - (1) Hour one: Student Paper Presentations
  - (2) Hour two: Student Paper Presentations
  - (3) Hour three: Student Paper Presentations
- xiii) Lesson thirteen: M&S Structure (DoDD 5000.59, AMSMP)
  - (1) Hour one: M&S in EMD: Integrated System Design (DoDI 5000.02, Defense Acquisition Guidebook, course notes)M&S in EMD: System Capability and Manufacturing Process Demonstration (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (2) Hour two: M&S Supporting the Critical Design Review Assessment Process (DoDI 5000.02, Defense Acquisition Guidebook, course notes)
  - (3) Hour three: Course Review (course notes and syllabus)
- xiv) Lesson fourteen: Examination