

# PROCEEDINGS OF SPIE

## ***Modeling and Simulation for Military Operations IV***

**Dawn A. Trevisani**

*Editor*

**15–16 April 2009**

**Orlando, Florida, United States**

*Sponsored and Published by*  
SPIE

**Volume 7348**

Proceedings of SPIE, 0277-786X, v. 7348

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Modeling and Simulation for Military Operations IV, edited by Dawn A. Trevisani, Proc. of SPIE Vol. 7348,  
734801 · © 2009 SPIE · CCC code: 0277-786X/09/\$18 · doi: 10.1117/12.834275

Proc. of SPIE Vol. 7348 734801-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Modeling and Simulation for Military Operations IV*, edited by Dawn A. Trevisani, Proceedings of SPIE Vol. 7348 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X

ISBN 9780819476142

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2009, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at [copyright.com](http://copyright.com). Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/09/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE**   
Digital Library

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

# Contents

vii *Conference Committee*

---

## MODELING FOR ISR

---

- 7348 02 **A stochastic process algebraic abstraction of detection evidence fusion in tactical sensor networks** [7348-01]  
D. J. Thornley, D. F. Gillies, Imperial College London (United Kingdom); C. Bisdikian, IBM Thomas J. Watson Research Ctr. (United States)
- 7348 03 **A simulation program for the Firefinder weapon locating radar** [7348-02]  
E. P. Lam, H. W. Birrell, Thales-Raytheon Systems Co. LLC (United States)
- 7348 04 **Updates on fuze and SAR modes in RF channel for Irma 5.2 signature prediction model** [7348-03]  
C. Willis, C. Coker, Air Force Research Lab. (United States); B. Thai, O. Aboutalib, J. Pau, Northrop Grumman Corp. (United States)
- 7348 05 **Generation of large scale urban environments to support advanced sensor and seeker simulation** [7348-04]  
J. Giuliani, D. Hershey, D. McKeown, Jr., TerraSim, Inc. (United States); C. Willis, T. Van, Air Force Research Lab. (United States)

---

## ADVANCED IMAGING CAPABILITIES

---

- 7348 06 **A practical enhanced-resolution integrated optical-digital imaging camera (PERIODIC)** [7348-05]  
M. Mirotznik, S. Mathews, The Catholic Univ. of America (United States); R. Plemmons, P. Pauca, T. Torgersen, R. Barnard, B. Gray, Q. Zhang, Wake Forest Univ. (United States); J. van der Gracht, HoloSpex, Inc. (United States); P. Curt, M. Bodnar, EM Photonics, Inc. (United States); S. Prasad, The Univ. of New Mexico (United States)
- 7348 07 **Development of a robust digital lock-in algorithm using a closed form least squares method** [7348-06]  
E. L. Stein, Jr., Univ. of Delaware (United States); C. A. Schuetz, Phase Sensitive Innovations, Inc. (United States); D. W. Prather, Univ. of Delaware (United States)
- 7348 08 **Development of a GPU-accelerated super-resolution solver** [7348-07]  
A. L. Paolini, F. Ortiz, D. K. Price, K. E. Spagnoli, EM Photonics, Inc. (United States)
- 7348 09 **Simulation for close air support** [7348-08]  
D. Hench, Air Force Research Lab. (United States)

---

## VV&A FOR M&S

---

- 7348 0C **Assessing risk levels of verification, validation, and accreditation of models and simulations** [7348-11]  
J. N. Elele, Naval Air Warfare Ctr., Naval Air Systems Command (United States)
- 7348 0D **P-8A Poseidon strategy for modeling and simulation verification validation and accreditation (VV&A)** [7348-12]  
D. L. Kropp, Naval Air Systems Command (United States)

---

## MODELING FOR THE DECISION MAKER

---

- 7348 0E **Adversarial intent modeling using embedded simulation and temporal Bayesian knowledge bases** [7348-13]  
N. J. Pioch, J. Melhuish, A. Seidel, BAE Systems (United States); E. Santos, Jr., D. Li, Dartmouth College (United States); M. Gorniak, Air Force Research Lab. (United States)
- 7348 0F **Developing methods for timely and relevant mission impact estimation** [7348-14]  
M. R. Grimaila, Air Force Institute of Technology (United States); L. W. Fortson, J. L. Sutton, Air Force Research Lab. (United States); R. F. Mills, Air Force Institute of Technology (United States)
- 7348 0G **Training for emergency response with RimSim:Response!** [7348-15]  
B. D. Campbell, K. A. Schroder, Univ. of Washington (United States)
- 7348 0H **Five-dimensional simulation for advanced decision making** [7348-16]  
C. Lammers, J. Steinman, M. Valinski, WarpIV Technologies, Inc. (United States); K. Roth, Air Force Research Lab. (United States)

---

## INFORMATION NETWORK TECHNOLOGIES

---

- 7348 0I **Addressing tomorrow's DMO technical challenges today** [7348-17]  
J. R. Milligan, Air Force Research Lab. (United States)
- 7348 0K **NeoCITIES: an experimental test-bed for quantifying the effects of cognitive aids on team performance in C2 situations** [7348-19]  
D. B. Hellar, D. L. Hall, The Pennsylvania State Univ. (United States)
- 7348 0L **AN-CASE NET-CENTRIC modeling and simulation** [7348-20]  
P. J. Baskinger, M. C. Chruscicki, Northrop Grumman Information Technology (United States); K. Turck, Air Force Research Lab. (United States)

---

## VEHICLE AND TERRAIN MODELING

---

- 7348 0M **Excitation event design and accuracy verification procedure for high-fidelity terrain measurement systems** [7348-21]  
H. Smith III, J. B. Ferris, Virginia Polytechnic Institute and State Univ. (United States)

- 7348 ON **Review of current developments in terrain characterization and modeling** [7348-22]  
H. M. Chemistruck, Z. R. Detweiler, J. B. Ferris, Virginia Polytechnic Institute and State Univ. (United States); A. A. Reid, D. J. Gorsich, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States)

---

**M&S TECHNOLOGIES AND APPLICATIONS**

---

- 7348 OQ **A GPU-accelerated toolbox for the solutions of systems of linear equations** [7348-25]  
J. R. Humphrey, A. L. Paolini, D. K. Price, E. J. Kelmelis, EM Photonics, Inc. (United States)
- 7348 OR **Future requirements for modeling and simulation technology** [7348-26]  
M. J. Leite, Science Applications International Corp. (United States)
- 7348 OS **Investigating the conducted EMI issues in fighter aircraft power supplies** [7348-27]  
A. Sharma, V. Agarwal, Indian Institute of Technology, Bombay (India)
- 7348 OT **Design and analysis of a chip-scale photonic analog-to-digital converter** [7348-28]  
A. Sharkawy, EM Photonics, Inc. (United States); C. Chen, B. Miao, S. Shi, D. Prather, Univ. of Delaware (United States)

*Author Index*



# Conference Committee

## *Symposium Chairs*

**Ray O. Johnson**, Lockheed Martin Corp. (United States)  
**Michael T. Eismann**, Air Force Research Laboratory (United States)

## *Conference Chair*

**Dawn A. Trevisani**, Air Force Research Laboratory (United States)

## *Program Committee*

**James N. Elele**, NavAir (United States)  
**Eric J. Kelmelis**, EM Photonics, Inc. (United States)  
**Alex F. Sisti**, Air Force Research Laboratory (United States)

## *Session Chairs*

- 1 Modeling for ISR  
**Carla B. Willis**, Air Force Research Laboratory (United States)
- 2 Advanced Imaging Capabilities  
**Ahmed S. Sharkawy**, EM Photonics, Inc. (United States)
- 3 VV&A for M&S  
**Mike Leite**, Science Applications International Corporation  
(United States)
- 4 Modeling for the Decision Maker  
**Mark S. Mirotznik**, The Catholic University of America (United States)
- 5 Information Network Technologies  
**Lee Stein**, University of Delaware (United States)
- 6 Vehicle and Terrain Modeling  
**Hurtford Smith III**, Virginia Polytechnic Institute and State University  
(United States)
- 7 M&S Technologies and Applications  
**Mary C. Chruscicki**, Northrop Grumman Information Technology  
(United States)

