

M&S Leadership Summit '08 Report

In cooperation with the
Congressional Modeling and Simulation Caucus

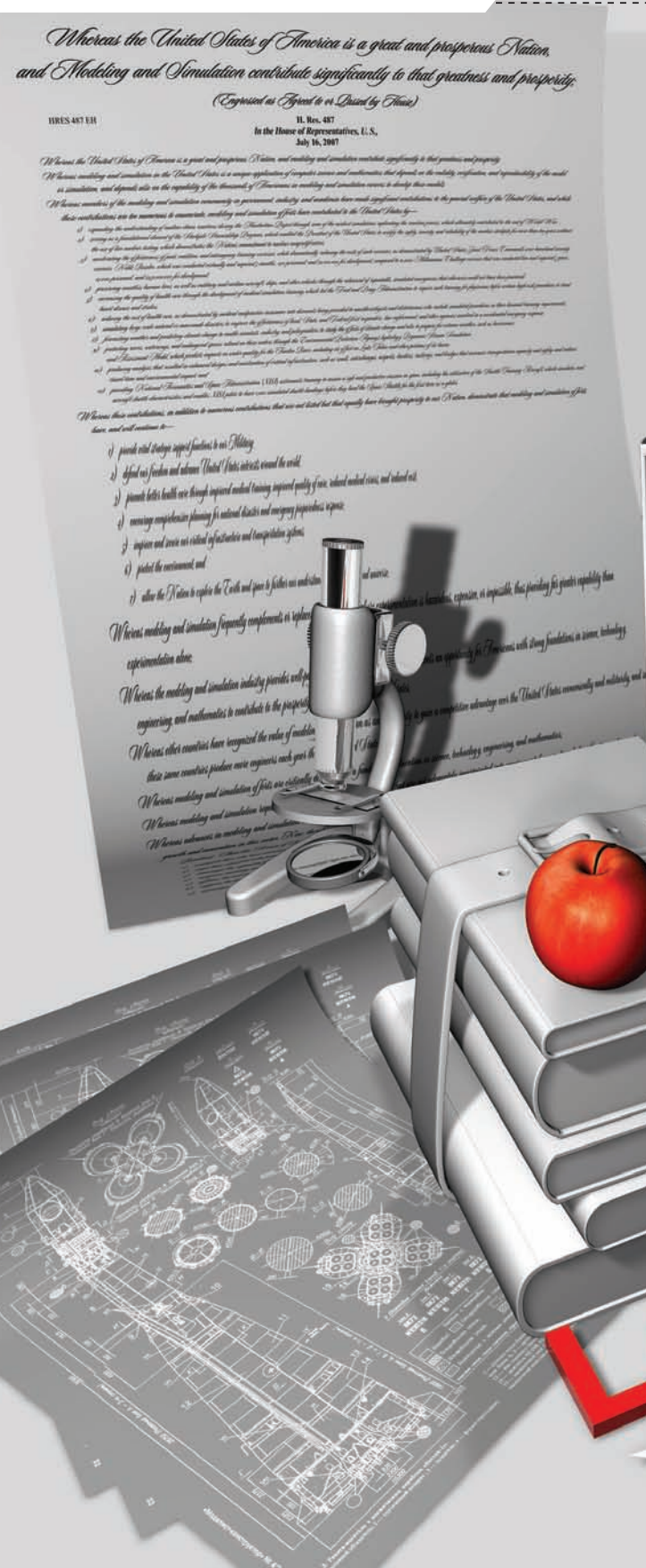
Led by:

J. Randy Forbes

VA, 4th District, Founder and Chair

Solomon Ortiz

TX, 27th District, Co-Chair



M&S Leadership Summit

FEBRUARY 11 2008 ► WWW.TRAININGSYSTEMS.ORG

WESTIN HOTEL, VIRGINIA BEACH TOWN CENTER ► VIRGINIA BEACH, VA

EVENT #81C0

A PROUD AFFILIATE OF



Acknowledgments

The National Training and Simulation Association (NTSA) sponsors the Modeling and Simulation (M&S) Leadership Summit. RADM Fred Lewis USN (Ret.), President of NTSA, and his organization provide support to the Modeling and Simulation Congressional Caucus, co-chaired by Congressman J. Randy Forbes and Congressman Solomon P. Ortiz. In order to support the furtherance of recommendations made through this summit, and in planning for future events, NTSA formed a standing committee to provide the interface to the Caucus for the planning of this event and others throughout the year in support of the Caucus. Members of this committee commit significant time and effort to ensure these events accomplish both the agendas of the Caucus and of the community of practice. In addition to RADM Lewis, the members of this standing committee, and their business affiliations, include:

Dr. Linda Brent, Chair, The ASTA Group

Mr. Bruce Bailey, Office of the Secretary of Defense

Mr. Rich Bensinger, SAIC

Mr. Michael Finnern, L-3 Communications

Mr. Tom Frost, Joint Forces Command

Mr. Fred Hartman, Institute for Defense Analyses

Mr. Russ Hauck, National Center for Simulation

Ms. Barbara McDaniel, National Training and Simulation Association

Dr. Mike McGinnis, Virginia Modeling, Analysis and Simulation Center

Ms. Lisa Moya, WernerAnderson, Inc.

Mr. Michael Papay, Northrop Grumman

Mr. Patrick Rowe, National Training and Simulation Association

Mr. Bill Tucker, The Boeing Company

Mr. Bill Waite, AEgis Technologies

We want to extend a sincere thanks to all the committee members and participants for their continued dedication and commitment to furthering the national agenda of modeling and simulation.



M&S LEADERSHIP SUMMIT REPORT, 2008

EDUCATION: ENABLING MODELING AND SIMULATION, A NATIONAL CRITICAL TECHNOLOGY

BACKGROUND

The National Training and Simulation Association (NTSA), in cooperation with the Congressional Modeling and Simulation Caucus, conducted the Third Annual Modeling and Simulation (M&S) Leadership Summit on February 11, 2008 in Virginia Beach, Virginia. RADM Fred Lewis, USN (Ret.), President, NTSA, provided opening comments, welcomed the Congressional Caucus members in attendance, and greeted the meeting participants and attendees. The 2008 M&S Leadership Summit continued the Association's collective effort to develop a framework for greater advocacy of modeling and simulation as begun at previous Leadership Summits.

We are indebted to Congressman J. Randy Forbes, VA, 4th District, M&S Caucus Founder and Co-Chair and Congressman Solomon Ortiz, TX, 27th District, M&S Caucus Co-Chair for lending support for this event. Congressman Forbes and Congressman Robert (Bobby) Scott, VA, 3rd District, provided opening comments to set the tone of the meeting and focus on the theme "Education: Enabling Modeling and Simulation, A National Critical Technology." Congressman Forbes made a point that the M&S Leadership Summit is the only M&S conference dedicated to federal policy. Therefore, it must be kept up to date. Among other points, Congressman Scott called on industry to develop realistic M&S tools. Congresswoman Thelma Drake, VA, 2nd District provided closing commentary to highlight a successful day of meaningful exchange and thank the attendees for their role in helping save the lives of our forward deployed forces through military training enabled by M&S systems. It is significant that Congressional Caucus members were personally present to ensure the success of the 3rd M&S Leadership Summit.

In his welcome letter for the meeting, RADM Lewis provided a short summary and background for the Congressional Caucus and NTSA support for M&S to be recognized as a National Critical Technology. In 2005, the US House of Representatives established the Modeling and Simulation Caucus, composed of Members who either have an economic interest in M&S activities or who have concerns about the advancement of technology in the US. The Caucus, founded and co-chaired by Congressman Randy Forbes (R) of Virginia and Congressman Solomon Ortiz (D) of Texas, has grown to about 30 additional Congressional Members. The purpose of the Caucus is to promote the growth of M&S activities throughout the US through advocacy and legislation. Actions taken by the Caucus to this point have been very encouraging to the M&S community, especially in light of HR 487 being passed by the House in June 2007 which declares M&S a "National Critical Technology." Most recently, legislation has been proposed for inclusion of information in the Higher Education Act offering attractive incentives to colleges and universities across the country for establishment of programs dedicated to the study of M&S.

In 2006, NTSA, with the support and encouragement of the M&S Caucus, began a series of meetings entitled the "M&S Leadership Summit." These events, designed to bring together key members of the M&S community of practice from industry, government and academia, assess the growth and potential for the M&S community at large. At previous meetings, attention was focused on a topical agenda designed to discuss and debate progress in areas such as M&S work force development, business practices, and technology. This year, the Leadership Summit focused on M&S education across the board. NTSA and meeting organizers brought together leaders from various domains within the society to address the level of utilization and sophistication of M&S within their specific areas. By continuing this discussion, we will be able to assess M&S educational requirements from important economic and technical sectors within our society, and develop actionable recommendations to the Congress for M&S educational support legislation. It is clear the issues at hand are, in fact, national-level in terms of their impact on both the nation's security and economic well-being.



In addition to recognizing M&S as a National Critical Technology and acknowledging the significant impact of M&S across a broad range of economic fields, HR 487 continues the emphasis on math and science as key disciplines in elementary and secondary education and encourages the expansion of M&S in higher education. The 2008 Leadership Summit format brought together panels of nationally known experts to discuss these issues in a broad forum. Although this meeting was conducted in a seminar format, the focus on education demonstrated a common need across all communities to increase the level of education and training in M&S topics beginning in elementary school and extending to post-graduate studies.

Previous Leadership Summits were concerned with “making the case” as to the importance of M&S to a wide range of areas and activities embraced by NTSA members. The importance of this Summit and the emphasis on Science, Technology, Engineering, and Mathematics (STEM) education as a foundation for M&S is an extension of the NTSA participation in developing future leaders in M&S. The basic conditions in the country today are brought home by a recent National Academy of Sciences study which includes the following compelling statistics:

- Less than a third of US 4th and 8th grade students performed at a level deemed “proficient” in mathematics.
- 68% of US 8th graders received (1999 data) instruction from a math teacher who did not hold either a degree or certification in mathematics.
- 93% of students in grades 5-9 (2000 data) were taught physical science by a teacher lacking a major or certification in any of the physical sciences. (Note: This data was cited in the report as the most recent. Actual numbers today, in fact, may be worse.)
- US 15 year-olds ranked 24th out of 40 countries in a 2003 exam (Program for International Student Assessment [PISA]) which assessed students’ ability to apply mathematical concepts to solve real world problems.
- The US also lags the world in higher education. Numbers for undergraduate students who receive their degrees in natural sciences or engineering are as follows: China 50%, France 47%, Singapore 67%, South Korea 38%, and US 15%.
- 34% of all Ph.D.s in natural sciences and 56% of engineering Ph.D.s are awarded to foreign-born students in the U.S. (Under current immigration rules, foreign students must now leave the US after a maximum of eight years of study.)
- Some 38% of Ph.D.s in the “science and technology” workforce (2000 data) were foreign-born.
- The US is now a net *importer of high-technology products*. The trade balance shifted from *plus* \$54B in 1990 to a *negative* \$50B in 2001.
- In 2005, American investors put more new money in foreign stock funds than in domestic stock portfolios.
- In 2001, US industry began to spend more on tort litigation than on research and development.
- In 2005, only 4 US companies ranked in the top 10 companies receiving US patents.

It would be useful to continue to collect data such as those in the previous bullets as representative metrics indicating how well we are making progress as we enable the national agenda for M&S as promoted by the Congressional Caucus and the Leadership Summit meetings.

The balance of this meeting report summarizes the three major panels devoted to: M&S and education in the scientific



realm; M&S applications in infrastructure, security, and education; and the M&S role in the education process. The experts on each of these panels also addressed their respective M&S area in the question and answer sessions. They produced a rich and robust list of recommendations to frame the agenda for the 2009 M&S Leadership Summit, and to chart a “way ahead” for years to come.

SUMMIT KEYNOTE ADDRESS

Mr. Charles Romine, *Senior Policy Analyst for the White House Office of Science and Technology Policy*, delivered the summit keynote address. Mr. Romine’s address provided significant insight into the overall White House policy position, and the critical role of M&S to support the technological advances required to maintain the nation’s competitive edge. To that end, he emphasized *the commitment of his office to support investments in research and development (R&D) specifically in support of M&S*. Several key initiatives supported by his office demonstrate this commitment. For example:

- In 2001, \$1.7 billion investment went to R&D supporting M&S; in the 2009 budget, the figure is now \$3.5 billion.
- The American competitiveness commitment over a 10 year period is to double to \$136 billion. The goal is for the US to lead the world in competitiveness and innovation.
- The America Competes Act (currently under consideration in the Congress) emphasizes the significance of mathematics for students and teachers involved in M&S.

Dr. Romine specifically identified high performance computer development as critical to the future of the country’s technological advantage. The High Performance Computing Program Office works with 13 agencies on investments relevant to M&S, including software, large scale networking, and human computer instruction. This investment is intended to provide the basis for expanding our knowledge bases, capability, and capacity to use high speed computing to solve complex social, financial, and cultural issues in our society. He cited examples of the use of M&S across disciplines: federal stockpile security issues, traffic simulation (particularly for emergency evacuation), twin tower collapse evaluations, prevention of bridge collapse, and hurricane tracking. In the private sector, he highlighted fluid dynamics, weather, aerospace, and manufacturing processes.

Key elements for consideration and recommendations include the following:

- Identify ways to quantify M&S return on investment. Priorities should be placed in the following areas: storage of nuclear material; traffic simulation; hurricane tracking; computational fluid dynamics; aircraft development (Boeing 777 & others); and manufacturing processes (Proctor & Gamble).
- Complement efforts in other countries by becoming more aggressive in promoting science and engineering. This would include the effort to counter the results of data from the President’s Council for Science and Technology (S&T) report on S&T and R&D for IT which states that the United States of America is losing ground to other countries. Some of this is due to current immigration laws where many foreign students come to the US to study S&T subjects yet, upon graduation, are forced to leave and return to their countries, ultimately competing with the US.

Dr. Romine, throughout his remarks, stressed the critical importance of raising awareness across the nation about the compromises that US S&T infrastructure has suffered. He identified the immediate need to increase efforts to support



innovation, S&T achievement and advancements in key areas including high performance computing, nanotechnology, and other critical areas of math, science and engineering.

PANEL 1: M&S AND EDUCATION IN THE SCIENTIFIC REALM

The first panel of the 2008 M&S Leadership Summit addressed “M&S and Education in the Scientific Realm.” This panel was intended specifically to:

- reflect the singular significance of M&S across diverse application domains;
- explore and review cross-domain opportunities for collaboration among the broad-based M&S community of practice; and
- emphasize particularly, the relationship of M&S to education for the good of the profession, the industry, and the Nation.

The panel simultaneously validated the M&S standing as a “National Critical Technology” of exceptional diversity and efficacy, and addressed the critical need for fertile relationships between M&S and the Nation’s agenda for technical education. Distinguished leaders testified to the critical need and opportunity for employment of M&S in their respective areas of expertise: medicine, engineering, space science, weather and climate, environment, and computational engineering. Panelists’ presentations and audience comments amply illustrated both the diversity of industrial domains where M&S is profitably employed and the degree to which M&S core competencies, tools and techniques serve these apparently disparate uses.

In each case, the need for systematic investment in education to develop a robust modeling and simulation workforce was identified. Panelists’ comments clearly supported the assertion of H. Res 487 that: 1) “... modeling and simulation require unique knowledge, skills, and abilities”; 2) “... modeling and simulation efforts are critically dependent on a fundamental education in science, technology, engineering, and mathematics”; and 3) “... the modeling and simulation community in government, industry, and academia have made significant contributions to the general welfare of the United States in areas including education.” Strategies and concrete recommendations were identified both for improving M&S competency while using M&S as an instructional tool to support overall scientific and technical education of the Nation’s next generation of professionals.

Dr. Mika Sinanan, *Professor of Surgery, University of Washington* addressed “M&S in the Medical Education Realm,” emphasizing the rationale for prompt action in improving medical-training simulation. Dr. Sinanan offered the following as motivation for use of M&S in medical training: intense national focus on patient safety; cost inefficiency of current apprenticeship training model in medicine; maturing technology and curriculum; regulatory requirements for medical skills training; benefits of learner-based and learner-focused training; and team training, maintenance of competency, introduction of new technology, and outreach to serve rural and remote training needs. His briefing effectively illustrated each of these benefits being realized in existing sophisticated simulation-based training programs. In fact, according to Dr. Sinanan, principles of simulation-based training for medical practice have already been formulated and are being implemented. These principles include: 1) Clinical skills should be learned away from the patient; 2) Mistakes are tolerated and are a powerful training tool; 3) Systems of practice can be simulated and optimized before patients are exposed; 4) Simulation-based training illuminates thought processes, leadership, and psychomotor skills; and 5) Simulation respects the learner with competency based education and professional development.

National needs for medical M&S which are highly correlated to the needs identified for other application domains, attention and investment are recommended and include the following:

1. Definitions and standards
2. Uniform curriculum
3. Validation methodology
4. Certification and quality assurance
5. Research agenda and educational research funding
6. National network and infrastructure
7. Access for rural and underserved areas
8. Infrastructure funding for initial capital expenses and long-term maintenance

Dr. Bernard P. Zeigler, *Professor, Department of Electrical & Computer Engineering, University of Arizona, and Co-Director of the Arizona Center of Integrated Modeling and Simulation (ACIMS)*, cited the emerging consensus that America is losing its innovative edge; commitment and positive action are necessary in order to reverse this disturbing trend. Dr. Zeigler suggested a need for a Modeling and Simulation Adoption Maturity Model analogous to those employed in systems- and software-engineering fields in order to establish objectives and metrics for investment in M&S education. Such a maturity model would correlate for each of five levels, the state of M&S maturity with the existence of progressively more robust M&S education offerings as suggested in the table that follows:

M&S Maturity Status	M&S Education
absent from most projects	None
ancillary to other disciplines	other discipline based
at the core of all projects	M&S course(s) at B.S. level
integral to knowledge innovation	M&S course(s) at M.S., Ph.D. levels
prime driver of innovation	in-depth coverage in all disciplines

Dr. Zeigler acknowledged encouraging progress in addressing support of education in M&S through the following: establishment of a task force at the Department of Education to raise awareness of, and further define the study of, M&S; the creation of grants for higher education institutions to develop new M&S degree programs; and to further develop existing M&S degree programs. However, he suggested more action is needed. His recommendations included:

- Shifting more funding to basic research in general, and particularly in M&S.
- Establishing M&S specific funding and development organization (e.g. National Institutes of Health [NIH]).
- Expanding international M&S funding in multi-disciplinary projects to lead the way to tackling so-called “wicked” global problems.



Dr. Edwin Z. Crues, *Constellation Program Modeling and Simulation Architect, National Aeronautics and Space Administration (NASA)*, discussed how modeling and simulation is used and the ways it has enhanced progress in the areas of space science. He noted, favorably, that NASA is:

- actively using modeling and simulation to execute the exploration mission.
- using detailed modeling and simulation to solve current large, multi-variable, complex problems.
- using modeling and simulation to define Lunar Outpost designs and operations.
- making conscious efforts to provide a foundation for modeling and simulation across the agency.

In this spirit, Dr. Crues noted that: "...modeling and simulation is an enabling technology for space flight [as] it is in many fields of advanced science and engineering." "... modeling and simulation are not the ends of our work but, rather, they are a 'critical technology' means to that work." However, he affirmed that "we cannot have an active and vibrant space program without an active and vibrant modeling and simulation community to support it."

From a modeling and simulation education perspective, Dr. Crues expressed concern regarding the numbers of trained simulation and modeling professionals together with the [lack of] rigor with which modeling and simulation is treated in many science and engineering programs. He noted that, based on his participation in several academic advisory groups, "in all but a few institutions, modeling and simulation is ignored as a discipline and scattered *ad hoc* throughout the curriculum."

Dr. Crues' recommendations for the science and engineering educational system emphasize focus on the following elements:

1. Recognize modeling and simulation as a discipline.
2. Incorporate modeling and simulation into the science and engineering curriculums in a consistent and rigorous way.
3. Add upper division electives in modeling and simulation that lead into their capstone design courses.
4. Add a modeling and simulation track in graduate level degree programs.

Regarding national issues that would further the use of modeling and simulation within space science and beyond, Dr. Crues opined that the space science community needs no additional incentives to further the use of modeling and simulation, being already sufficiently sensitive to the attendant needs and opportunities. Rather, he suggests that the national interest would be well-served if colleges and universities begin to recognize modeling and simulation as a critical technology and infuse it in a rigorous manner into their curricula; noting that this could be fostered by a government and industry coalition to sponsor academic programs and academic scholarships in modeling and simulation.

Dr. Robert M. Atlas, *Director of the Atlantic Oceanographic and Meteorological Laboratory, National Oceanic and Atmospheric Administration (NOAA)*, described NOAA's seamless suite of forecast products spanning climate and weather and introduced their aggressive programs for coupled high resolution representations leading to comprehensive Earth System Modeling.

Dr. Atlas reinforced the expression by other panelists that modeling and simulation in any disciplinary area requires careful consideration of M&S practice in associated domains, and that many challenges of modern modeling and



simulation are shared across alternative application domains. In particular, Dr. Atlas cited the need for even more capable high-performance computing as a pacing technology in achieving NOAA's mission objectives

According to Dr. Atlas, continued progress toward addressing the climate problem requires specifically:

- Fresh approaches to computational techniques.
- Cross-disciplinary capability in the atmospheric, oceanic, and biogeochemical sciences.
- Integration of technological solutions into projections of climate change.
- Application of scientific outcomes to assess societal and economic impacts.

Regarding M&S education issues, Dr Atlas reinforced the comments of other panelists indicating:

- Undergraduate programs often do not contain sufficient scientific programming.
- Agencies typically do not fund sufficiently or work closely enough with universities in numerical model and data assimilation development.
- There exists a big gap between scientific education and software engineering skills. With models becoming highly complex, M.S. and Ph.D. graduates need to excel in both fields.

Dr. John Nestler, *U.S. Army Engineer Research and Development Center (ERDC)*, reported the degree to which ERDC Modeling & Simulation is important and pervasive, with diverse representations, a few of which include: Computational Fluid Dynamics, transportation analysis, terrain visualization, environmental management, groundwater quality forecasting, engineering geophysics analysis, infrastructure materials, and combat theater assessment.

Dr. Nestler's concerns related particularly to the degree to which suitable collaboration across application domains could be managed in such ways as to meet the challenge for "enterprise investment" in M&S applications and science and engineering competency so necessary for today's multidisciplinary organization missions, programs and simulation operations. He notes, by way of explaining the challenge that each component discipline has:

- Different "currencies" and processes for different pattern and scales.
- Different "First Principles" using reference frameworks, concepts, & tools optimized for itself.
- Hundreds of years of convention and tradition.
- Tool and data asset investments made without regard to the limits and capability of alternative collaborative needs and opportunities.

The challenge identified by Dr. Nestler—pervasive in modern enterprise modeling and simulation environments—is to fully integrate disparate disciplines without compromising the first principles of any. Consequently, he inferred the necessity of collaboration among the diverse professionals in the M&S community and offered the following principles for effective interaction:

- IT Professionals should facilitate, not dominate.
- Users/Builders of discipline-specific models should collaborate, not isolate.
- End-users (policy- and decision-makers) should synthesize, not fragment.



Dr. Kyle Anderson, *University of Tennessee – Chattanooga, SimCenter: National Center for Computational Engineering* provided diverse and impressive applications of high-performance computing applied toward modeling and simulation implementation and execution. Illustrative instances included: oceanographic transport, forensic engineering, rotary wing computational fluid dynamics and aerodynamic performance, adjoint-based grid sensitivity analysis, and fuel-cell design flow dynamics.

Dr. Anderson cited student population growth at the Center and indicated considerable private sector investment in the enterprise, thereby quantifying robustness of the organization and its posture in providing Ph.D. level education support to the modeling and simulation industry. Business strategies associated with the Center include:

- Establishment of a cross-disciplinary business and research center at the University of Tennessee - Chattanooga.
- An interdisciplinary team of professionals and students engaged in application-driven research.
- Tools developed to integrate large, dedicated, advanced supercomputers and advanced communication systems.

Dr. Anderson's contributions to the Panel served to reinforce the two central themes: 1) the considerable degree of correlation of topics and issues relevant across application domains and 2) the critical need and ongoing initiative for education within the M&S community of practice.

PANEL 2: M&S APPLICATIONS IN INFRASTRUCTURE, SECURITY AND EDUCATION

Mr. Russ Hauck, *Executive Director, National Simulation Center*, chaired the panel session on M&S Applications in Infrastructure, Security and Education. This panel convened to provide a sampling of the breadth of applications in M&S across the federal government, as well as focus on the reach of M&S and some of the issues being addressed by these essential tools. An understanding of the pervasiveness and potential applications of M&S is an essential prerequisite to an appreciation of the importance of these technologies and the pressing need to support and expand M&S education. Expert panelists from Energy, Transportation, Homeland Security, Finance, and Higher Education provided a window into M&S applications in each of these sectors.

Mr. Clark Gellings, *VP of Technology, Electric Power Institute (EPRI)*, discussed some of the significant and pressing infrastructure needs in his industry which are exacerbated by an aging technical workforce and a decline in young people entering this field. The complexity of the Nation's power grid, combined with shortfalls in trained and qualified engineers and technicians, demonstrate the need for major expansion in the use of technology for monitoring and controlling this critical component of national infrastructure. While the Electric Power industry has been late to embrace M&S technology, the need is pressing.

Mr. John Wiley, *Managing Director, Federal Aviation Administration (FAA) Integrated Engineering Services*, described problems with the nation's aviation industry and current systems for air traffic control. He also described the future air traffic control system and stated that M&S will be essential to developing the concept of operations and infrastructure to make this system work. A listing of FAA applications for M&S included concept development, architecture, and port simulations, among others.

Mr. George Ryan, *Director of Test & Evaluation, Department of Homeland Security Science and Technology Directorate*, presented some of the applications and needs for expanded use of M&S in Homeland Security. In general, these in-



clude the following: the use of M&S in support of improved decision-making, including analysis and assessment of risks, response and mitigation; timely access to data and data sharing across agencies and jurisdictions; and the need for better standards and validation of models and simulations. Mr. Ryan recommended M&S should be treated as a “core discipline,” embedded in every degree program.

Mr. Lawrence Boyer, *Principal Economist, Freddie Mac Corporation*, presented ways M&S enhances the management and reduction of risk and improves the range of product offerings while helping to hold the line on costs. Some of the important challenges include layering models and judgment; modeling the future; modeling the impact of shocks to the financial markets (such as oil price fluctuations and the impact of terrorism); modeling the impacts of new technologies and policies; and accurately modeling the increasing complexity of interactions. The education system needs to afford opportunities for students to apply M&S in interdisciplinary coursework.

Dr. R. Bowen Loftin, *Vice President and Chief Executive Officer, Texas A&M University – Galveston*, focused his remarks on M&S education and pointed to the need for development of a consensus on an M&S body of knowledge, definitive textbooks, additional peer-reviewed M&S specific venues for publication, an academic “home,” and federal funding for M&S education, as well as M&S research. He emphasized the complete lack of undergraduate degree programs, academic departments, or a definitive undergraduate textbook in M&S. Dr. Loftin’s bottom line: we need to be more organized and systematic about M&S education at all levels.

Recommendations from this panel include:

- There is a great, pressing need for M&S to be applied in the electric power industry for education of new engineers in the face of major projected personnel shortfalls, and in simulation of the nation’s power systems and grid for monitoring, preparedness and rehearsal, and protection of this critical national infrastructure.
- The complexity and speed of new development in the nation’s air traffic control system make it critical M&S play an increasing role in system development and support for current and emerging operational requirements, as well as for education and training of the workforce.
- M&S should be treated as a core discipline supporting the entire spectrum of all technical degree programs.
- M&S should be a required course, or set of courses, at the undergraduate college level.
- The education system at all levels should provide opportunities to learn and apply M&S in interdisciplinary coursework.
- There is a need for better coordination of M&S needs, activities and resources, across all federal agencies.
- A mechanism for sharing experiences and best practices in application of M&S in K-12 education – especially in Science, Technology, Engineering and Math (STEM)-related applications. What is being tried, what works, and why.

This panel provided important insights into some current applications and status of M&S in a sampling of federal government activities and in M&S education in general, and also pointed to some pressing needs in these areas. There is an obvious need for more and better coordination of M&S requirements and activities across all government lines, and a need for more structure and coordination in our M&S education programs at all levels. This panel also emphasized workforce development and education requirements, especially STEM-related requirements that could be addressed, at least in part, by more extensive use of M&S technologies in K-12 curricula.



PANEL 3: THE M&S ROLE IN THE EDUCATIONAL PROCESS

The creation and infusion of new computer and information technology during the past half century has unquestionably changed the market and work place for most nations and societies forever. Educational institutions at all levels have responded to the infusion of technology and increased specialization by adopting new ways of teaching and designing and creating new spaces for learning that incorporate modern computer, visualization and information technologies; especially in areas for teaching mathematics and science.

The theme of this year's M&S Leadership Summit, "Education: Enabling Modeling and Simulation, A National Critical Technology" was well supported by the panel of experts who discussed the theme "The M&S Role in the Education Process." A growing number of high schools, colleges and universities in the United States, and a handful throughout the world, are exploring the increased use of modeling and simulations to teach topics in mathematics, science and physics.

Dr. Mike McGinnis (BG, USA, Ret.), *Executive Director, Virginia Modeling, Analysis and Simulation Center (VMASC)*, facilitated this panel featuring presentations from four distinguished speakers.

Mr. Brian Wells, *Senior Engineering Fellow at Raytheon*, offered vast experience in using technology for education at the secondary level. He feels the key to improving American competitiveness is improving K-12 education. Mr. Wells stressed that the current problems with US competitiveness in the market place reflects a downward trend in US science and engineering degree attainment as well as a declining student interest in STEM. Large companies need to make this issue a primary focus and work toward solutions that will maximize the potential of the future workforce. Mr. Wells concluded with the charge to attendees that to fully develop our workforce of tomorrow, we must educate the children of today. More money must be provided to hire more and better teachers at the elementary and high school levels.

Dr. Roseann Runte, *President of Old Dominion University*, home to VMASC, provided an overview of M&S and addressed the challenges involved in using M&S as a teaching tool at the university level. In her remarks, Dr. Runte shared her past experiences and the importance of forming partnerships between academia, industry and government organizations to promote and advance the use of technology to reach and teach today's generation of students. As digital natives, the current generation of students, and all future generations, will accept and adopt M&S as a classroom learning tool. President Runte also shared her insights on ways to implement the "Socratic Method" through technology and M&S which will require educators to adopt new methods for teaching and to create new learning environments.

Mr. Jeffrey Goss, *Assistant Dean of the Ira A. Fulton School of Engineering at the University of Arizona*, gave a comprehensive overview of the *Decision Theater* which is a new virtual learning environment that features an advanced technology component referred to as the 'Drum.' The Drum allows up to 25 people to view a high fidelity 3D representation of images and renderings as well as providing an environment for examining future scenarios.

Dr. David Olwell, *Chair of the Department of Systems Engineering at the Naval Postgraduate School, Monterey, California*, delivered an insightful presentation on the importance of professional development in the field of M&S and related sectors. According to Professor Olwell, we [educators] must constantly educate ourselves on the benefits of using M&S so we can pass this knowledge along to others. Dr. Olwell presented progress on the successful development of a pilot professional development program for military personnel working in the areas of modeling, simulations and acquisition.

Mr. Jon Parker, *Assistant Director for Modeling and Computing at the Center on Social and Economic Dynamics for the Brookings Institution*, showcased in his presentation some of the Center's recent work on pandemic flu modeling. Mr. Parker discussed the mathematical foundations required to properly develop and use models and simulations, and gave an overview of current M&S applications to include coupled contagion, epidemic dynamics, obesity, and civil violence.



Mr. Bill Tucker, *Chief Scientist for M&S at Boeing and Chair of the Certification of Modeling and Simulation Professionals Board of Directors*, discussed the importance of the M&S Professional Certificate Program as well as the need for certification and accreditation of M&S professionals to maintain the vitality of M&S as a profession. Mr. Tucker stressed this will become more important to M&S as systems we model grow in complexity and breadth. Mr. Tucker urged everyone in attendance to take action to ensure the quality of the M&S workforce remains at a high level through proper certification.

As discussed by the expert panelists noted above, the missions and purposes of educational institutions—from high school to graduate—are as diverse as they are complex. It is clear the successful growth of modeling and simulation, as both an industry and a discipline, will be closely tied with the introduction and advancement of M&S into curriculum at all levels of education. If this takes place, we will ensure that the next generation of leaders to emerge in academia, government, military and industry will be comfortable and confident in using and promoting modeling simulation as a national critical technology.

SUMMARY

The results of the 3rd Annual Modeling and Simulation Leadership Summit have provided the community of practice with a vision and objectives for the future. Several key recommendations resulting from the event are highlighted below:

- Include M&S as a “core” or required block of instruction for STEM graduate and undergraduate programs.
- Include more M&S in elementary and high schools. Increase the numbers of certified teachers and ensure they are current. One suggested method would have a roving “science instructor” in grade schools if the regular classroom teachers resist teaching themselves. (RADM Lewis noted that retired military provide a good source of expertise in communities across the Nation).
- Use grant funding not just to buy more teachers or computers but also to set up game labs, workshops and competitions to interest the students in underlying education.
- Establish undergraduate degree programs in M&S with career path to Ph.D. at all accredited universities.
- Require M&S college credits in the Defense Acquisition University (DAU), and for entry into the Defense Acquisition Workforce.
- Outline a standard path to recognize M&S credentials (to include on the job training) for M&S certification.
- Set up a Professional M&S exam of the caliber of Professional Engineering or CPA examinations.
- Sponsor a study to quantify impact of M&S industry and identify data and metrics to track progress over time.
- Form an NTSA task force to study and collaborate recommendations to:
 1. Identify roles and responsibilities of a national organization.
 2. Designate structure of national organization with a mixture of academic, industry, and government participants.



3. Provide a way ahead for the M&S industry.
4. Work with Congress on policy issues and national-level support for M&S.
5. Create a list of specific initiatives to foster greater use of M&S in education at all levels.

This watershed event brought together the diversity of thought and practice with experts in their disciplines, all sharing use of M&S as a tool to improve human performance, technical achievement, and our national educational objectives. The movement of the community of practice towards a national organization provides the basis by which these objectives can be furthered. It is incumbent upon all those involved in the M&S community of practice at the local, regional, and national levels to support and further the initiatives recommended by this leadership summit. Together, the community can achieve these objectives and substantially increase the viability, knowledge and skills of our youth in furthering our national objectives and increasing the levels of STEM of our workforce, thereby providing the skills required to support M&S across the many domains requiring its application.



CONGRESSIONAL MODELING AND SIMULATION CAUCUS

Co-Chairs

J. Randy Forbes
R/Virginia 4th District

Solomon Ortiz
D/Texas 27th District

Caucus Members

Duncan Hunter
R/California 52nd District
House Armed Services Committee Ranking Member

Robert Aderholt
R/Alabama 4th District

Doug Lamborn
R/Colorado 5th District

Ken Calvert
R/California 44th District

Jim Matheson
D/Utah 2nd District

John Carter
R/Texas 31st District

Jeff Miller
R/Florida 1st District

Mike Conaway
R/Texas 11th District

Todd Russell Platts
R/Pennsylvania 19th District

Robert "Bud" Cramer
D/Alabama 5th District

Dutch Ruppersberger
D/Maryland 2nd District

Susan Davis
D/California 53rd District

Bobby Scott
D/Virginia 3rd District

Tom Davis
R/Virginia 11th District

Joe Sestak
D/Pennsylvania 7th District

Thelma Drake
R/Virginia 2nd District

James Walsh
R/New York 25th District

Tom Feeney
R/Florida 24th District

Zach Wamp
R/Tennessee 3rd District

Phil Gingrey
R/Georgia 11th District

Heather Wilson
R/New Mexico 1st District

Maurice Hinchey
D/New York 22nd District

Joe Wilson
R/South Carolina 2nd District

Ric Keller
R/Florida 8th District

Rob Wittman
R/Virginia 1st District

The Congressional Modeling & Simulation Caucus continues to exert its influence as a national focus for the simulation and training industry. Under the leadership of Co-Chairmen Representative J. Randy Forbes (VA-04) and Representative Solomon Ortiz (TX-27), Caucus Membership now totals 27 members. The most significant event of recent Caucus activity is the unanimous passage on July 16, 2007 of House Resolution 487 which formally honors the contribution of M&S technology to the security and prosperity of the United States and recognizes M&S as a National Critical Technology. Furthermore, H.Res. 487 acknowledges the significant impacts of M&S on a breadth of fields including, defense, space, national disaster response, medical, transportation and construction. Congress is urged to continue to place emphasis on math and science as key disciplines in elementary and secondary education and to encourage the expansion of M&S within higher education. Finally, H.Res. 487 affirms the need to study the national economic impact of the simulation and training industry.



2111 Wilson Boulevard Suite 400
Arlington, VA 22201-3061
(703) 247-9471
(703) 243-1659
prowe@ndia.org
www.trainingsystems.org