Dr. MICHAEL J. MURPHY
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Senior Principal Engineer

Simulation and Modeling • Energetic Materials • Detonics • Design • Optimization

Dr. Murphy is President and a Senior Principal Engineering Consultant at Hydrosoft International and also a Senior Scientific Advisor to the Lawrence Livermore National Laboratory. Prior to retirement from LLNL in August 2012, Dr. Murphy was a Program Leader, Group Leader, and Research Scientist. He is an internationally recognized expert in the fields of energetic materials, explosive modeling, and computational design. His work has been published in many forums including the International Detonation Symposium, International Ballistics Symposium, APS Shock Compression of Condensed Matter Conference, DYMAT International Conference, SIAM conference, AIAA conference and others. His primary areas of expertise are nuclear and warhead design and the design of complex experiments. Additional expertise include using experiments combined with computational science and non-linear optimization applied to the fields of shockwave hydrodynamics, high explosive equation of state, energetic and non-energetic material response. In addition to his scientific leadership and research, Dr. Murphy is best known for solving difficult scientific and engineering problems in a timely and cost conscious manner.

LLNL Work Experience

- 2014-2016 Subcontractor to SAIC (AFRL Program)
- 2012-2016 Senior Scientific Advisor to LLNL, Nuclear Counter Terrorism, Global Security
- 2001-2012 Group Leader, Security Applications, B Division, WCI Directorate
- 1991-2000 Group Leader, Energetic Materials Response, Chemical Sciences Division, Chemistry
- 1999-2001 Principal Investigator on the Target Damage Enhancement Project in the MOU Program
- 1998–2001 Project Leader on the DoD Penetration Augmented Munition Warhead & Fuze Upgrade
- 1996-1997 Principal Investigator on using GLO to improve the high explosive JWL EOS.
- 1995-1999 Project Leader on the development of GLO (Global Local Optimizer) Software Package
- 1994-2001 Principal Investigator on the Warhead Optimization Project in the MOU Program.
- 1992-1995 Project Leader for the LTH-5 project (explosives initiation thresholds).
- 1980-2001 Hydrocode model developer, computational scientist, munition designer.

Recent Hydrosoft Consulting Activities

- 1983-2016 President and Consultant, Hydrosoft International
- 2012-2014 Southwest Research Institute, San Antonio, TX
- 2011-2013 American Ordnance, Middletown, IA
- 2010-2011 Schlumberger Technology, Rosharon, TX

Education

- 1974 - University of California, Berkeley B.S. Mechanical Engineering (Applied Mechanics)
- 1975 - University of California, Davis M.S. Mechanical Engineering (Applied Mechanics)
- 1983 - University of California, Davis Ph.D. Mechanical Engineering (Applied Mechanics)

Areas of Expertise

Project Management/Leadership - 25 years experience as Project Leader/Program Manager Current project leader on $13M/year joint NNSA-DTRA MOU for Counterterrorism, Weapons Effects, and Survivability. Deputy program manager for $20M/year Phoenix Project

Reliability, Margins, and Uncertainties - 20 years experience with improving product and system reliability using margins (safety factor) and uncertainty (unknowns). Quantification of Margin and Uncertainties (QMU) is a formal methodology used to facilitate reliability analysis for the certification of complex systems.

Design and Optimization - 30 years experience in the field of munition design and test including a PhD thesis on shaped charges. Leader of the Advanced Conventional Weapons design group. Developer of the Global Local Optimization (GLO) package.

Analysis and Modeling - 35 years experience in the field of munition technology analysis and modeling. Proficient with first principles analytic code development, hydrocode development, and modeling and simulation of munition components and systems.

Energetic Material Properties and Material Response - Past leader of the Energetic Materials response group. Numerous publications on material modeling and response of metals, explosives, concrete, geologic materials, plastics and foams.

Registration and Memberships

Registered Professional Engineer in State of California (Mechanical Engineer License #18214)
National Defense Industrial Association - Ballistics Division - Executive Committee
National Defense Industrial Association - Bombs & Warheads Division - Executive Committee
International Ballistics Society – Founding Lifetime Fellow and Past Chairman

PUBLICATIONS – Journal/Conference/Symposium

M. Denigan, M.J. Murphy, D. Bland, J. Granier, “A Warhead Design Approach For High Speed Air-Ground Missiles”, Warheads & Ballistics Classified Symposium, Monterey, CA, 4 August, 2015.

M.J. Murphy, L. McMichael, M. King, “Scaling Law for Multiphase Blast Explosives”, Warheads & Ballistics Classified Symposium, Monterey, CA, 4-7 August, 2014.

E. Scheid, T. D. Burleigh, N. U. Deshpande, M. J. Murphy, "Shaped Charge Liner Early Collapse Experiment Execution and Validation", January 2014

E. Scheid, N.U. Deshpande, A. Pedigo, B.T. Voigtschild, M.J. Murphy, K. Hovden, T.D. Burleigh, "Flash X-Ray Examination of the Effects of Shaped Charge Liner Processing Conditions", 2014

M.J. Murphy and D.S Stevens, "Flash X-Ray Resolved Trajectory of Discrete Particles from Embedded Explosive Detonation", 15th International Symposium on Detonation, San Francisco, CA, July, 2014.

D. Richard, et al., “Validation of an Impulse Measurement Technique with High Temporal and Spacial Resolutions”, 12th Hypervelocity Impact Symposium, Baltimore, MD, Sept, 2012,

D.E. Stevens and M.J. Murphy,”A New Multiphase Method for Simulating Energetically Driven Particles”, 25th International Symposium on Ballistics, Beijing, China, May, 2010.

M.J. Murphy, "An Improved Reaction Rate Equation for Simulating the Ignition and Growth of Reaction in High Explosives", 14th International Symposium on Detonation, Coeur d'Alene Resort, Idaho, April, 2010

D.B. Reisman, et al., “The Full Function Test Explosive Generator”, Applied Physics Letters, January, 2010

D.B. Reisman, et al., “The Advanced Helical Generator”, Review of Scientific Instruments, November 2009.

P.A. Pincosy and M.J. Murphy, ”Calculated Concrete Target Damage by Multiple Rod Impact and Penetration”, 23rd International Symposium on Ballistics, Tarragona, Spain, April, 2007.

R.G. Ames and M.J. Murphy, “Blast Impulse Measurements for a Family of Composite-Cased Multiphase Blast Explosives”, JANNAF, 2007

D.E. Stevens, M.J. Murphy, T. A. Dunn, “A Multiphase Model for Heterogeneous Explosives in Both the Dense and Dilute Limits”, International Detonation Symposium, Norfolk, VA, 2006

R.G. Ames, M.J. Murphy, S.E. Groves, D. Cunard, “Diagnostics For Multiple-Phase Blast Flows”, 3rd International Conference on Fluid-Structure Interaction, 2005

R.G. Ames, M.J. Murphy, S.E. Groves, D. Cunard, “Characterization of Multiple-Phase Blast Flows Produced by Particle-Laden Explosives”, 35th AIAA Fluid Dynamics Conference and Exhibit, 2005

R.G. Ames, M.J. Murphy, S.E. Groves, D.A. Cunard, “Characterization of Multiple-Phase Blast Explosive Formulations”, 75th Shock & Vibration Symposium, Virginia Beach, October, 2004

M.J. Murphy, R.M. Kuklo, T.A. Rambur, L.L. Switzer, M.A. Summers, ”Single And Multiple Jet Penetration Experiments Into Geologic Materials”, 21st International Symposium On Ballistics, Adelaide, Australia, April 2004.

M.J. Murphy, "GLO - Global Local Optimizer User's Manual, Lawrence Livermore National Laboratory, UCRL-MA-133858, December 2003.

M.J. Murphy, G. Randers-Pehrson, R.M. Kuklo, T.A. Rambur, L.L. Switzer, M.A. Summers, “Experiments and Simulations of Penetration into Granite by an Aluminum Shaped Charge”, DYMAT 2003, 7th International Conference on Mechanical and Physical Behaviour of Materials Under Dynamic Loading, Porto, Portugal, September 8-12, 2003

M.J. Murphy, S.E. Groves , D.A. Cunard, J.C. Foster, R.G. Ames, “Novel Explosives For Low-Collateral Damage Munitions (U), 6th Joint Classified Bombs/Warheads & Ballistics Symposium, Monterey, California, 3-5 June 2003

M.J. Murphy, J.J. Hsu, A.L. Nichols, “A New Reaction Rate Equation for Simulating the Ignition and Growth of Reaction in High Explosives”, International Workshop on New Models and Hydrocodes for Shock Wave Processes in Condensed Matter, Edinburgh, Scotland, May, 2002

M.J. Murphy and J.J. Hsu, “EDC37 Initiation Model Parameterization Using the Global Local Optimizer – GLO”, 13th Biennial Nuclear Explosives Design Physics Conference (NEDPC), Lawrence Livermore National Laboratory, October, 2001

M.J. Murphy, D.W. Baum, R.M. Kuklo, S.C. Simonson, “Effect Of Multiple And Delayed Jet Impact And Penetration On Concrete Target Borehole Diameter”, 19th International Symposium On Ballistics, Interlaken, Switzerland, May 2001.

M.J. Murphy, D.W. Baum, D.B.Clark, E.M. McGuire, S.C. Simonson, “Numerical Simulation of Damage and Fracture in Concrete from Shaped Charge Jets”, DYMAT 2000, 6th International Conference on Mechanical and Physical Behaviour of Materials Under Dynamic Loading, Krakow, Poland, September 25-29, 2000

D. McDonald, M.J. Murphy, W. Tabor, W. Grantham, “Response Surface Model Development using Radial Basis Functions”, 8th AIAA/NASA/USAF/ISSMO Symposium on Multidisciplinary Analysis and Optimization, Long Beach, CA 6-8 September 2000

M.J. Murphy and R. M. Kuklo, “Fundamentals of Shaped Charge Penetration in Concrete”, 18th International Symposium On Ballistics, San Antonio, TX, November 1999.

M.J. Murphy, E.L. Baker, Mini Symposium: “Nonlinear Optimization Applied to High Explosive Materials”, presented at '99 SIAM Conference on Optimization, Atlanta, GA, May 1999.

M.J. Murphy, “Overview of Coupling Nonlinear Optimization with Large Scientific Software Applications”, presented at '99 SIAM Conference on Optimization, Atlanta, GA, May 1999.

S.C. Simonson, D.W. Baum, R.M. Kuklo, M.J. Murphy, “High-Speed Jets, Designs and Experiments”, 2nd Annual Joint Classified Ballistics Symposium, Monterey, CA, May, 1999.

J.J Osborn, R.L. Wallace, R.J. Tuznik, J.C. Foster, L.M. Hull, M.J. Murphy, D.W. Baum, “A New Liner Material for Shaped Charges”, 2nd Annual Joint Classified Ballistics Symposium, Monterey, May, 1999.

L.E. Fried, M.J. Murphy, P.C. Souers, B.J. Wu, S.R. Anderson, E.M. McGuire, D.E. Maiden, “Detonation Modeling with an In-Line Thermochemical Equation of State”, 11th International Symposium on Detonation, Snowmass CO, September 1998.

M.J. Murphy, D.W. Baum, R.L. Simpson, J. Monolo, L. Montesi, K. Newman, D. Tuerpe, J. Osborn, "Demonstration of Enhanced Warhead Performance With More Powerful Explosives", UCRL-JC-127575, Ballistics '98, 17th International Symposium on Ballistics, South Africa, March 1998.

M.J. Murphy, R.P. Matzke, I.R. Corey, "The Optimizing Hydrocode: A Coupling of GLO with our Numerical Modeling Codes", Second Biennial Tri-Laboratory Engineering Conference on Modeling and Simulation, Los Alamos, NM, November 1997.

M.J. Murphy and D.H. Lassila, "Modeling and Evaluation of HE Driven Shock Effects In Copper with the MTS Model", UCRL-JC-125679, Journal de Physique IV, Colloque C3, Volume 7, August 1997.

M.J. Murphy, R.L. Simpson, D.W. Baum, S. Karlsson, "Effect of High Explosive Properties on Shaped Charge Jet Characteristics", presented at the First International Seminar on Cumulation Effect St. Petersburg, Russia, July, 1997

M.J. Murphy, T.W. Moore, C.G. Lee, R.D. Breithaupt, G.R. Avara, "Examination Of Shaped Charge Liner Shock Loading", UCRL-JC-124795, Ballistics '96, 15th International Symposium on Ballistics, San Francisco, September 1996.

M.J. Murphy, "Utility of Coupling Nonlinear Optimization Methods with Numerical Modeling Software", UCRL-JC-123949, presented at Shock Waves In Condensed Matter, St. Petersburg, Russia, September, 1996.

M.J. Murphy, R.L. Simpson, P.A. Urtiew, P.C. Souers, F. Garcia, R.G. Garza, "Reactive Flow Model Development of PBXW-126 Using Nonlinear Optimization Methods", 1995 APS Topical Conference on Shock Compression of Condensed Matter, Seattle, September 1995.

E.L. Baker and M.J. Murphy, "An Application of Variable Metric Nonlinear Optimization to Two-Dimensional Lagrangian EFP Geometry Modeling", Ballistics '95, 15th International Symposium on Ballistics, Jerusalem Israel, May 1995.

M.J. Murphy and D. Lambert, "Non-Linear Optimization of Insensitive and Multi-Mode Warheads, 45th Annual Bomb & Warhead Meeting, Huntsville, Alabama, May 1995.

M.J. Murphy, E.L. Baker, "Using Nonlinear Optimization Methods to Reverse Engineer Liner Material Properties from EFP Tests", UCRL-JC-117649, Feb. 1995.

M.J. Murphy, E.L. Lee, and A.E. Weston, "Composition-B Shock Initiation Report", UCRL-ID-118300, September 1994.

M.J. Murphy, "Constitutive Model Parameter Determination from Generic EFP Warhead Tests", Journal de Physique IV, Colloque C8, Volume 4, September 1994.

M.J. Murphy, E.L. Lee, A.M. Weston, A. Williams, "Modeling Shock Initiation in Comp-B", 10th International Symposium on Detonation, Boston, July 1993.

M.J. Murphy, J. Monolo, L. Montesi, D. Tuerpe, "Performance of the SMAW Warhead Loaded with RX-39-AC, a CL-20 Based High Explosive", 43rd Annual Bomb & Warhead Meeting, Albuquerque, May 1993.

M.J. Murphy, K. Weimann, K. Doeringsfeld, "The Effect of Explosive Detonation Wave Shaping on EFP Shape and Performance", 13th International Symposium on Ballistics, Stockholm, June 1992.

M.J. Murphy and C.F. Cline, "Modeling of Shock Wave and Dynamic Interactions on PC Based Computers", Journal De Physique - Colloque, DYMAT 91, Strasbourg, Oct. 1991.

M.J. Murphy, "Design and Evaluation of High Velocity Molybdenum Jets for Defeat of Advanced Armors", 41st Annual Bomb & Warhead Meeting, San Diego, May 1991.

M.J. Murphy, "DYNA/NIKE Modeling of Shock Wave Interactions and High Explosive Effects on a Personal Computer", 5th International Symposium on the Interaction of Conventional Munitions with Protective Structures, Mannheim, FRG, April 1991.

M.J. Murphy, "Examination of Coherency Criteria for High Velocity Jets", UCRL-102943, 12th International Symposium on Ballistics, San Antonio, TX, Oct. 1990.

M.J. Murphy, R.L. Simpson, R.D. Breighthaupt, & C.M. Tarver, "Reactive Flow Measurements and Calculations for ZrH2-Based Composite Explosives", 9th International Symposium on Detonation, Portland, Oregon, August 1989.

M.J. Murphy, "The Effect of Gradients in HMX/TNT Content and Porosity on Shaped Charge Jet Characteristics", 11th International Symposium on Ballistics, Brussels, Belgium, May 1989.

M.J. Murphy, "Survey of the Influence of Velocity and Material on the Projectile Energy/Target Hole Volume Relationship", 10th International Symposium on Ballistics, San Diego, Oct. 1987.

M.J. Murphy, "Performance Analysis of Two-Stage Munitions", 8th International Symposium on Ballistics, Orlando, Florida, October 1984.

M.J. Murphy & J.M. Henderson, "Computer Simulation of Concrete Penetration by Shaped Charge Jets", 7th International Symposium on Ballistics, The Hague, Netherlands, April 1983.

M.J. Murphy, "Shaped Charge Penetration in Concrete: A Unified Approach", Doctor of Engineering Dissertation, UCRL-53393, January 1983.

M.J. Murphy, "Development of a 71mm Two-Stage Warhead", UCID-19651, August 1982

D.B. Tuft and M.J. Murphy, "Computer Design of a High Explosive Velocity Augmented Kinetic Energy Penetrator", Computers & Structures, Vol. 13 pp. 303-309, 1981

F.E. Walker, R.E. Varosh, G.J. Tanaka, M.J. Murphy, "Feasibility Study of a Dual-Stage Submunition for the Cruise Missile (U), UCRL-52608, November 29, 1978 (Conf).