



Workshop on Grand Challenges in Modeling, Simulation, and Analysis for Homeland Security (MSAHS-2010)

March 17-18, 2010
The Center for Infrastructure Protection (CIP),
George Mason University School of Law
FDIC L. William Seidman Training Center,
Arlington, VA

Overview

Modeling and simulation is being adapted to a wide variety of applications that impact our daily lives. When dealing with protecting critical infrastructures such as: Energy, Drinking Water/Wastewater, Transportation, Food & Agriculture, or Chemical, it is critical to take into account the multi-events, multi-threats and cascading effects. Addressing such complex threat structure presents a tremendous challenge—modeling and simulation has proven to be a powerful technique for effectively addressing this challenge.

Workshop Goals and Objectives

The objective of the workshop is to provide a forum for:

- I. Representatives from government agencies to present their strategic vision of MSA focusing on infrastructure protection
II. Researchers from academia, industry and national laboratories to assess the state-of-the-art, identify related R&D challenges, and propose solutions to address these challenges
III. Subject matter experts, practitioners, and state/local representatives to discuss their perspectives on the current state of MSA; (a) where should the technology and science be in 3-5 years?; (b) why are we not there now? (c) what are some of the challenges? (d) what legitimate case(s) can be made to justify needed R&D investments?

The results of the 2010 workshop will help identify the grand challenges in the area of MSA focusing on protecting the nation's infrastructure and key resources. As a result of the 2008 workshop, the Science and Technology (S&T) Directorate at the US Department of Homeland Security was able to publish the report "Future Directions in Critical Infrastructure Modeling & Simulation." The 2008 workshop also resulted in a Broad Agency Announcement (BAA) issued in August 2009. Similar to the 2008 workshop, the output of this 2010 workshop will also be included in a published report and a related BAA is expected to follow.

Classification

The workshop will be conducted as Unclassified.

Workshop Structure, Format, and Output

- Keynote Speakers

Program Committee

- Nabil Adam, DHS-S&T (Program Chair) nabil.adam@dhs.gov
Osman Balci, Virginia Tech
Robin Bloomfield, City U, London, UK
Keith Bergeron, USAF Academy
François Cellier, ETH Zurich, Switzerland
Dean Checknita, DHS-IP-RDMB
Paul Chouinard, CSS, Canada
Jesse Citizen, Jr., OSD-ATL
Jerry Couretas, Lockheed Martin
Gerald Diaz, Homeland Security Institute
James Doyle Jr., Los Alamos NL/NISAC
Steven Fernandez, Oak Ridge NL
Zach Furness, MITRE Corp
Richard Garber, CSS, Canada
Erol Glenbe, Imperial College London
Yacov Y. Haimes, U. of Virginia
Dan Horschel, Sandia NL/NISAC
John Illgen, Northrop Grumman (NGC)
Jim Kadtke, ND./GMU, CIP
Frederick Krimgold, Virginia Tech
Rene LeClaire, Los Alamos NL/NISAC
Marcelo Masera, European Commission
Pieter Mosterman, MathWorks, Inc.
Jean-Pierre Nordvik, European Commission
Mohammad Obaidat, Monmouth U and Society for Modeling & Simulation Intn.
Tuncer Ören, U of Ottawa
Curtis Papke, Idaho NL
James Peerenboom, Argonne NL
Walter M. Polansky, DOE
Paul Trushell, CIPMA Program, Australia
Arch Turner, DHS-S&T
Andrew Vallerand, CSS, Canada
William Waite, Aegis Technologies
Amy Waters, Lawrence Livermore NL
Rhys Williams, Critical Infrastructure Modeling, UK



- Panels, research papers, and posters presentations
- Breakout sessions and reports
- A selected number of authors will be invited to submit an extended version of their papers for publication in an edited volume of the *Simulation Series* published by the Society for Modeling and Simulation International (papers included in the edited volume will go through the standard peer-review process).

## **Society for Modeling and Simulation International (SCS)**

The Society for Modeling & Simulation International (SCS) is a nonprofit, volunteer-driven corporation established in 1952 (original name was Simulation Councils, Inc.). It is managed by a Board of Directors elected by the members. SCS is dedicated to advancing the use of modeling & simulation to solve real-world problems; and, as the principal technical society, is devoted to the advancement of modeling and simulation in all fields. The purpose of SCS is to facilitate communication among professionals in the field of simulation. To this end, SCS organizes sponsors and co-sponsors national and international conferences, and publishes different high caliber journals.

## **Submission Requirements**

**If interested in presenting at the workshop, please submit 5-page paper** (excluding references) in the IEEE style (8.5" x 11", Two-Column Format). The formatting instructions can be downloaded from:

<ftp://pubftp.computer.org/press/outgoing/proceedings/instruct8.5x11.pdf>

Papers not selected for presentations at the workshop will be considered for a poster session.

## **Areas of interest include, but are not limited to:**

- Analysis methodologies and techniques
- Verification, validation and accreditation
- Techniques for real-time simulation
- Human-in-the-loop simulation

## **Sub-topics areas include:**

- Management, development, and reuse of M&S systems (models, tools, services and databases)
- Interoperability of M&S
- Analysis of large scale dynamic systems
- Methodologies to search across the space of possible infrastructure behaviors to identify tipping points that could drive high consequence failures
- Eliciting causal relationships within complex models placing emphasis not only on results, but underlying causal factors and drivers
- Preferred methodology, given question asked, with respect to level of abstraction, level of detail, spatial and temporal resolution, level of aggregation, transparency, and presentation of common set of metrics
- Modeling human behavior, social networks, and their impacts on infrastructure behavior
- Modeling policy, mitigation options and risk and ability of models to support risk reduction in the long-term, and infrastructure investment decisions with appropriate economic modeling and impact of various policy choices
- Estimating sensitivity and robustness
- Novel methods in exploratory modeling, data farming, and multi-resolution modeling
- Effectiveness of various means for client-modeler interaction: Reach-back, Handoff, and Participatory modeling
- Methods and algorithms that enable the creation of models and simulations of complex events enabling the analysis of disruption to interdependent infrastructures in order to allow analysts to



# Homeland Security

## Science and Technology

rapidly make informed estimates of disruption impacts; guide use and development of more detailed models; and assist in developing a high level of confidence in model results

- Modeling & simulation for useful decision support for state, local and private mitigation investment decision-making
- Applying Verification and Validation (V&V) Techniques to Modeling: Lexicon among groups of diverse backgrounds' Validation of catastrophic and other data sparse events, including the human, social, cultural, and behavioral aspects; Does V&V of model components equate to validation of a federated model?; How and when to apply V&V to the lifecycle of a model that is in continuous development and continuously changing "intended use"?; Using graded approaches to V&V: from screening used by program managers to accreditation for operational use of models in high consequence environments.
- Visualization methodology that provides analysts with a responsive and comprehensive view of the geographic, operational, and temporal effects of complex events, taking into account, and revealing critical infrastructures and key resources interdependencies

### Paper Submission

Submission site: <http://www.easychair.org/conferences/?conf=msahs2010>

### Important Dates

- **February, 8, 2010** - Deadline for submitting 5-page paper
- **February 16, 2010** - Author notification (**Extended to Feb. 21, 2010**)
- **February 17, 2010** – Hotel registration deadline (**Extended to Feb. 24, 2010**)
- **March 10, 2010** – Workshop registration deadline

### Registration

Workshop attendance is open subject to space availability. Workshop registration is free. For registration details and an up-to-date copy of this workshop announcement, please visit:

<https://www.enstg.com/signup/passthru.cfm?ConferenceCode=WOR44111>

### Workshop Venue

This workshop venue is CIP, George Mason University (GMU) School of Law. The CIP is nationally and internationally recognized as a leading facilitator and provider of infrastructure protection programs that help secure and defend the United States and its allies. This Center integrates law, policy, and technology to conduct comprehensive infrastructure protection analysis and research, including resiliency studies, security assessments, educational initiatives, and recommendations relevant to improving U.S. and international security. GMU is one of the largest and most diverse universities in the mid-Atlantic region with international visibility in information technology, cyber security, public health, law, public policy and economic analysis.

### Workshop Location

FDIC L. William Seidman Training Center

### Hotel Accommodation

FDIC Residence Hotel

Hotel phone #: 703.516.4630

[http://www.fdic.gov/about/guest\\_services/index.html](http://www.fdic.gov/about/guest_services/index.html)

Alternate Hotel registration POC: Vernie James E-Mail: [vejames@fdic.gov](mailto:vejames@fdic.gov)

**Note:** Please include workshop title in subject line of e-mails related to hotel reservations:

*Subject line: Workshop on Grand Challenges in Modeling, Simulation, and Analysis for Homeland Security*



**Workshop on  
Grand Challenges in Modeling, Simulation, and Analysis for Homeland Security  
AGENDA (DRAFT)  
Wednesday March 17, 2010**

7:30-8:00 am	<b>Registration (Atrium, 3<sup>rd</sup> Floor, Bldg C)</b>		
8:00-8:10 am	Workshop Kickoff <b>Dr. Nabil Adam</b> , DHS-Science and Technology Directorate (A3125 Hove Auditorium)		
8:10-8:25 am	Welcome Address <b>Christopher Doyle</b> , DHS-Science and Technology Directorate (A3125 Hove Auditorium)		
8:25-8:55 am	Keynote Speech <b>Dr. Jacqueline Henningsen, Director for Studies &amp; Analyses, HQ USAF</b> (A3125 Hove Auditorium)		
8:55-9:25 am	DHS Perspective Speaker- <b>TBD</b> (A3125 Hove Auditorium)		
9:25-9:40am	Break		
9:40-11:10 am	Government Panel <b>Dr. Sean O'Brien, DARPA; Warren Fishbein, US Dept. of State; Carmelo Di Mauro, Lombardy Region, Italy; Secretary John Wheeler, NM State Gov; Dr. Douglas Post, DoD</b> Chair: <b>Dr. Jim Kadtko, ND./GMU, CIP</b>		
11:10-12:40 pm	<b>Research Paper Sessions (parallel sessions)</b>		
	Session 1 Dr. Frederick Krimgold, Virginia Tech (A3125 Hove Auditorium)	Session 2 Dr. Keith Bergeron, USAFA (VASQ Auditorium Quad C)	Session 3 Dr. James Peerenboom, Argonne NL (VASQ Auditorium Quad D)
12:40-1:40 pm	Lunch		
1:40-3:10 pm	Industry Panel <b>Dr. Mohamed Belkhat, Northrop-Grumman; Judith Sperring, Boeing; Zubin Wadia, Civiguard; Trevor Ament, ARPC, Australia; Phil Cooley, RTI International</b> Chair: <b>Pieter Mosterman, Mathworks, Inc.</b>		
3:10-3:25pm	Break		
3:25-4:55 pm	<b>Breakout Sessions (Working Groups 1 – 3)</b>		
	WG1 Chair: <b>Osman Balci</b> Co-Chairs: <b>Zach Furness</b> Co-Chair: <b>Rene LeClaire</b> Co-Chair: <b>Arch Turner</b> (A3125 Hove Auditorium)	WG2 Chair: <b>Frederick Krimgold</b> Co-Chairs: <b>William Waite</b> Co-Chair: <b>Steven Fernandez</b> Co-Chair: <b>Gerald Diaz</b> (VASQ Auditorium Quad C)	WG3 Chair: <b>Mohammad Obaidat</b> Co-Chairs: <b>John Illgen</b> Co-Chair: <b>James Peerenboom</b> Co-Chair: <b>Keith Bergeron</b> (VASQ Auditorium Quad D)
4:55-5:10 pm	Break		
5:10-5:55 pm	<b>Breakout Reports</b>		
	WG1 Report, Speakers: <b>Osman Balci; Zach Furness; Rene LeClaire; Arch Turner</b> WG2 Report, Speakers: <b>Frederick Krimgold; William Waite; Steven Fernandez; Gerald Diaz</b> WG3 Report, Speakers: <b>Mohammad Obaidat; John Illgen; James Peerenboom; Keith Bergeron</b> (A3125 Hove Auditorium)		
5:55-6:00 pm	Wrap-Up		



**Workshop on  
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AGENDA (DRAFT)  
Thursday March 18, 2010**

<b>7:30-8:00 am</b>	<b>Registration (Atrium, 3<sup>rd</sup> Floor, Bldg C)</b>		
<b>8:00-8:15 am</b>	DHS Welcome Back <b>Christopher Doyle</b> , DHS-Science and Technology Directorate (A3125 Hove Auditorium)		
<b>8:15-8:45 am</b>	Keynote Speech Speaker- <b>TBD</b> (A3125 Hove Auditorium)		
<b>8:45-10:15 am</b>	CIKR Modeling, Simulation, and Analysis for the DHS Enterprise and the NIPP Partner <b>Dr. Rene LeClaire, LANL/NISAC; Dr. James Doyle, LANL/NISAC; Dan Horschel, SNL/NISAC; Drake Warren, SNL/NISAC</b> Chair: <b>Dean Checknita, DHS-IP</b> (A3125 Hove Auditorium)		
<b>10:15-10:30 am</b>	Break		
	<b>Research Paper Sessions (parallel sessions)</b>		
<b>10:30-12:00 pm</b>	Session 1 <b>Dr. Osman Balci</b> , Virginia Tech (A3125 Hove Auditorium)	Session 2 <b>Curtis Papke</b> , Idaho NL (VASQ Auditorium Quad C)	Session 3 <b>Dr. Gerald Diaz</b> , Homeland Security Institute (VASQ Auditorium Quad D)
<b>12:00-1:00 pm</b>	Lunch		
<b>1:00-2:30 pm</b>	International Panel <b>Dr. Rhys Williams, UK Government; Jean-Pierre Nordvik, European Commission; Paul Trushell, Australian Government; Dr. Jose' Marti, UBC</b> Chair: <b>TBD</b> (A3125 Hove Auditorium)		
<b>2:30-2:45 pm</b>	Break		
	<b>Breakout Sessions (Working Groups 1 – 3)</b>		
<b>2:45-4:15 pm</b>	<b>WG1</b> Chair: <b>Osman Balci</b> Co-Chairs: <b>Zach Furness</b> Co-Chair: <b>Rene LeClaire</b> Co-Chair: <b>Arch Turner</b> (A3125 Hove Auditorium)	<b>WG2</b> Chair: <b>Frederick Krimgold</b> Co-Chairs: <b>William Waite</b> Co-Chair: <b>Steven Fernandez</b> Co-Chair: <b>Gerald Diaz</b> (VASQ Auditorium Quad C)	<b>WG3</b> Chair: <b>Mohammad Obaidat</b> Co-Chairs: <b>John Illgen</b> Co-Chair: <b>James Peerenboom</b> Co-Chair: <b>Keith Bergeron</b> (VASQ Auditorium Quad D)
<b>4:15-4:30 pm</b>	Break		
	<b>Breakout Reports</b>		
<b>4:30-5:15 pm</b>	WG1 Report, Speakers: <b>Osman Balci; Zach Furness; Rene LeClaire; Arch Turner</b> WG2 Report, Speakers: <b>Frederick Krimgold; William Waite; Steven Fernandez; Gerald Diaz</b> WG3 Report, Speakers: <b>Mohammad Obaidat; John Illgen; James Peerenboom; Keith Bergeron</b> (A3125 Hove Auditorium)		
<b>5:15-5:30 pm</b>	Adjourn		



Research Papers  
Wednesday March 17, 2010

Session 1: A3125 Hove Auditorium

Chair: Frederick Krimgold, Virginia Tech

1. "Computation of Things for Sustainable Development", Justyna Zander (Harvard U) and Pieter Mosterman (MathWorks)\*\*
2. "Requirements for Standards Based Dynamic Interoperation of Critical Infrastructure Models", Bernard Zeigler (RTSYnc, Corp and C4I Center) and Steven Hall (Lockheed Martin Space Systems Company)\*\*
3. "Modeling and Simulation for Supply Chain Decisions in Influenza Pandemic" Ali Ekici, Pinar Keskinocak and Julie Swann (Georgia Tech)\*\*
4. "Wide-Area, Real-time simulation and Visualization of Static and Dynamic Data", Michael Pack (U of Maryland)\*
5. "Assessing and Mitigating the Vulnerability of Critical Infrastructure Using Fully-Coupled Blast Effects Modeling", Larry McMichael, Jonathan Margraf, Lee Glascoe and Charles Noble (Lawrence Livermore NL)\*

Session 2: VASQ Auditorium Quad C

Chair: Keith Bergeron, USAFA

1. "Grand Challenges in Modeling, Simulation and Analysis: Extraction and Visualization of Power Systems", Steven Fernandez and Olufemi Omitaomu (Oak Ridge NL)\*\*
2. "Random Neural Network for Emergency Management", Erol Gelenbe and Stelios Timotheou (Imperial College); and David Nicholson (BAE Systems Ltd)\*\*
3. "ENEA Platform for Critical Infrastructures Modeling and Simulation", Antonio Di Pietro, Sandro Bologna, Elisa Castorini, Gregorio D'Agostino, Vincenzo Fioriti, Elena Marchei, Silvia Ruzzante and Alberto Tofani (ENEA)\*\*
4. "Plural Models for Adaptive Adversary Modeling", Dennis Buede, Suzanne Mahoney, Seth Guikema and Barry Ezell (Innovative Decisions, Inc)\*
5. "V&V Methodology for Socio-Cultural Models", Julie Bouchard (Sandia NL)\*

Session 3: VASQ Auditorium Quad D

Chair: James Peerenboom, Argonne NL

1. "Lessons Learned from Infrastructure Assessment and Interdependency Characterization of the New Madrid and Wabash Valley Seismic Zones", James Kavicky, Edgar Portante, Stephen Folga and Ronald Fisher (Argonne NL)\*\*
2. "Modeling and Analysis for Robust Risk Management: PortSec Resource Allocation Decision Support Framework", Anthony Barrett (USC)\*\*
3. "Developing a New Modeling and Simulation Methodology: A Grand Challenge", Osman Balci (Virginia Tech)\*\*
4. "Leveraging DHS Modeling and Simulation Investments to Support State and Local Decision Makers", Rene LeClaire (Los Alamos NL); Gary Hirsch (Creator of Learning Environments); and Alisa Bandlow (Sandia NL)\*
5. "Enabling Modeling and Simulation in the U.S. Department of Homeland Security", Charles Hutchings (DHS-S&T)\*

\*\* 20 minute presentation

\* 10 minute presentation



Research Papers  
Thursday March 18, 2010

Session 1: A3125 Hove Auditorium

Chair: Osman Balci, Virginia Tech

1. "Approaches to Modeling and Simulation for Dynamic, Distributed Cyber-Physical Systems", Kurt Rohloff, Partha Pal, Michael Atighetchi and Richard Schantz (BBN Technologies); Kishor Trivedi (Duke U); and Christos Cassandras (Boston U)\*\*
2. "Modeling of Economic Impact of Implementing Counter-Measures on Container Terminals and Evaluating Traffic Flow on Adjacent Road Network", Afshin Abadi and Petros Ioannou (USC)\*\*
3. "DHS S&T Center of Innovation at USAFA FY09/FY10 Rare Events Games", Terry Pierce (DHS-S&T); and Keith Bergeron (USAFA)\*
4. "A Knowledge Sharing Framework for Critical Infrastructure Modeling, Simulation, and Analysis", Sanjay Jain (GWU); Charles Hutchings (DHS-S&T); Y. Tina Lee and Charles McLean (NIST)\*
5. "Reference World: A Multi-Capability, Integrated, Information and Simulation Environment for Infrastructure Protection", Alok Chaturvedi (Purdue U); Bala Chidambaram, Saurabh Sircar, Susan Martin and Michelle Crivella (The Boeing Company); Midh Milpuri and Zeb Forney (Simulex, Inc.)\*
6. "QEM@: Modeling and Simulation for Protection Against Chemical, Biological, and Radiological Airborne Hazards", Sam Martin and Michael Boehler (IEM, Inc.)\*
7. "Modeling Biological Attacks and their Cascading Consequences", Dennis McBride, Kristofer Younger, and Bin Yu (Quantum Leap Innovations); and Amy Kircher (U.S. Northern Command)\*

Session 2: VASQ Auditorium Quad C

Chair: Curtis Papke, Idaho NL

1. "Large-Scale Simulation Modeling of Ports and Waterways", Tayfur Altiok (Rutgers U)\*\*
2. "Critical Infrastructure Modeling: An Approach to Characterizing Interdependencies of Complex Networks & Control Systems", Lyle Roybal and Shane Cherry (Idaho NL)\*\*
3. "Managing Debris Collection and Disposal Operations", Ozlem Ergun, Jose Antonio Carbajal, Pinar Keskinocak, Kael Stilp and Monica Villarreal (Georgia Tech)\*
4. "PortSec: A Framework For Modeling Complex Port Infrastructures", Michael Orosz, Anthony Barrett, Jennifer Chen, Andrew Blair and Isaac Maya (USC)\*
5. "Selected Survey of Infrastructure Disruption Events and Consequences", Dennis Powell, Rebecca Haffenden and Rene LeClaire (Los Alamos NL)\*
6. "Presenting a modeling of interdependencies. Application for planning major events", Benoit Robert, Luciano Morabito and Gabriel Yan (École Polytechnique de Montréal)\*
7. "Infranomics: A Discipline-of-disciplines for the XXIst Century", Adrian Gheorghe (Old Dominion U); and Marcelo Masera (IPSC)\*

Session 3: VASQ Auditorium Quad D

Chair: Gerald Diaz, Homeland Security Institute

1. "Models and Algorithms for Radiation Detection", Mani Chandy, Julian Bunn and Annie Liu (Cal State U)\*\*
2. "An Effective Rare-event Simulation Technique and Its Application to Cyber Security and Electric Grid", John Shortle and Chun-Hung Chen (GMU); Martin Fischer and Denise Masi (Noblis, Inc.)\*
3. "Adaptive Infrastructure Protection: Machine Learning Approach to Data Collection", Janusz Wojtusiak, Steven Prior and Donald Thompson (GMU)\*



# Homeland Security

## Science and Technology

4. “Overcoming Challenges in Critical Infrastructure Resilience Analysis: A New Framework for Resilience Assessments”, Drake Warren, Eric Vugrin and Mark Ehlen (Sandia NL)\*
5. “High-Speed Real-Time Simulation and Infrastructure Protection”, Roy Crosbie and Nari Hingorani (Cal State U)\*
6. “Authentication Based Communication in Wireless Home Area Mesh Networks”, Sanjay Dhurandher, Rahul Garg and Dhruv Varma (U of Delhi); and Mohammad Obaidat (Monmouth U)\*

\*\* 20 minute presentation

\* 10 minute presentation