**Modeling and Simulation Body of Knowledge (M&S BoK)** – **Index**

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**Professional Concerns in M&S**

**(Professionalism, Achievements, Progress, Challenges)**

**Content**

1. Three aspects of professionalism in M&S
2. Achievements
3. Progress
4. Challenges

1. **Three Aspects of Professionalism in M&S**

Three aspects of professionalism in M&S and corresponding activities/knowledge needed are depicted in Figure 1 and summarized in the following Table 1:

|  |  |  |
| --- | --- | --- |
| 1.1 Generation of ***products*** *and/or* ***services***to solve problems(Industry) | 3.1 Professional and ethical ***conduct***Both voluntary (responsibility) and required (accountability) | 1.2 Generation & dissemination of ***knowledge*** (Academia, R&D) |
|  | 2.4 Application area(s) |  |
| 2.2 Science, Engineering & Technology | 2.1 **M&S *BoK***(body of knowledge) | 2.3 Systems Engineering, (Project) Management |
|  | 2.5 Code of professional ethics |  |
| 3.2 ***Certification*** of:*- Individuals* as M&S professionals*- Companies* for their maturity levels |
| 1.3 ***Funding***(Owner(s) of the project, governmental agencies, users, interest groups) |

 Figure 1. Three Aspects of Professionalism in M&S

 (1: activites, 2: knowledge, 3: conduct and monitoring)

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Table 1: Three aspects of professionalism in M&S and corresponding activities/knowledge

|  |  |
| --- | --- |
| **Aspect** | **Activities/knowledge needed** |
| 1. **Activities**
 | 1.1 *Generation of* **products/services** *to solve problems* (Industry)1.2 *Generation & dissemination* of **knowledge:** (Academia, R&D)1.3 *Funding:* (Owner(s) of the project, governmental agencies, users, interest groups) |
| 1. **Knowledge**
 | **Knowledge to solve problems**2.1 Knowledge of the M&S Body of Knowledge  (Core Elements of M&SBoK)Knowledge of Supporting Domains: 2.2 Science, Engineering, Technology 2.3 Systems Engineering, (Project) Management2.4 Knowledge of Application Area(s)**2.5 Code of professional ethics** |
| 1. **Monitoring**
 | 3.1 Professional and ethical **conduct**  (both voluntary (responsibility) and required (accountability)* 1. **Certification** of professionalism of

3.2.1 Individuals as M&S professionals  3.2.2 Companies for their maturity levels (yet to be specified) |

Hence, a practitioner (or a member of a team) of M&S needs to know the following three types of knowledge to solve problems:

(1)  knowledge of M&S that will be referred to as the core elements of M&S BoK, i.e., Body of Knowledge of M&S;

(2)  knowledge of supporting domains such as scientific, engineering, and technological knowledge as well as systems engineering and project management knowledge; and

(3)  knowledge of the application area(s), i.e., knowledge of existing or system of interest to be

 engineered,

Furthermore, a practitioner of M&S needs to know and act according to a Code of professional ethics in his/her profession.

1. **Achievements**

 US [Congressional Caucus](http://forbes.house.gov/Biography/mscaucus.htm) for Modeling and Simulation

 US MSLS  - Modeling and Simulation Leadership Summit

 [SimSummit](http://www.sim-summit.org/Sim_Summit/default.htm%22%20%5Ct%20%22_new)

 [Professional Ethics](http://www.site.uottawa.ca/~oren/SCS_Ethics/ethics.htm) (Page at [SCS](http://www.scs.org/ethics/)), [Code of Ethics](http://scs.org/upload/SCS%20Code%20of%20Ethics1.pdf), [Rationale](http://168.143.44.55/upload/scsEthicsCodeRationale.pdf)

 [Certification Program](http://www.simprofessional.org/%22%20%5Ct%20%22_new) - for Individuals (M&S Professional Certification Program)

  Over 160 Associations / Organizations / Committees / Groups / Centers /

 Military Organizations in M&S ([List](http://www.site.uottawa.ca/~oren/links-MS-AG.htm))

1. **Ongoing Progress**

 [M&SBOK](http://www.site.uottawa.ca/~oren/MSBOK/MSBOK-index.htm%22%20%5Ct%20%22_new)

[](http://www.site.uottawa.ca/~oren/MSBOK/MSBOK-index.htm%22%20%5Ct%20%22_new) [Workforce Development](http://www.scs.org/magazines/2010-04/index_file/Files/Tucker.pdf)

 Job Categorization

 Curriculum

 Perception of M&S from a Broad Perspective (Importance of a consolidated view)

**2002**

 Amico, V. and L. Amico Grace (2002). Simulation in Search of Recognition in the Economy. Simulation. Proceedings of SCSC 2002*.*

 Ören, T.I. (2002a - Invited Plenary Paper). [Growing Importance of Modelling and Simulation: Professional and Ethical Implications](http://www.site.uottawa.ca/~oren/pubs/2002/07-Shanghai.pdf). Proceedings of the Asian Simulation Conference / the 5th International Conference on System Simulation and Scientific Computing, Cheng, Zongji et al., eds. Shanghai, China. Vol.1, pp. 22-26.

**2004**

 Amico, V. and L. Amico Grace (2004). Proposed Revisions to the NAICS Codes for    Modeling and Simulation. Modeling and Simulation,.Vol. 3, nb. 3, July-Sept., pp.6-8.

**2008**

 María Jesús de la Fuente (2008). Body of Knowledge of Modeling & Simulation (M&SBOK) [Presentation](http://www.isa.cie.uva.es/simulacion08/docencia_M%26S.ppt#256,1,Body) at the Jornadas de modelado y simulación, Jornadas de modelado y simulación, Universidad de Valladolid, 2008-12-10.

 **4. Additional Challenges**

 Mutual Feedback: M&SBOK, Curricula, Workforce Development

 Perception of M&S from a Broad Perspective

    (Importance of a consolidated view)

 Exploring the Synergy of M&S with Relevant Knowledge Processing Fields

 Importance of the Consequences of M&S Studies

 Capability Maturity Models:

* for individuals
* for industry

 M&S Process and Product Improvement

    (Similar to [software process](http://www.amazon.com/gp/product/0136266231/qid%3D1137691376/sr%3D1-3/ref%3Dsr_1_3/104-5113780-1111113?s=books&v=glance&n=283155) and product improvement)

 New Success Metrics for M&S Studies

**1999**

 Ashby, S.F. [Meeting the ASCI Challenge: Terascale Scientific Simulation](http://www.siam.org/meetings/pp99/ip1.htm).

 Panel: Strategic Directions in Simulation Research at the Winter Simulation Conference.

**2000**

 Kleijnen, J.P.C. Strategic Directions in Verifications, Validation, and Accreditation Research:

    A personal View

 Ören, T.I. et al. ([Panel](http://www.informs-sim.org/wsc00papers/241.PDF)) Agent-Directed Simulation:

    Challenges to Meet Defense and Civilian Requirements

**2001**

 Reynolds, Jr., P.F. and D. Drewry. [The Grandest Challenge in Distributed Simulation](http://csdl2.computer.org/comp/proceedings/ds-rt/2001/1348/00/13480036.pdf).

**2002**

 1st Industrial Fluid Properties Simulation Challenge

 Fujimoto, R. et al. [Grand Challenges for Modelling and Simulation](http://www.dagstuhl.de/02351/).

 Ören, T.I. (2002). [Future of Modeling and Simulation: Some Development Areas](http://www.site.uottawa.ca/~oren/pubs/pubs-2002-05-future.pdf). Proc. of the 2002 Summer Computer Simulation Conference, pp. 3-8.

**2004**

 [ICGCMS](http://www.thesimguy.com/GC/WMC02.htm%22%20%5Ct%20%22_new) 2002 - 1st International Conference on Grand Challenges for Modeling and Simulation.

 [2nd Industrial Fluid Properties Simulation Challenge](http://www.cstl.nist.gov/FluidSimulationChallenge/program2004.htm%22%20%5Ct%20%22_new)

 Ackerman, R.K. [Simulation Plots its Own Path](http://www.afcea.org/signal/articles/anmviewer.asp?a=419).

 Curatola, G., G. Fiori, G. Iannaccone. [Modelling and Simulation Challenges for Nanoscale MOFSETs in the Ballistic Limit](http://monteverdi.iet.unipi.it/~fiori/articles/sse.pdf).

 Karcanias, N. Modelling and Simulation in Technological and Emerging Fields: Emerging Challenges.

 Numrich, S.K.(Invited talk) DMSO Program Overview for MOVES Open House.

 Zeigler, B.P. [Thoughts on Strategic Directions for SCS](http://www.acims.arizona.edu/EVENTS/strategicDirectionsACIMS.pdf)

**2005**

 [Invited Talks](http://aiche.confex.com/aiche/2005/techprogram/S1339.HTM%22%20%5Ct%20%22_new): Frontiers of Molecular Simulation

 Stuckey, R.M. "Sample of Common M&S Failings" (slide 38) of  US Department of Defense Systems Engineering & Test -Progress Toward Revitalization

**2006**

 [Defense Modeling, Simulation, and Analysis: Meeting the Challenge](http://www.nap.edu/catalog/11726.html). The National Academies Press. ISBN: 0309103037