



Determinations and Findings of the
***SimSummit* Convention and Workshop**
on the
Future of the Modeling and Simulation
Profession, Industry and Marketplace

W. Waite, B Fairchild, W. Katz, and F. Lewis
SimSummit Executive Committee

INTRODUCTION

On the 18th and 19th of July 2002, a group of the most world's most significant Modeling and Simulation organizations met in convention at *SimSummit* in San Diego, California to address the future of the M&S profession, industry, and marketplace. Systematically solicited from Government, Academic and the Commercial sectors, the *SimSummit* delegates executed a structured workshop designed to explore the influence of modeling and simulation as a broadly applicable enabling technology and to consider how evolution of M&S technical infrastructure may be best influenced. This report briefly describes the organization of the *SimSummit* event, identifies its principal determinations and findings, and indicates topical activities that are consequently being pursued.

CONTEXT

SimSummit occurred because, by some accounts, simulation technology is mature and robust, but the modeling and simulation profession, industry, and marketplace are not. By executing the *SimSummit* workshop, the participants expected to build consensus on the 'way forward' for the modeling and simulation industry.

SimSummit was an unusual event – possibly unique. In fact it was, as far as we know, the first and only: *formal, public workshop; among organizations; intentionally solicited from across the entire M&S spectrum worldwide; to address the implications of emerging modeling and simulation technology.* The objective of the meeting was no less than to significantly advance the evolution of the modeling and simulation profession, industry, and market-place.

In order to appreciate the *SimSummit* debate at the broadest level of scope and highest level of generality possible, while still preserving focus on the

fundamental nature of modeling and simulation, consider for a moment the range of *technologies*, types and venues of *applications*, and facets of *business practice* of modeling and simulation that were included within the scope of *SimSummit*.

M&S TECHNOLOGY was construed to include ‘all the forms of knowledge which are necessary for M&S and which distinguish M&S from other technical arts’. Particular concern exists regarding the specification of the so-called ‘Body-of-Knowledge’, which can be taken as definitional of the modeling and simulation domain.

M&S APPLICATION – meaning the use of modeling and simulation in a concrete context to produce some beneficial effect – is the dimension on which the ubiquity and variety of modeling and simulation is perhaps most apparent. Modeling and simulation is used for a variety of purposes (analysis, decision-making, design specification, training, etc.) in an enormous range of contexts (academic, industrial, governmental), to represent ‘everything-under-(and beyond)-the sun’. This variety of relevance of application is the basis of the power and influence of M&S. And last, but not least...

M&S BUSINESS PRACTICE - meaning the various forms of meta-enterprise structure and process related to development and application of M&S technology - is crucial to appreciating how M&S ‘works’ in the real world of people, organizations, programs, and systems.

By establishing for *SimSummit* this broad-field-of-regard of discourse, we intended: 1) to be as comprehensive as possible in addressing those elements of technology, application, and business practice which are relevant to the entire industry; and 2) to produce determinations, findings and actions which are as widely influential as possible.

CIRCUMSTANCE

Modeling and simulation technology is:

- *pervasive* in its application – like “Chicken Man”, modeling and simulation are seemingly everywhere.
- *diverse* in its implementation – so diverse in kind in fact that many practitioners of one class of techniques are unfamiliar with other significant domains of practice – continuous-system, discrete-event and finite-element-analysis communities seem to be effectively insulated by their choice of representational schema.
- *versatile* in its employment – M&S technology ecumenically supports: experimentation, analysis, engineering design and development, testing, training, operations, etc. depending upon need and opportunity.

- *powerful* in its effect – modeling and simulation are, compared to other technologies, particularly effective and convincing.
- *valuable* in its use – sometimes, indispensable, and
- *cost-effective* in concert with or in lieu of other techniques.

On the other hand... the case may be made that as a profession, an industry, and a marketplace, modeling and simulation is fundamentally immature. There are several 'markers' of this immaturity that were addressed during the *SimSummit* workshop:

- There is no satisfactory specification of the Body-of-Knowledge or a Code-of-Ethics for the M&S Profession / Industry.
- There are no agreed-upon disciplinary curricula for higher education of simulation professionals, ... nor are there any acknowledged standards for professional education and training of simulation professionals.
- There is no comprehensively relevant and widely recognized form of professional certification.
- There is no generally recognized set of fora and administrative mechanisms that support the whole M&S profession, industry, and market.
- There is no clear and immediate acknowledgement of Modeling and Simulation as a unified profession / industry either among its practitioners or by those outside the profession.
- The M&S 'market' has neither the identity, the cohesion, nor the visibility typical of mature industries.

INHIBITION

Like other industries before ours - previous technology-enabled professions and enterprise domains, such as electrical engineering, systems engineering, software engineering, etc. – we are experiencing the typical syndrome of (apparent) lack of critical mass of an emerging market. Significantly, that was *then* and this is *now*, and it is *we* who are struggling with the inefficiencies pursuant to the immaturity of the modeling and simulation industry.

TECHNOLOGY - Without the appreciable presence of an identifiable professional cadre and industrial constituency, investment-in and promulgation-of simulation technology is necessarily fragmented and particular.

PROFESSIONAL DEVELOPMENT - Without shared perception of the body-of-knowledge and code-of-ethics, there can be no recognition of M&S as profession / industry and consequently, no self perception of cadre - We don't know we are a profession with interests in common. Further, an appreciation of how simulation technology competencies relate to work-force performance capabilities is impossible. The result is the existence of only an implicit job-description for professionals with modeling and simulation roles. This circumstance taken together with only implicit indications of employer functional

proficiency requirements, academic departments find it difficult (or unproductive) to develop curricula for the simulation profession.

APPLICATIONS - Since the body of knowledge is not clearly discriminated, appreciating how simulation technology may be applied liberally and ecumenically across *apparently* widely disparate application domains is difficult. Application domain custodians do not appreciate or accept the very general applicability of M&S technology. Finding our domains of competency within the field of simulation technology and appreciating the relationships among them is inhibited.

BUSINESS PRACTICE - Failing to appreciate the body-of-knowledge, and organization's roles and relationships therein, the development of efficient product and service markets is inhibited. Without any form of unambiguous identification of simulation professionals, the labor supply is indefinite. The net effect is an extremely insecure and inefficient labor market. Economies-of-scale are not achieved, and the mobility of technology and assets within the modeling and simulation industry and across applications domains is reduced. Potential markets are unnecessarily fragmented; and the identification and provision of necessary products and services is duplicative. And, perhaps most significantly, financial investment both from within and outside the industry is deterred by the lack of perceptible market. Investment of intellectual effort into standards, technology, tools, and business practices is discouraged.

In condensed form, *SimSummit* Delegates presumed for themselves then, as we might continue to believe altogether now, the following:

- Modeling and Simulation is important.
- Its fundamental value is manifest in something as universally significant as the capacity it provides for systematic and rational 'storytelling' in real and imagined worlds.
- Modeling and Simulation's influence is predicated on the underlying technologies that define the discipline.
- The nature, use, and influence of these technologies is 'emerging'.
- The modeling and simulation industry is evolving under the influence of natural mechanisms from a relatively immature state toward one of fuller potential – it's not that M&S is new, but that the comprehensive set of conditions whereby the heretofore disparate uses and users of M&S can now be appreciated 'in-the-large' is different.
- The evolution of the modeling and simulation technology, profession, industry, and market is inhibited by (or conversely can be aided and abetted by) a variety of factors.
- We all have a stake in the maturation of modeling and simulation.
- Now, together, we can make a difference.

INTENTION

The premise of *SimSummit* was that by collective ACTION, we might influence the maturation of the modeling and simulation profession, industry and marketplace for the common good. In simple form, the ‘idea’ of *SimSummit* is defined in terms of what? how? who? and why?

WHAT – *SimSummit* was a convention of representatives of organizations that are ‘leaders’ in modeling and simulation worldwide. The convention was conceived as a summit meeting and workshop wherein matters of strategic importance to the entire M&S community can be systematically addressed and where consensus and agreements among the most influential organizations may be established for the general good.

HOW – *SimSummit* leveraged the opportunity for ‘precipitation’ of an identifiable M&S-based technical sector for which considerable readiness already exists.

WHO – *SimSummit* involved a set of organizations in government, academia, industry and the professional societies that were best prepared to work toward establishing M&S technology and business practice.

WHY – *SimSummit* intended to influence the modeling and simulation profession, industry and market by intentionally investing in the maturation of the M&S industry for the collective good.

The *SimSummit* Convention’s Concept-of-Operations had a few significant characteristic features. *SimSummit* was conducted as a structured workshop. A few simple activities comprised the program – a sort of collaborative engineering exercise. *SimSummit* Delegates, serving on behalf of solicited participating Organizations provided diversity of representation and stature within the industry, as well as manifest interest in the *SimSummit* event. *SimSummit* was conducted as a ‘non-zero sum’ activity, wherein the participants self-consciously cooperated (played the ‘game’ together) out of intelligent self-interest. *SimSummit* was a collective activity insofar as whatever the Workshop decided was ‘the answer’. And finally, *SimSummit* was ACTION-oriented – the goal of *SimSummit* was to change the future. The *SimSummit* Event was appreciated to be the beginning-of-the-beginning of an industry-wide, collective thread-of-activity.

PARTICIPATION

Participation in *SimSummit* was ‘by invitation’ in accordance with a pre-defined set of preference criteria. Relevant factors in selecting invitees emphasized, the representativeness, stature, and commitment of the candidate organizations.

Participating organizations, classified in accordance with their principle mission-function are listed in the table of Figure 1.

COMMERCIAL / INDUSTRIAL Aegis Technologies Group, Inc. The Boeing Company - Phantom Works CACI, Inc. Greenley & Associates Illgen Technologies, Inc. RAM Laboratories, Inc. Raytheon Company
EDUCATION Georgia Tech - Modeling and Simulation Research & Education Center (MSREC) McLeod Institute of Simulation Sciences (MISS) Old Dominion - Virginia Modeling, Analysis and Simulation Center (VMASC) University of Arizona - Arizona Center for Integrative Modeling and Simulation (ACIMS) University of Central Florida - Institute for Simulation and Training (IST)
GOVERNMENT DND Synthetic Environment Coordination Office Defence & Science Technology Laboratories Synthetic Environment Efforts NASA - Kennedy Space Center NASA - Langley Research Center NATO Modelling & Simulation Group UK Synthetic Environment Coordination Office U. S. Air Force Agency for Modeling and Simulation U.S. Army / Army Model and Simulation Office U.S. DoD / Defense Modeling and Simulation Office U.S. Marine Corps Technology Division U.S. Navy / Navy Modeling and Simulation Management Office
PROFESSIONAL SOCIETY ACM Special Interest Group on Simulation National Training Systems Association (NTSA) Simulation Interoperability Standards Organization (SISO) The Society for Modeling and Simulation International (SCS)
HYBRID California Rotorcraft Small Business Consortium National Center for Simulation

Figure 1 - List of SimSummit participating organizations

PROCESS

The *SimSummit* operational process consisted, simply, of four activities:

1. Introduction of Organizations and Statements-of-Position by Delegate Representatives

2. Identification of topical Issues- and Opportunities-of-interest to participating Organizations
3. Discussion and analysis of selected Topics
4. Establishment of *SimSummit* Plenary consensus on Working Group findings and recommendations.

Those activities and their consequent work products are indicated in the illustration of Figure 2.

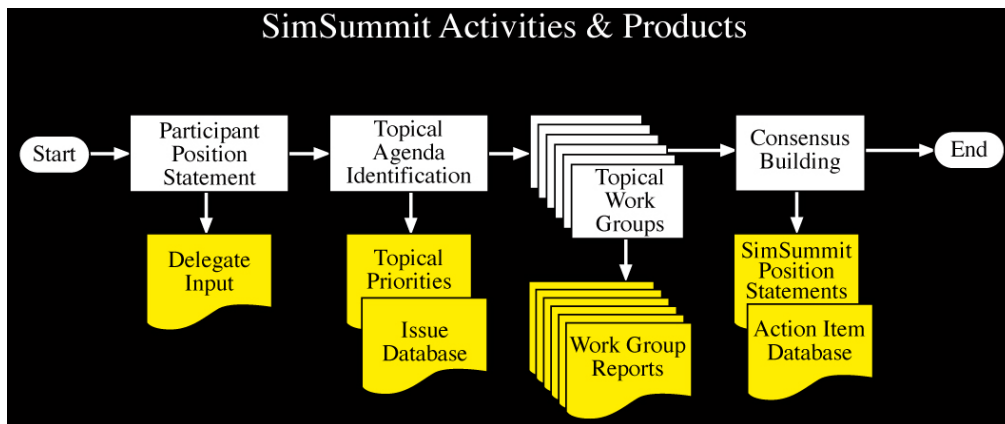


Figure 2 – SimSummit planned activities and Work-products

RESULTS

Three sets of results of the *SimSummit* experience are particularly important. These include ISSUES, DECLARATIONS, and ACTIVITIES identified as relevant to the evolution of the M&S profession, industry and marketplace. In the sections that follow, each set of results is introduced with brief commentary regarding its perceived significance.

ISSUES – Each of the participating representatives was asked to nominate those issues that were considered most significant to the success of M&S from the perspective of his own organization. Candidate issues were compiled, discussed among the committee of the whole, captured in short form, and classified in accordance with their apparent relevance to the M&S technology, professional industry or marketplace. That set of issues is denoted in the Figure 3.

TECHNOLOGY:

- Sound Intellectual basis (science) of M&S technology
- Interoperability, composability, data management, etc. challenges
- Implications of Standards
- Research Programs, Funding, Execution

PROFESSION:

- Professional Identity
- Body of Knowledge, associated culture
- Acknowledged Discipline

- Education, Training and Professional Development
- Certification
- Quality Workforce
- Code of Ethics

INDUSTRY:

- Recognition of identity
- Fragmentation ('Balkanization') vs. Synergy vs. Mobility
- Shared, cost-effective Process / Practice
- Internationality
- Policy Management loci
- Visionary Context (e.g. SBA-ish, but not limited to Govt. acquisition)

MARKETPLACE:

- Cost of ... M&S asset development, training system delivery, etc.
- Value of... standards, M&S infrastructure, M&S use, etc.
- Conditions for cooperation (business case, non-zero sum game, etc.)
- Economic Impact
- Rational investment management in ...'infrastructure' ... and recovery of investment

Figure 3 – ISSUES identified as relevant to participating organizations

While not entirely unexpected, these ISSUE topics are nevertheless valuable from a variety of perspectives. First, they are concrete and amenable to further pursuit. Naturally the denotative titles provided here are brief, but they are by no means cryptic, and the details associated with each issue title are available in the meetings' records. In addition, the topics themselves are relatively comprehensive in their scope and are conveniently organized, so that the consideration in other venues of the completeness, consistency, and balance of this set of issue topics is a reasonable undertaking. Finally, (and certainly most significantly) they are both representative of the concerns of the participating organizations and so generally relevant as to have been accepted by consensus of the entire convention – practically guaranteeing further consideration to be worthwhile.

TOPICAL ACTIVITY – During the *SimSummit* deliberations, the delegates, debated a wide variety of topics of general interest and concern. Beginning with nomination of topics from the participants and proceeding through consideration of: present state shortfall, future state desiderata, level of interest, urgency of concern, and tractability of solution; a variety of topics were ultimately identified for which remedial activity was considered viable. The designation of topics for which collective action was considered appropriate and to which *SimSummit* participating organizations were willing to subscribe interest is of utmost importance. Typical topics, organized as relevant to technology, business or professional development perspectives are indicated in the details of Figure 4.

BUSINESS	TECHNOLOGY	PROFESSIONAL DEVELOPMENT
Event Frequency	Interoperability with real systems	Fragmented Educational Programs
Value of M&S	Repository of research (and body of knowledge)	Quality of the practitioner (for buying labor)
Taxonomy or standard definition of body-of-knowledge	VV&A	Education and training as a process
Relevance of professional society activities	Usability	
Business practice guidance	Databases	
Assessment of the quality of the product.	Composability	
M&S Repositories	Model construction	
Integration of technology profession and industry	Web enablement	
M&S Development Expense		
Cost-effective development processes		
Data management and availability		
Market Segmentation Model		
Time-to-Market challenges		
Market forces reducing duplication		
Simulation Operations Dependencies		

Figure 4 – ACTIVITIES Identification

It is these topics and interest subscriptions that are the basis of specification of ACTIVITIES that might comprise a *de facto SimSummit* program-of-activity. Action-item assignments from the *SimSummit* included primarily the generation of just such ACTIVITIES specifications, whose structure is indicated in the details of Figure 5.

TOPIC: <How is the ACTIVITY designated?>
POC: <Who is submitting / specifying the topic?>
PROBLEM STATEMENT: <What's busted? What need is unfilled? What is at issue? What opportunity is at hand?>
SOLUTION STRATEGY: <How is the Issue / Opportunity to be approached? What strategic guidance should be followed in executing the activity?>
DESCRIPTION: <What is to be done? What steps are there, that, if taken will result in the resolution of the issue or the realization of the opportunity?>
PARTICIPANTS: <Who is to do it?>
RESOURCES: <What's it take to do the job? Preconditions, Cost, Schedule, Information, ...?>
RESULT: <What product or end-state will result? What is the exit criteria?>

Figure 5 - SimSummit ACTIVITIES Specification Form

DECLARATIONS – Declarative statements generated from the floor of the convention, and accepted by consensus of the participants provide a particularly salient view of the will of the assembly. While consistent with other findings and results-products, these declarations are significant as that set of statements that the *SimSummit* convention felt compelled to ‘post’ to the larger M&S community-of-interest by way of establishing an unequivocal, persistent position in relation to which subsequent pursuit of the topic could proceed. In each case the respective declarations are stated in paraphrase without elaboration.

1. The *SimSummit* participants (as identified) confirmed that their intention was to promote recognition of simulation as a profession, industry, and marketplace.
2. *SimSummit* endorses the tactics of identifying M&S issues and identifying associated joint action items and of coordination and collaboration among now disparate simulation organizational entities.
3. Affiliation and cooperation of organizations is essential to the identification of an M&S community. Recommended relationships include:
 - cooperation among professional societies in scheduling and conducting events
 - cooperation among educational institutions in establishing, implementing, and executing M&S curricula and courses of study
 - clarification of roles and relationships between ‘for profit’ and ‘not for profit’ organizations
4. Collective action is necessary to advance the industry. Recommended initiatives include:
 - Pursuit of ISSUES and ACTIVITIES identified by *SimSummit*
 - Sponsorship of high risk, high pay-off M&S activities and enterprises
 - Support of broad M&S process and application strategies (e.g. SeBA and SMART)
5. Understanding of the business-case economics of M&S by means of data collection and analysis is necessary to enable expression of cost-effectiveness and value added of M&S practice.
6. Consensus on a body-of-knowledge and a code-of-ethics for the M&S profession are powerful enablers for evolution of the M&S industry.

CONCLUSION

SimSummit was unique, stimulating, and productive. It reflected both the need for evolutionary maturation of the modeling and simulation, profession, industry, and marketplace, and the readiness within a significant segment of that

community-of-interest to precipitate such change. For all that, no persistent value will derive from the *SimSummit* experience unless the participating organizations - *and others* - pursue to significant effect the issues and topical activities that were disclosed therein.

Naturally, the *SimSummit* Executive Committee is actively coordinating the attentions and efforts of the original participants. In addition, disclosure of the *SimSummit* determinations and findings, along with other collateral information is being made liberally throughout the M&S community in hopes of stimulating interest in the *SimSummit* agenda and consequent activities.

The *SimSummit* Executive Committee invites expressions of interest in any of the findings identified here, and promises to pursue to the greatest extent possible the cooperative inclusion of any interested organizations into the *SimSummit* initiative.