Michael R. Hieb

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PROFILE

Research Associate Professor at George Mason University's Center for Excellence in Command, Control, Communications, Computers and Intelligence (C4I Center) and a Technical Director for the Army's Simulation to C4I Overarching IPT (SIMCI OIPT). Dr. Hieb is the C4I Center's Lead for its Modeling and Simulation (M&S) Technology Focus Area and the Director of its International C2 Testbed. World-class expertise in formalizing the information required for Command and Control (C2) of military organizations as well as civil and non-governmental organizations. Co-founder of the IEEE Standard "Coalition Battle Management Language." Established NATO and IEEE working groups in the fields of Computer Science, Networking, Semantics, and Computational Linguistics.

EDUCATION

Doctor of Philosophy in Information Technology   1996
George Mason University
PhD Dissertation title: Training Instructable Agents Through Plausible Version Space Learning.
PhD Advisor: Prof. Gheorghe Tecuci

Master of Science in Systems Engineering   1990
George Washington University

Bachelor of Science in Nuclear Engineering   1980
University of California, Santa Barbara, California

CURRENT ACADEMIC AFFILIATIONS

C4I & CYBER CENTER   Since 2006
Volgenau School of Engineering - George Mason University
Research Associate Professor

PERSONAL DATA AND CONTACT DETAILS

D.o.B.: 1958   **Place**:   Lodi, California – United States
Citizenship: United States   **Clearance:** U.S. DoD Secret

Work Address: C4I & Cyber Center, George Mason University
4400 University Drive, MS 4B5
Engineering Building, room 4609
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SHORT BIO

Dr. Hieb is a Research Associate Professor at George Mason University's Center for Excellence in Command, Control, Communications, Computers and Intelligence (C4I Center), a Technical Evaluator for NATO's Modeling and Simulation Group and a Technical Director for the Army's Simulation to C4I Overarching IPT (SIMCI OIPT). Dr. Hieb has over 120 Publications and has presented his research on Command Intent to many international C2 Forums. In 2017 Dr. Hieb performed a study on Megacities for DARPA. Dr. Hieb also was the Principal Investigator for several major projects at the C4I Center, including a large 8 Year Research Project from the Army Geospatial Center on integrating C2, M&S and Geospatial functionality. He received his PhD in Information Technology from George Mason

University in 1996, a MS in Artificial Intelligence & Human Factors from George Washington University and a BS in Nuclear Engineering from UC Santa Barbara.

Dr. Hieb worked for several technology companies from 1996 to 2006 including SAIC, AB Tech, ITTRI, And Alion S&T.   He oversaw projects, performed research and provided technical direction for the Defense Modeling and Simulation Office (DMSO) and the Army Modeling and Simulation Office (AMSO).

Prior to his work with the military, Dr. Hieb was a Nuclear Engineer with General Electric, and worked on testing and startup at three Nuclear Power plants from 1980 to 1987 (Grand Gulf I at Port Gibson, MS; Riverbend I at Baton Rouge, LA; and Nine Mile Point II at Oswego, NY).

Dr. Hieb is an accomplished cyclist and was the Mississippi Road Champion in 1980. He was the Co-Chair of the Potomac Pedalers Touring Club's (PPTC) Century (100 mile ride) between 2003-2005, growing the event from 400 to 2,000 riders.

MAJOR COURSES AND CERTIFICATES

General Electric Senior Reactor Operator Certification   1983
Black Fox Nuclear Power Plant Training Facility, Tulsa, Oklahoma

AWARDS AND SPECIAL RECOGNITIONS

NATO Scientific Achievement Award for Modelling & Simulation Group 048   2013
Technical Activity MSG-048 (Assessment of Coalition Battle Management
Language)

Willard S. Vaughan, Jr. Best Student Paper at the International Command and   2008
Control Research Technology Symposium with Per Gustavsson (a Ph.D. Student in
Sweden)
*13th International Command and Control Research Symposium, Bellevue, WA,
USA.*

SIWzie Awards for the Simulation Interoperability Workshops – 11 of Dr.   1999-
Hieb's technical papers on his C4I work with the Army were awarded the "SIWzie"   2005
and put on the Simulation Interoperability Workshop's Recommended Reading List

TEACHING

TEACHING: SELECTED PARTICIPATION IN GRADUATE COMMITTEES

J. Tim Balint – PhD graduated in 2017   Current
George Mason University – Fairfax, VA, USA

PhD Dissertation : Automated Extraction Of Action Semantics For Embodied
Virtual Agents Using Textual Knowledge Bases

Henrique Costa Marques – PhD, graduated in 2012   2012
Instituto Tecnológico de Aeronáutica – São José dos Campos, Brazil

PhD Dissertation: Semantic Layer to Support Military Planning Systems
Interoperability

RESEARCH

RESEARCH: SELECTED CURRENT AND PAST GRANTS

EOIR / US Army   Current
Fund#: 203569/204080   **Award #**: S15-06027/S16-06071
Role: Principal Investigator
Principle Investigator on award for SIMCI OIPT to evaluate interoperability
solutions for the US Army's PEO-STRI and PEO-C3T
Total Award Amount: $206K   **Total Award Period**: 05/26/2015 – 08/31/2019

DARPA
Fund#: 204090   **Award #**: HR0011-17-C-0032   **Role**: Principal Investigator
Principle Investigator on award to perform a study for DARPA on how to provide
analysis and information support for operations within a Megacity
Total Award Amount: $375K   **Total Award Period**: 01/24/2017 – 07/24/2017

CACI / Night Vision Electronics Sensor Directorate / US Army   Past
Fund#: 203310   **Award #**: S15-131950   **Role**: Principal Investigator
Principal Investigator on award to develop gaming technologies for advanced sensor
training systems.
Total Award Amount: $120K   **Total Award Period**: 07/14/2014 – 06/31/2015

Army Geospatial Center / US Army   Past
Fund#: 202494   **Award #**: W9132V-11-C-007   **Role**: Principal Investigator
Principal Investigator on award to develop Command and Control Algorithms for
Geospatial Reasoning.
Total Award Amount: $2.1 M.   **Total Award Period**: 9/27/2011 - 10/25/2015

Alion / US Army   Past
Fund#: 202230   **Award #**: SUB1113616MDT_   **Role**: Principal Investigator
Principle Investigator on award for SIMCI OIPT to develop recommendations on
Simulation interfaces to Command and Control for the US Army Modeling and
Simulation Office.
Total Award Amount: $1.1M.   **Total Award Period**: 8/10/10-5/31/12

Northrup Grumman / Army Geospatial Center / US Army   Past
Fund#: 201941   **Award #**: 7500067840   **Role**: Principal Investigator
Principal Investigator on award to develop Geospatial Representations and Reasoning for a US
DoD Joint Technology Concept Demonstration.
Total Award Amount: $1.6 M   **Total Award Period**: 09/28/2009-07/20/11

Army Geospatial Center / US Army   Past
Fund#: 201188   **Award #**: W9132V-07-C0006   **Role**: Co-Principal Investigator
Principal Investigator on award to develop automated methods of geospatial
reasoning for C4I systems. Led five multidisciplinary teams
Total Award Amount: $5.5M   **Total Award Period**: 12/20/06-12/20/10

RESEARCH: DISTINGUISHED PRESENTATIONS & PANELS

MILCOM international conference for military communications on October 24, 2017 at Baltimore, MD.
Panel Participant: *"Can We Trust the Robots?"*

85th Military Operations Research Society Symposium on June 20, 2017 at USMA, Westpoint, NY.
Presented: *"Modeling and Simulation for Homeland Security: Challenges and Opportunities."*

21th International Command and Control Research Technology Symposium on September 8, 2016 at London, UK.
Panel Participant: *IoT, Autonomy, and Things to Come (Session 13)*

Esri International User Conference on July 26, 2012 at San Diego, CA.   2012
Presented: *"Aligning Operational and Simulation Terrain for Command and Control" (UC1148)*

AFCEA-GMU C4I Center Symposium   2012
Presented: *"The Collaborative International Command and Control Research Testbed: A Simulation Based Environment for Concept Development and Assessment"*

XII International Symposium Electronic Warfare (SIGE 2010), Brazil   2010
Keynote Speaker

IDGA C2 Summit, Arlington, VA   2010
Invited Speaker

M&S in the Global Information Grid Tutorial at the Interservice Training and Education Conference (ITSEC)   2004
Invited Speaker

C4I Tutorial at the Fall Simulation Interoperability Workshop, Orlando, FL.   2002
Invited Speaker

C4I Tutorial at the Fall Simulation Interoperability Workshop, Orlando, FL.   2001
Invited Speaker

NATO Land Group 1, NATO HQ in Brussels, Belgium   2001
Invited Speaker

RESEARCH: BOOK ARTICLES AND CHAPTERS (5)

Schade, U. and Hieb, M.R. 2009. Battle Management Language. In Grosche, J. & Wunder, M. (Eds.), *Verteilte Führungsinformationssysteme*. Heidelberg, Germany: Springer. pp. 235-245.

Dybala, J. and Hieb, M.R. 1998. Knowledge Acquisition and Learning. In *Building Intelligent Agents: An Apprenticeship Multistrategy Learning Theory, Methodology, Tool and Case Studies*, G. Tecuci, Academic Press, London, pp. 79-146.

Hieb, M. and Hille, D. 1998. Case Study: Virtual Agent for Distributed Interactive Simulations. In *Building Intelligent Agents: An Apprenticeship Multistrategy Learning Theory, Methodology, Tool and Case Studies*, G. Tecuci, Academic Press, London, pp. 274-293.

Wnek, J. and Hieb, M.R. 1993. Bibliography of Multistrategy Learning Research. In *Machine Learning: A Multistrategy Approach*, Volume IV, Eds. R.S. Michalski and G. Tecuci, Morgan Kaufmann, San Mateo, CA, pp. 657-729.

Silverman, B.G., Hieb, M.R. and Mezher, T. 1991. In Unsupervised Discovery in an Operations Control Setting. in *Knowledge Discovery in Databases*, Eds. Gregory Piatetsky-Shapiro and William Frawley, AAAI Press, pp. 431-448.

RESEARCH: REFEREED JOURNAL PAPERS (8)

Gustavsson, P. M., Hieb, M.R., Moore, P.R., Eriksson, P., and Niklasson, L. 2011. Operations Intent and Effects Model. *The Journal of Defense Modeling and Simulation: Applications, Methodology, Technology.* vol. 8, no. 1 (January): 37-59. SAGE Publications. DOI: 10.1177/1548512910379477.

Schade, U. and Hieb, M.R. 2007. Improving Planning and Replanning: Using a Formal Grammar to Automate Processing of Command and Control Information for Decision Support. *C2 Journal.* vol. 1, no. 2 (June): 69-90.   CCRP. (Available at: http://www.dodccrp.org/files/IC2J_v1n2_04_Schade.pdf.)

Pullen, J. M., Brunton, R., Brutzman, D., Drake, D., Hieb, M.R., Morse, K.L., and Tolk, A. 2004. Using Web Services to Integrate Heterogeneous Simulations in a Grid Environment. *Proceedings of the International Conference on Computational Science* 2004, Krakow, Poland, June 2004. Also published in a Special Issue on Grid Computing, *Future Generation Computer Systems Journal.* vol. 21, no. 1 (January 2005): 97-106. Elsevier.

Tecuci, G. and Hieb, M.R. 1996. Teaching Intelligent Agents: the Disciple Approach. *International Journal of Human Computer Interaction.* vol. 8, no. 3: 259-285. Lawrence Erlbaum Associates Inc.

Tecuci, G., Hieb M.R. and Dybala T. 1995. Teaching an Automated Agent to Monitor the Electrical Power System of an Orbital Satellite, *Telematics and Informatics*, vol. 12, no. 3-4: 229-245. Elsevier.

Tecuci, G. and Hieb, M.R. 1994. Consistency-driven Knowledge Elicitation: Using a Machine Learning-oriented Knowledge Representation to Integrate Learning and Knowledge Elicitation in NeoDISCIPLE, *Knowledge Acquisition Journal,* vol. 6, no. 1. pp. 23-46. Elsevier.

Hieb, M.R. and Michalski, R.S. 1993. Multitype Inference in Multistrategy Task-adaptive Learning: Dynamic Interlaced Hierarchies. *Informatica: An International Journal of Computing and Informatics*, vol 17, no 4: 399-412.

Hieb, M.R., Silverman, B.G. and Mezher, T. 1992. Rule Acquisition for Dynamic Engineering Environments. *Heuristics – The Journal of Knowledge Engineering,* Winter, vol. 5, no. 4: 72-82.

RESEARCH: REFEREED CONFERENCE AND WORKSHOP PAPERS (102)

2017

Hieb M.R., Peterson, M.S., Kelly, S.P., Riecken, M., Vassiliou, M. (2017). Exploring Trust and Autonomy in a Hybrid Human/Robotic Force. Paper 32, In *Proceedings of the 22th International Command and Control Research Technology Symposium*, Santa Monica, CA: DoD Command and Control Research Program. November.

2016

Fernandes, R., Hieb M. R. and Costa, P.C.G. 2016. Levels of Autonomy: Command and Control of Hybrid Forces. Paper I-060. *The Proceedings of the 21th International Command and Control Research Technology Symposium,* London, UK: DoD Command and Control Research Program. September.

Monteiro, M., Sarmento, T., Barreto, A., and Costa, P.C.G. 2016. An Integrated Mission and Cyber Simulation for Air Traffic Control.   Paper FrC-T7.4. *IEEE 19th International Conference on Intelligent Transportation Systems (ITSC 2016),* Rio de Janeiro, Brazil, November 1-4, 2016.

Riecken, M., and Hieb, M.R. 2016. The Changing Paradigm for Integrated Simulation in Support of Command and Control (C2). Paper 9848-1. SPIE *(Society of Photographic Instrumentation Engineers) Defense + Security Symposium, Modeling and Simulation for Defense and Commercial Systems and Applications XI*, Baltimore, MD, April.

West, J., Jensen, D. and Hieb M.R. 2016. Developing Numerical C2 Models of Complex Operations: A Case Study of the Pearl Harbor Attack. Paper I-44. *The Proceedings of the 21th International Command and Control Research Technology Symposium,* London, UK: DoD Command and Control Research Program. September.

2015

Balint, J., Allbeck, J.M. and Hieb, M.R. 2015. Automated Simulation Creation from Military Operations Documents. Paper 15227. *The Interservice/Industry Training, Simulation & Education Conference,* Orlando FL, November.

Hieb M. R. 2015. Command and Control in Multiteam Systems: Measuring and Building Trust between People and Groups. Paper 111. *The Proceedings of the 20th International Command and Control Research Technology Symposium*.

Hieb M. R., 2015. Developing and Communicating Intent for Distributed Staff. Paper 112. *The Proceedings of the 20th International Command and Control Research Technology Symposium*.

2014

Barreto, A., Costa, P.C.G.; and Hieb, M.R. (2014) Cyber-Argus: Modeling C2 Impacts of Cyber Attacks. Paper I-096. *Proceedings of the 19th International Command and Control Research and Technology Symposium*. Alexandria, VA: DoD Command and Control Research Program. June.

Hieb, M.R., Riecken, M., Gearhart, T. and Powers, J. 2014. Beyond Interoperability – Simulation Services for Command and Control. Paper 14F-SIW-059. *Proceedings of the Fall 2014 Simulation Interoperability Workshop,* Orlando, FL: SISO/IEEE CS Press, September. ISBN: 9781634393898.

Neto, J. B., Hieb, M.R., Paulo, P.C.G. and Hirata, C. M. 2014. Agility through Automated Negotiation for C2 Services, Paper I-064, *The Proceedings of the 19th International Command and Control Research and Technology Symposium*, Arlington, VA:DoD Command and Control Research Program. June.

2013

Gustavsson, P.M. and Hieb, M.R. 2013. The Operations Intent and Effects Model: A Command and Control Methodology for Increased Automation. Paper I-120. *Proceedings of the International Command and Control Research and Technology Symposium*, Alexandria, VA: DoD Command and Control Research Program. June.

Neto, J. B., Hieb, M.R., Hirata, C. M. and Paulo, P.C.G. 2013. Simulating the Allocation of Resources for Command and Control with E-Contracts. Paper 13190. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference*, Orlando, FL. December.

Scrudder, R., Foley, P., Seagrave, M. and Hieb, M.R. 2013. Bridging the Chasm: Aligning Simulation and C2 Geospatial Data Production, Paper 13186*, Proceedings of the Interservice/Industry Training, Simulation & Education Conference*, Orlando, FL, December [Honorable Mention for Best Paper Award].

Stanzione, T., Maxwell, D., and Hieb M.R. 2013. Agile Terrain for Integrated Simulation and C2 Using Open Standards. Paper 13189. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference*, Orlando, FL, December.

2012

Barreto, A., Yano, E., Hieb, M.R. 2012. Developing a Complex Simulation Environment for Evaluating Cyber Attacks**.** Paper 12248. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference.* Orlando FL, November.

Hieb, M.R. and Maxwell, D. 2012. Converging Simulation and C2: Improving Foundation Data Consistency and Affordability**.** Paper 12326. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference.* Orlando FL, November. [Awarded Best Paper of the Policy, Standards, Management, and Acquisition (PSMA) Subcommittee, One of Six Papers Nominated as Best Conference Paper].

2011

Marques, H.C., Costa, P.C.G., de Oliveira, J.M.P., Hieb, M.R., and Barreto, A. 2011. Distributed Simulation as a Planning Support Tool for Relief Operations Conference. *Proceedings of the XIII SIGE - Simpósio de Aplicações Operacionais em Áreas de Defesa.* São José dos Campos, Brazil. ISBN: 19837402. October.

Schade, U., Haarmann, B., and Hieb, M.R. 2011. A Grammar for Battle Management Language. *Proceedings of the 2011 IEEE/ACM 15th International Symposium on Distributed Simulation and Real Time Applications.* pp.155-159. IEEE/ACM Press. ISBN: 978-1-4577-1643-0. September.

2010

Costa, P.C.G., Zeigler, B.; Hieb, M.; and Laskey, K.B. 2010. Probabilistic Ontologies And Pragmatics For Complex Systems Integration. Paper I-062. *Proceedings of the Fifteenth International Command and Control Research and Technology Symposium.* Santa Monica, CA:DoD Command and Control Research Program. June.

Schade, U. and Hieb, M.R. (2010). Linguistic Principles of C2 Languages and Grammars. Paper 10S-SIW-036. *Proceedings of the Spring Simulation Interoperability Workshop*, Orlando, FL: SISO/IEEE CS Press, April. ISBN: 978-1-6173-8113-3.

2009

Gustavsson, P.M., Michael R. Hieb, Lars Niklasson, Patric Eriksson, and Philip Moore. 2009. Formalizing Operations Intent an Effects for Network-Centric Applications. *Proceedings of the 42nd Hawaii International Conference on System Sciences*, pp. 1-10. Big Island, Hawaii: IEEE. ISBN: 978-0-7695-3450-3. March.

Gustavsson, P.M., Michael R. Hieb, and Joakim Wemmergård. 2009. The Operations Intent and Effects Model and Formalism - A contribution to the ongoing C-BML and MSDL Standardization. Paper 09S-SIW-013. *Proceedings of the Spring Simulation Interoperability Workshop.* San Diego, CA: SISO/IEEE CS Press. ISBN: 978-0-7695-3450-3. March.

Gustavsson, P.M., and Hieb, M.R. 2009. Supporting Collaboration in Collective Endeavours with a Model of Operations Intent and Effects. Paper I-055. *Proceedings of the 14th International Command and Control Research and Technology Symposium.* Washington D.C: DoD Command and Control Research Program, June.

Hieb, M.R, Kleiner, M., Carey, S. and Schade, U. 2009. Characterizing Doctrine Through a Formalization of C2 Processes. Paper I-027. *Proceedings of the 14th International Command and Control Research and Technology Symposium.* Washington D.C: DoD Command and Control Research Program, June.

Kunde, D., Orichel, T., Tolk, A., Schade, U., Hieb, M.R. (2009). Harmonizing BML Approaches: Grammars and Data Models for a BML Standard. Paper 09S-SIW-046. *Proceedings of the Spring Simulation Interoperability Workshop*. San Diego, CA: SISO/IEEE CS Press. ISBN: 978-0-7695-3450-3. March.

Rein, K., Schade, U. and Hieb, M.R. 2009. Battle Management Language (BML) as an Enabler. Proceedings of the IEEE International Conference on Communications – ICC 2009, Dresden, Germany. June.

2008

Gustavsson, P.M., Hieb, M.R., Kamath, V., Grönkvist, M., and Blomberg, J. 2008. BLACK-CACTUS - Towards an Agile Joint/Coalition Embedded C2 Training Environment. Paper 08S-SIW-017. *Proceedings of the Spring Simulation Interoperability Workshop*. Providence, Rhode Island: SISO/IEEE CS Press, April. ISBN: 9781605601083.

Gustavsson, P.M., Hieb, M.R., Kamath, V., Grönkvist, M., Blomberg, J. and Wemmergård J. 2008. BLACK-CACTUS – Embedded Training using a Battle Management Language in a Swedish Command and Control System. Paper 08E-SIW-067. *Proceedings of the European Simulation Interoperability Workshop*. Edinburgh, Scotland: SISO/IEEE CS Press, June. ISBN: 9781605602004.

Gustavsson, P.M., Hieb, M.R., Niklasson, L., Eriksson, P. and Moore, P. 2008. Machine Interpretable Representation of Commander's Intent. Paper I-188. *Proceedings of the 13th International Command and Control Research and Technology Symposium*. Bellevue, Washington: DoD Command and Control Research Program, June.

Hieb, M.R. and Schade, U. 2008. Applying a Formal Language of Command and Control for Interoperability between Systems. *Proceedings of the AFCEA-GMU C4I Center Symposium Critical Issues in C4I*. Fairfax, VA, May.

Pullen, J.M., Hieb, M.R. and Levine, S. 2008. Using Web Service-Based Command and Control to Support Coalition Collaboration in C2 and Simulation. Paper I-234. *Proceedings of the 13th International Command and Control Research and Technology Symposium*. Bellevue, Washington: DoD Command and Control Research Program, June.

Pullen, J.M., Hieb, M.R., Schade, U., Kruger, K., Frey, M. and Orichel T. 2008. Enabling the MSG-048 Multinational Demonstration 2007 with the Command and Control Lexical Grammar and JBML Web Services. *Proceedings of the NATO 2008 Modelling & Simulation Symposium*. Vancouver, CA 2007

Ulrich, S. and Hieb, M.R. 2008. A Linguistic Basis For Multi-Agency Coordination. Paper I-152. *Proceedings of the 13th International Command and Control Research and Technology Symposium*. Bellevue, Washington: DoD Command and Control Research Program, June.

2007

Abbot, J., Hieb, M.R. and Gustavsson, P.M. 2007. BML Grammar Development by a Task Analysis Methodology. Paper 07F-SIW-016. *Proceedings of the Fall Simulation Interoperability Workshop*. Orlando, FL: SISO/IEEE CS Press. September, ISBN: 9781622761449.

Hieb, M.R., Mackay S., Powers, M.W., Harland, Y., Kleiner, M., and Pullen, M.J. 2007. Geospatial Challenges in a Net Centric Environment: Actionable Information Technology, Design and Implementation. Paper 6578-43. *Proceedings of the SPIE Defense and Security Symposium, Defense Transformation and Net Centric Systems Conference*. Orlando, FL, March.

Hieb, M., Nielsen, M., Pedersen, K., Powers, M., Pullen, J.M. and Swann, D. 2007. A Standards-Based Framework for Integrating Command and Control Systems. Geospatial Information Systems and Simulations: Generating Actionable Geospatial Information. Paper 07E-SIW-043. *Proceedings of the Euro Simulation Interoperability Workshop*. Genoa, Italy: SISO/IEEE CS Press. June, ISBN: 9781615671700.

Hieb, Michael R., and Ulrich Schade. 2007. Formalizing Command Intent Through Development of a Command and Control Grammar. Paper I-069. *Proceedings of the 12th International Command and Control Research and Technology Symposium (ICCRTS)*. Newport, RI: DoD Command and Control Research Program. June.

Hieb, M.R., Powers, M.W., Mackay, S., Kleiner, M.S. and Pullen, M.J., 2007. The Environment in Network Centric Operations: A Framework for Command and Control. Paper I-156. *Proceedings of the 12th International Command and Control Research and Technology Symposium (ICCRTS)*. Newport, RI: DoD Command and Control Research Program. June.

Laskey, K.B., Adelman, L., Powell, W.A., Hieb, M. and Kleiner, M. 2007. Evaluation of Advanced Automated Geospatial Tools. Paper I-194. *Proceedings of the 12th International Command and Control Research and Technology Symposium (ICCRTS)*. Newport, RI: DoD Command and Control Research Program. June.

Levine, S., M. Hieb, J. Pullen, C. Pandolfo, C. Blais, J. Robert, and J. Kearley, 2007. Joint Battle Management Language (JBML) - Phase 1 Development and Demonstration Results. Paper 07F-SIW-051. *Proceedings of the Fall Simulation Interoperability Workshop*. Orlando, FL: SISO/IEEE CS Press. September, ISBN: 9781622761449.

Pullen, J.M., Hieb, M.R, Levine, S., Tolk, A. and Blais, C. 2007. Joint Battle Management Language (JBML) – US Contribution to the C-BML PDG and NATO MSG-048 TA. Paper 07E-SIW-029. *Proceedings of the Euro Simulation Interoperability Workshop*. Genoa, Italy: SISO/IEEE CS Press. June, ISBN: 9781615671700.

Pullen, J.M., Hieb, M.R, Khimeche, L., Powers, M. and Galvin, K. 2007. Evaluating the Proposed Coalition Battle Management Language Standard as a Basis for Enhanced C2 to M&S Interoperability. *Proceedings of the NATO 2007 Modelling and Simulation Symposium*. Prague, Czech Republic, June.

Schade, U. and Hieb, M.R. 2007. Battle Management Language: A Grammar for Specifying Reports. Paper 07S-SIW-036. *Proceedings of the Spring Simulation Interoperability Workshop*. Norfolk, VA: SISO/IEEE CS Press, March. ISBN: 9781604239232.

2006

Bernard, F., Pullen, J.M., Hieb, M., Khimeche, L., and Powers, M. 2006. Battle Management Language Transformations. *Proceedings of the NATO Modeling and Simulation Symposium*. Rome, Italy, October.

Lambert, S., Hieb, M.R. 2006. Improving Unity of Effort in Command and Control Processes: An Operational Analysis of a Joint Doctrinal Language. Paper 06S-SIW-121. *Proceedings of the Spring Simulation Interoperability Workshop*. Norfolk. VA: SISO/IEEE CS Press, April. ISBN: 1-930638-41-8.

Schade, Ulrich, and Michael R. Hieb. 2006. Formalizing Battle Management Language: A Grammar for Specifying Orders. Paper 06S-SIW-068. *Proceedings of the Spring Simulation Interoperability Workshop*. Norfolk, VA: SISO/IEEE CS Press. April. ISBN: 1-930638-41-8.

Schade, U. and Hieb, M.R. 2006. Development of Formal Grammars to Support Coalition Command and Control: A Battle Management Language for Orders, Requests, and Reports. Paper I-069. *Proceedings of the 11th International Command and Control Research and Technology Symposium (ICCRTS)*. Cambridge, UK: DoD Command and Control Research Program, June.

Sudnikovich, W., Ritchie, A., Hieb, M., Pullen, J., de Champs, P. & Khimeche, L. 2006. NATO Exploratory Team 016 Integration Lessons Learned for C2IEDM and C-BML. Paper 06E-SIW-033. *Proceedings of the 2006 Euro Simulation Interoperability Workshop*. Stockholm, Sweden: SISO/IEEE CS Press. ISBN: 9781622761432.

2005

Perme, D., Tolk, A., Sudnikovich, W.P., Pullen, J.M. and Hieb, M.R. 2005. Integrating Air and Ground Operations Within a Common Battle Management Language. Paper 05S-SIW-054. *Proceedings of the 2005 Spring Simulation Interoperability Workshop*. San Diego, April.

Tolk, A, M. Hieb, K. Galvin, L. Khimeche, and J. Pullen, 2005. Developing a Coalition Battle Management Language to facilitate Interoperability between Operation CIS and Simulations in support of Training and Mission Rehearsal. Paper 249. *Proceedings of the 10th Command and Control Research and Technology Symposium*. McLean, VA, June.

2004

Hieb, M.R., Tolk, A., Sudnikovich, W.P., Pullen, J.M. 2004. Developing Extensible Battle Management Language to Enable Coalition Interoperability. Paper 04E-SIW-064. *Proceedings of the 2004 European Simulation Interoperability Workshop*. Edinburgh, Scotland, June.

Hieb, M.R., Tolk, A., Sudnikovich, W.P., Pullen, J.M. 2004. Extensible Battle Management Language (XBML): A Methodology for Web Enabling Command and Control for Network Centric Warfare. Paper 201. *Proceedings of the 2004 Command and Control Research and Technology Symposium*. San Diego, CA, June.

Hieb, M.R., and Kearley, J. 2004. A Methodology for Doctrine in Modeling and Simulation: Battle Management Language (BML) and the Mission to Means Framework (MMF). Paper 04S-SIW-110. *Proceedings of the 2004 Spring Simulation Interoperability Workshop*. Crystal City, VA, April.

Hieb, M.R., Sudnikovich, W., Tolk, A., and Pullen, J.M. 2004. Developing Battle Management Language into a Web Service. 04S-SIW-113. *Proceedings of the 2004 Spring Simulation Interoperability Workshop*. Crystal City, VA, April.

Numrich, S., Hieb, M.R., and Tolk, A. 2004. M&S in the Global Information Grid (GIG) Environment: An Expanded View of Distributing Simulation. *Proceedings of the 2004 Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)*. Orlando, FL, December.

Sudnikovich, W., Hieb, M.R., Kleiner, M. and Brown, R. 2004. Developing the Army's Battle Management Language Prototype Environment. Paper 04S-SIW-115. *Proceedings of the 2004 Spring Simulation Interoperability Workshop*. Crystal City, VA, April.

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PROFESSIONAL EXPERIENCE

EXPERIENCE: ASSIGNMENTS (SUMMARIZED)

C4I Center Research Associate Professor   2006 –2016

George Mason University, C4I & Cyber Center

Lead for Modeling and Simulation Focus Area at the C4I Center. Technical Advisor for the US Army Simulation to C4I Overarching IPT (SIMCI OIPT). Directly Support the Army Modeling and Simulation Coordination Office in C2 to Simulation activities. Established a Cooperative C2 Research Testbed with the ITA University in Brazil.

Assistant Vice President for C4I Programs   2004 –2005

Alion Science and Technology, M&S Support Operation.

Initiated the development of a Battle Management Language (BML) standard to bridge Simulations and Command and Control (C2) Systems. Chief Architect for Army Simulation to C4I Overarching IPT (SIMCI OIPT). Previously was C4I M&S Expert for the Army's Directorate of Information Systems for C4 (DISC4) and the Army Modeling and Simulation Office (AMSO). Created a Technical Reference Model for C4I M&S Interfaces for the Army. Published numerous papers at national simulation conferences that specified architectural requirements for C4I and M&S Interoperability. Established the Modeling and Simulation Community of Interest for the Defense Modeling and Simulation Office (DMSO).

Senior Research Scientist   2000 - 2004

IITRI AB Technologies Group, M&S Programs Division

Technical Expert for DoD and Army on C4I to M&S Interoperability. Chief Architect for Army Simulation to C4I Overarching IPT (SIMCI OIPT). Directly Supported the Army Modeling and Simulation Office and the Army Office of the Director for Information Systems for C4I.

Senior Scientist for Modeling and Simulation   1998 - 1999

AB Technologies Inc

Developed Enterprise Architectures for the Department of Defense that support interoperability of live systems and simulations. Developed C4I M&S Interface standards for the Army's Directorate of Information Systems for C4 (DISC4) and the Army Modeling and Simulation Office (AMSO). Created a Technical Reference Model for C4I M&S Interfaces for the Army. Initiated participation of M&S in the DII COE Technical Working Groups to develop M&S requirements for live systems. Provided technical representation to the Joint (J-6) NETWARS Communications Modeling program for DISC4.

Senior Research Scientist for Advanced Programs and   1996 - 1997
Experimental Systems

Science Applications International Corporation

Technical Lead for the Simulation to C4I interfaces, including the Modular Reconfigurable C4I Interface (MRCI) and JSIMS External System Interfaces. The MRCI was a major Defense Modeling & Simulation Office (DMSO) project within their High Level Architecture Program to facilitate the interoperability of all types of models and simulations among themselves and with C4I systems. Responsibilities included designing the MRCI software, implementing this design in prototypes, determining simulation requirements and developing a set of common messages using the Command and Control Simulation Interface Language (CCSIL) for use with the MRCI C4I systems.

Research Associate   1990 - 1996

George Mason University – Computer Science Department and Center for Excellence in Command, Control, Communications and Intelligence (C3I Center)

Investigated Artificial Intelligence (AI) interactive learning techniques for instructing Software Agents with Dr. Gheorghe Tecuci (PhD advisor). Developed an application of these training techniques for agents in a complex distributed interactive military simulation (ModSAF), implemented these learning techniques to construct instructable agents with an agent training environment (Captain), and directed programming staff in the construction of interfaces to ModSAF.

Research Assistant   1994 - 1995

George Mason University – Center for the New Engineer

Authored internet module on Workflow under Dr. Peter Denning and conducted research in modeling and optimizing university business processes using workflow tools.

System Developer   1990- 1992

Computer Sciences Corporation

Consulted on AI Projects within the company. Worked on database design of the Financial Institution Regulatory Agencies Criminal Referral Enforcement System for the FINCEN division of the Treasury Department to create a national criminal referral database for financial institutions.

Artificial Intelligence Researcher   1989 - 1990

George Washington University Institute for Artificial Intelligence

Designed, developed and debugged rule-based Knowledge Acquisition system for U.S. Army TRADOC. (This project was selected for the Innovative Applications in AI Conference for 1991). Coordinated with and directed programming staff on project.

Senior Research Scientist   1988 - 1989

IntelliTek, Inc.

Implemented Testbed for AI Applications at NASA Goddard based upon the Hubble Space Telescope's Electrical Power Subsystem (EPS); integrated Blackboard System and Machine Learning tools into the Testbed to diagnosis, identify and fix EPS faults. Mr. Hieb performed the research for his master's thesis upon this NASA Testbed,

Startup, Test, Design and Analysis Engineer   1986 - 1988

General Electric –Nuclear Energy Business Operations

Directed Startup Testing at Niagara Mohawk's Nine Mile Point 2 Nuclear Power Station during power ascension program.

Startup, Test, Design and Analysis Engineer   1985 - 1986

General Electric – Apparatus and Engineering Services Organization

Served as test engineer during power ascension program for Gulf States Utilities' River Bend Power Plant. Acted as lead engineer during the test program close-out, meeting with the Plant Review Committee to resolve any open items associated with testing results.

Startup Test Supervisor   1981 - 1985

General Electric – Apparatus and Engineering Services Organization

Supervised nuclear and balance of plant piping thermal expansion and vibration monitoring. Received Management Award for completing accelerated SRO Certification Course.