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EDUCATION

Ph.D. 2004, M.S. 2001, and B.S. 1999
Nuclear Engineering, University of Tennessee, Knoxville, TN, USA

EXPERIENCE

Oct. 2006 to Present — **Oak Ridge National Laboratory** Oak Ridge, TN, USA
Senior Research and Development Staff Member
Working on a number of projects involving radiation shielding, nuclear criticality safety, nonproliferation and post nuclear detonation forensics, and Monte Carlo methods development

- *Radiation shielding*
  - Performed dose assessments for the U. S. Department of Energy (DOE) analyzing shipping packages for special nuclear material
  - Performed dose assessments in commercial nuclear power plant refueling halls for the U. S. Nuclear Regulatory Commission (NRC) after a postulated lose of spent fuel pool cooling water accident (this analysis was motivated by the Fukushima Daiichi accident)
  - Performed radiation transport calculations (MCNP and ANISN) to design shielding for an ORNL soft x-ray camera at the General Atomics DIII-D Tokamak
  - Part of a team that developed 5 new coupled neutron / photon multi-group cross section libraries based on EDNF/B-VI.8 and EDNF/B-VII.0 data: V6-200N47G, V7-200N47G, and V7-27N19G all for inclusion with the SCALE software package and VITAMIN-B7 and BUGLE-B7 for general release
- *Nuclear criticality safety*
  - Designed, executed, and published results of a criticality accident alarm system (CAAS) benchmark experiment that was a joint project between the U. S. DOE and French Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
  - Modeling to assist designing and publishing critical and subcritical experiments at the U. S. Nuclear Criticality Experiments Research Center (NCERC) in Nevada, about half of which are published as benchmarks by the International Criticality Safety Benchmark Experiment Program (ICSBEP)
  - Part of a team that performed the new CAAS analysis for the LANL PF-4 facility
  - Developed a guidance document for criticality safety practitioners that describes how to perform CAAS analysis and detector placement design that was specifically oriented to SCALE and MCNP (http://scale.ornl.gov/caas_input.shtml)
- *Nonproliferation and post nuclear detonation forensics*
  - Performed MCNPX simulations to determine source strengths needed in order to reliably detect nuclear material in maritime environments, these include neutron and photon sources for standoff detection and boarded search
  - Designed a passive activation detector and software system for use in post nuclear detonation forensics using MCNP, DORT, and HEATING 7
  - Modeling scanning electron microscope (SEM) microanalysis to identify elements in material samples using MCNP, PENELOPE, and ITS
  - Model neutron and photon background on the earth's surface due to galactic cosmic rays (GCR) and solar particle events (SPE) using MCNPX and MCNP6 and sources generated by NASA's HZETRN for the purposes of modeling natural occurring background during operational scenarios
- *Monte Carlo methods development*
  - Part of the SCALE development team responsible for the MAVRIC sequence and the Monte Carlo code Monaco
  - Implementation of multi-group adjoint transport capability in Monaco and automated variance reduction techniques for adjoint calculations in the MAVRIC sequence

- Implementation of the multi-group fixed-source sensitivity/uncertainty analysis with MAVRIC and Monaco
- Improved the SCALE CAAS analysis methodology
- Regularly conduct the SCALE shielding training course using MAVRIC and Monaco

- *Advising undergraduate and graduate students*
  - Serve on thesis committees of students performing M.S. and Ph.D. research at ORNL
  - Assist graduate and undergraduate students enrolled in design courses at the University of Tennessee learn to run SCALE and MCNP

Feb. 2005 to Oct. 2006 **Bettis Atomic Power Laboratory** West Mifflin, PA, USA
Senior Engineer B

Used S_N and Monte Carlo codes to design shielding for the U. S. Naval Reactors (NR) Program and was the Bettis lead shielding design engineer for the NASA Prometheus Project's Jupiter Icy Moons Orbiter (JIMO)

- Designed a LiH radiation shield between the nuclear reactor and onboard scientific equipment of NASA's JIMO using MCNP and a combination of MCNP and DORT
- Performed dose assessment for existing spent fuel handling facilities for the U. S. NR facility in Idaho using MCNP and PARTISN, and also used these codes to design new refueling and spent fuel handling and storage equipment for NR
- Use of PARTISN to perform 3-D shielding design and analysis led to the need for specialized biased quadrature sets, particularly for shielding configurations with small streaming gaps. Developed a C program that generates these biased quadrature sets by selecting the region of angular phase space that needs additional quadrature angles and specifying how many angles to use in that region

Aug. 1999 to Dec. 2004 **University of Tennessee** Knoxville, TN, USA
Graduate Research Assistant

- Ph.D. dissertation, which was sponsored by NASA's Marshal Space Flight Center in Huntsville, Alabama, involved creating an event generator to model the particle production of nucleus-nucleus collisions for nuclei as heavy as lead with energies up to 22.5 GeV. This event generator was then incorporated into the code HETC to create HETC-HEDS
- M.S. thesis, in the Applied Physics Group in the Computational Physics and Engineering Division of ORNL, involved performing bulk shielding design calculations with S_N (DORT and TORT) and Monte Carlo (MCNPX) methods for the Spallation Neutron Source (SNS) around the mercury target and along the neutron beam lines. This work assisted in the design of the neutron beam line shutters and uninstrumented neutron beam line plugs

COMPUTER SKILLS

- *Operating systems* – advanced user of Windows, Mac OS X, and Linux
- *Microcomputer applications* – advanced user of Microsoft's Word, Excel, and Powerpoint
- *Programming*
  - Expert user of FORTRAN 77 and C
  - Advanced user of FORTRAN 90/95, C++, and Linux shell programming (tcsh and bash)
  - Beginner user of MATLAB, Python, and Java
- *Radiation transport tools*
  - Expert user of MCNP, MCNPX, SCALE (KENO-V, KENO-VI, MAVRIC/Monaco), HETC, HETC-HEDS, and NUCFRG2
  - Advanced user of MCNPX-PoliMi, SCALE (TSUNAMI and ORIGEN), PARTISN, DOORS (GIP, ANISN, DORT, and TORT), ADVANTG, Denovo, BRYNTRN, and HZETRN
  - Beginner user of SCALE (TRITON/NEWT), AMPX, PENELOPE, ITS, and Geant4
- *Thermal hydraulics and heat transfer* – beginner user of RELAP5 and HEATING-7

PROFESSIONAL ORGANIZATIONS

- American Nuclear Society 10/1997-present
  - Member of the ANS Radiation Protection and Shielding Division Executive Committee 7/2014-present
  - Technical Program Co-Chair of the 13th International Conference on Radiation Shielding (http:// www.icrs13-rpsd2016.org)
  - Member of the ANS Nuclear Criticality Safety Division Executive Committee 7/2012-6/2015
  - Technical Program Chair of the ANS Radiation Protection and Shielding Division 2014 topical meeting (http://www.rpsd2014.org)
- American Nuclear Society Oak Ridge/Knoxville local Section 11/2006-present
  - Chair of the Oak Ridge/Knoxville local Section 7/2011-6/2012

PUBLICATIONS

Ph.D. Dissertation

Miller, Thomas Martin, Comprehensive Cross Section Database Development for Generalized Three Dimensional Radiation Transport, Ph.D. Dissertation, University of Tennessee, Knoxville (2004).

M.S. Thesis

Miller, Thomas Martin, Radiation Transport Analysis in Support of the Spallation Neutron Source Target Station Neutron Beam Line Shutters, MS Thesis, University of Tennessee, Knoxville (2001).

Peer Reviewed Journals

1) T. M. Miller, W. C. de Wet, and B. W. Patton, "Computational Assessment of Naturally Occurring Neutron and Photon Background Radiation Produced by Extraterrestrial Sources," *Nuclear Technology*, **192**, p. 240 (2015).

2) T. M. Miller, B. W. Patton, B. R. Grogan, J. J. Henkel, B. D. Murphy, J. O. Johnson, and J. T. Mihalczo, "Investigations of Active Interrogation Techniques to Detect Special Nuclear Material in Maritime Environments: Standoff Interrogation of Small and Medium Sized Cargo Ships," *Nuclear Instruments and Methods in Physics Research Section B*, **316**, p. 94 (2013).

3) B. R. Grogan, J. J. Henkel, J. O. Johnson, J. T. Mihalczo, T. M. Miller, and B. W. Patton, "Investigation of Active Interrogation Techniques to Detect Special Nuclear Material in Maritime Environments: Boarded Search of a Cargo Container Ship," *Nuclear Instruments and Methods in Physics Research Section B*, **316**, p. 62 (2013).

4) D. E. Peplow, T. M. Miller, B. W. Patton, and J. C. Wagner, "Hybrid Monte Carlo/Deterministic Methods for Accelerating Active Interrogation Modeling," *Nuclear Technology*, **182**, p. 63 (2013).

5) J. M. Risner, D. Wiarda, T. M. Miller, D. E. Peplow, B. W. Patton, M. E. Dunn, and B. T. Parks, "Development and Testing of the VITAMIN-B7/BUGLE-B7 Coupled Neutron-Gamma Multigroup Cross-Section Libraries," *Journal of ASTM International*, **9**, (2012).

6) L. W. Townsend, D. L. Stephens Jr., J. L. Hoff, E. N. Zapp, H. M. Moussa, T. M. Miller, C. E. Campbell, and T. F. Nichols, "The Carrington Event: Possible Doses to Crews in Space from a Comparable Event," *Advances in Space Research*, **38**, pp. 226 – 231 (2006).

7) L. W. Townsend, T. M. Miller, and T. A. Gabriel, "HETC Radiation Transport Code Development for Cosmic Ray Shielding Applications in Space", *Radiation Protection Dosimetry*, **116**, p. 135 (2005).

8) W. Atwell, L. W. Townsend, T. M. Miller, and C. E. Campbell, "A Reassessment of Galileo Radiation Exposures in the Jupiter Magnetosphere", *Radiation Protection Dosimetry*, **116**, p. 220 (2005).

9) T. M. Miller and L. W. Townsend, "Comprehensive Cross Section Database Development for Generalized Three Dimensional Radiation Transport," *Nuclear Science and Engineering*, **149**, p. 65 (2005).

10) T. M. Miller and L. W. Townsend, "Double Differential Heavy Ion Production Cross Sections", *Radiation Protection Dosimetry*, **110**, p. 53 (2004).

11) T. M. Miller and L. W. Townsend, "Double Differential Light Ion Production Cross Sections", *Radiation Protection Dosimetry*, **110**, p. 57 (2004).

Full Conference Papers

1) T. M. Miller, et. al., "Evaluation of the Concrete Shield Compositions from the 2010 Criticality Accident Alarm System Benchmark Experiments at the CEA Valduc SILENE Facility," *Proceedings of the International Conference on Nuclear Criticality Safety*, Charlotte, North Carolina, USA, September 2015 (2015).

2) K. B. Bekar, T. M. Miller, B. W. Patton, and C. F. Weber, "penORNL: A Parallel Monte Carlo Photon and Electron Transport Package Using PENELOPE," *Proceedings of the Joint International Conference on Mathematics and Computation (M&C), Supercomputing in Nuclear Applications (SNA) and the Monte Carlo (MC) Method*, Nashville, Tennessee, USA, April 2015 (2015).

3) T. M. Miller, et. al., "Benchmark Data from Experiments 2 and 3 of the 2010 CAAS Benchmark at the CEA Valduc SILENE Facility," *Proceedings of the ANS Nuclear Criticality Safety Division Topical Meeting 2013 – Criticality Safety in the Modern Era: Raising the Bar*, Wilmington, North Carolina, USA, September 2013 (2013).

4) T. M. Miller and D. E. Peplow, "Methods to Calculate Criticality Accident Alarm System Detector Response and Coverage," *Proceedings of the ANS Nuclear Criticality Safety Division Topical Meeting 2013 – Criticality Safety in the Modern Era: Raising the Bar*, Wilmington, North Carolina, USA, September 2013 (2013).

5) K. H. Reynolds, T. M. Miller, and L. F. Miller, "Sensitivity and Uncertainty Analysis of a Fixed Source Criticality Accident Alarm System Benchmark Experiment," *Proceedings of the ANS Nuclear Criticality Safety Division Topical Meeting 2013 – Criticality Safety in the Modern Era: Raising the Bar*, Wilmington, North Carolina, USA, September 2013 (2013).

6) T. M. Miller, et. al., "2010 Criticality Accident Alarm System Benchmark Experiments at the CEA Valduc SILENE Facility," *Proceedings of the International Conference on Nuclear Criticality 2011*, Edinburgh, Scotland, United Kingdom, September 2011 (2011).

7) S. W. Mosher, T. M. Miller, T. M. Evans, and J. C. Wagner, "Automated Weight-Window generation for Threat Detection Applications Using ADVANTG," *Proceedings of the 2009 International Conference on Mathematics, Computational Methods & Reactor Physics (M&C 2009)*, Saratoga Springs, New York, USA, May 2009 (2009).

8) S. I. Sriprisan, L. W. Townsend, F. A. Cucinotta, T. M. Miller, "Improved knockout-ablation-coalescence model for secondary neutron and light ion production in nucleus-nucleus collisions," *Proceedings of the 11th International Conference on Radiation Shielding and 15th Topical Meeting of the Radiation Protection and Shielding Division of the American Nuclear Society*, Callaway Gardens, Pine Mountain, Georgia, USA, April 2008 (2008).

9) T. M. Miller, L. W. Townsend, and T. A. Gabriel, "Heavy Ion Collision Event Generator for the 3D Monte Carlo Transport Code HETC", *Proceedings of the 11th International Conference on Nuclear Reaction Mechanisms*, Varenna, Italy, June 2006, (2006).

10) L. W. Townsend, T. M. Miller, and C. E. Campbell, "Predictions of Fragment Fluences from High-Energy Iron Interaction with ISS Wall Targets," *Proceeding of the Space Nuclear Conference 2005*, San Diego, California, USA, June 2005, (2005).

11) W. Atwell, W. Bartholet, M. Clowdsley, B. Anderson, J. Wilson, J. Nealy, T. Miller, and L. Townsend, "Radiation Exposure Estimates for Manned Exploratory Missions Utilizing Selected Shielding Materials," *Proceeding of the Space Nuclear Conference 2005*, San Diego, California, USA, June 2005, (2005).

12) T. M. Miller, L. W. Townsend, T. A. Gabriel, and T. Handler, "HETC-HEDS Radiation Transport Code Development and Benchmarking for Cosmic Ray Shielding Application in Space," *Proceedings of the Monte Carlo 2005 Topical Meeting*, Chattanooga, Tennessee, USA, April 2005, (2005).

13) T. M. Miller and L. W. Townsend, "Comprehensive Cross Section Database Development for Generalized Three Dimensional Radiation Transport Codes: Report of Completion of Phase I" *Proceedings of the Monte Carlo 2005 Topical Meeting*, Chattanooga, Tennessee, USA, April 2005, (2005).

14) W. Atwell, L. W. Townsend, T. M. Miller, and C. E. Campbell, "A Reassessment of Galileo Radiation Exposures in the Jupiter Magnetosphere," *Proceeding of the 10th International Conference on Radiation Shielding and the 13th Radiation Protection and Shielding Topical Meeting*, Funchal, Madeira Island, Portugal, May 2004 (2004).

15) L. W. Townsend, T. M. Miller, and T. A. Gabriel, "HETC Radiation Transport Code Development for Cosmic Ray Shielding Applications in Space," *Proceeding of the 10th International Conference on Radiation Shielding and the 13th Radiation Protection and Shielding Topical Meeting*, Funchal, Madeira Island, Portugal, May 2004 (2004).

16) T. M. Miller and L. W. Townsend, "Comprehensive Cross Section Database Development for Generalized Three Dimensional Radiation Transport Codes: A Status Report" *Proceeding of the Nuclear Mathematical and Computational Sciences Topical Meeting,* Gatlinburg, Tennessee, USA, April 2003, p. 106 (2003).

17) L. W. Townsend, T. M. Miller, and T. A. Gabriel, "Modifications to the HETC Radiation Transport Code for Space Radiation Shielding Applications: A Status Report," *Proceedings of the 12th Biennial Radiation Protection and Shielding Division Topical Meeting*, Santa Fe, New Mexico, USA, April 2002, p. 37 (2002).

18) T. M. Miller, R. E. Pevey, R. A. Lillie, and J. O. Johnson, "Radiation Transport Analyses in Support of the SNS Target Station Neutron Beam Line Shutters Title I Design," *Radiation Protection for our National Priorities Medicine, the Environment, and the Legacy*, Spokane, Washington, USA, September 2000, pp. 141 – 147 (2000).

Conference Summaries

1) T. M. Miller and W. C. de Wet, "Computational Assessment of Naturally Occurring Background Radiation Produced by Extraterrestrial Sources," *18th Topical Meeting of the Radiation Protection and Shielding Division of the American Nuclear Society*, Knoxville, Tennessee, USA, September 2014 (2014).

2) T. M. Miller, B. W. Patton, and C. F. Weber, "Simulation of Electron Probe Microanalysis for the Purposes of Automated Material Identification—Initial Evaluation of Available Monte Carlo Tools," *Transactions of the American Nuclear Society*, **110**(1), p. 497 (2014).

3) T. M. Miller and D. E. Peplow, "Corrected User Guidance to Perform Three-Dimensional Criticality Accident Alarm System Modeling with SCALE", *Transactions of the American Nuclear Society*, **108**(1), p. 498 (2013).

4) T. M. Miller and K. H. Reynolds, "SILENE Benchmark Critical Experiments for Criticality Accident Alarm Systems," *Transactions of the American Nuclear Society*, **105**(1), p. 609 (2011).

5) T. M. Miller, H. Akkurt, and B. W. Patton, "Personnel Dose Assessment During Active Interrogation," *American Nuclear Society Radiation Protection and Shielding Division 2010 Topical Meeting*, Las Vegas, Nevada, April 2010 (2010).

6) T. M. Miller and B. W. Patton, "Investigations of Active Interrogation Techniques to Detector Special Nuclear Material in Maritime Environments," *American Nuclear Society Radiation Protection and Shielding Division 2010 Topical Meeting*, Las Vegas, Nevada, April 2010 (2010).

7) D. E. Peplow, T. M. Miller, and B. W. Patton, "Hybrid Monte Carlo/Deterministic Methods for Active Interrogation Modeling," *American Nuclear Society Radiation Protection and Shielding Division 2010 Topical Meeting*, Las Vegas, Nevada, April 2010 (2010).

8) T. M. Miller, L. W. Townsend, T. A. Gabriel, and T. Handler, "HETC-HEDS Fragment Fluence Predictions Compared with High-Energy Heavy Ion Beam Laboratory Data," *Transactions of the American Nuclear Society*, **91**, p. 707 (2004).

9) T. M. Miller and L. Nugent, "Shielding Design of CTI Inc.'s P-39 Positron Emission Tomography Scanner," *Transactions of the American Nuclear Society*, **87**, p. 196 (2002).

Technical Reports

1) T. M. Miller, et. al., "Neutron Activation and Thermoluminescent Detector Responses to a Bare Pulse of the CEA Valduc SILENE Critical Assembly," *International Handbook of Evaluated Criticality Safety Benchmark Experiment*, NEA/NSC/DOC(95)03 (September 2015) [also published as ORNL/TM-2015/462].

2) T. M. Miller, B. W. Patton, C. F. Weber, and K. B. Bekar, "Sensitivity Analysis of X-ray Spectra from Scanning Electron Microscopes," ORNL/TM-2014/316 (2014).

3) C. F. Weber, K. B. Bekar, B. W. Patton, and T. M. Miller, "Simulation of SEM-EDS Spectra: Monte Carlo Code Development and Inverse Analysis," ORNL/LTR-2014/557 (2014).

4) A. Nicholson, D. E. Hornback, B W. Patton, T. M. Miller, et. al., "Systematic Assessment of Neutron and Gamma-ray Backgrounds Relevant to Operational Modeling and Detection Technology Implementation," ORNL/LTR-2013/596 (2014).

5) T. M. Miller and D. E. Peplow, "Guide to Performing Computational Analysis of Criticality Accident Alarm Systems", ORNL/TM-2013/211 (2013).

6) T. M. Miller, B. W. Patton, and C. F. Weber, "Monte Carlo Simulations of X-Ray Spectra from Scanning Electron Microscopes," ORNL/LTR-2013/467 (2013).

7) I. C. Gauld, T. M. Miller, and B. W. Patton, "Analysis of Dose Rates in the Peach Bottom Unit 3 Spent Fuel Pool Hall Following a Loss-of-Pool-Water Accident," ORNL/LTR-2012/24 R1 (2012).

8) J. M. Risner, D. A. Reed, and T. M. Miller, "Criticality Accident Modeling and Criticality Accident Alarm System Analysis," ORNL/LTR-2011/325 (2012).

9) J. M. Risner, D. Wiarda, T. M. Miller, D. E. Peplow, B. W. Patton, M. E. Dunn, and B. T. Parks, "Production and Testing of the VITAMIN-B7 Fine-Group and BUGLE-B7 Broad-Group Coupled Neutron/Gamma Cross-Section Libraries Derived from ENDF/B-VII.0 Nuclear Data," ORNL/TM-2011/12, NUREG/CR-7045 (2011).

10) D. Wiarda, M. E. Dunn, D. E. Peplow, T. M. Miller, and H. Akkurt, "Development and Testing of ENDF/B-VI.8 and ENDF/B-VII.0 Coupled Neutron-Gamma Libraries for SCALE 6," ORNL/TM-2008/047, NUREG/CR-6990 (2009).

11) S. D. Clarke, F. Marek, T. M. Miller, V. A. Protopopescu, and S. A. Pozzi, "Monte Carlo Simulation for LINAC Standoff Interrogation of Nuclear Material," ORNL/TM-2007/079 (2007).