Stephen A. Batzer, Ph.D., P.E. **June 1, 2016**
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EXPERTISE

Mechanical Engineering
Intellectual Property and Patent Analysis
Materials Science and Material Failure Mechanisms
Vehicle Crashworthiness including Glazing and Roof Crush
Accident Reconstruction and Occupant Kinematics Analysis
Firearms Safety and Failure Analysis

UNIVERSITY EDUCATION

Ph.D. Mechanical Engineering - Engineering Mechanics
Michigan Technological University

M.S. Manufacturing Systems Engineering
GMI Engineering and Management Institute

B.S. Mechanical Engineering
Michigan Technological University

ENGINEERING LICENSURE

Michigan #620141556

PROFESSIONAL HISTORY

2000 – Present	President, *Batzer Engineering, Inc.*
2016 – Present	Adjunct Faculty, Calvin College
2003 – 2013	Adjunct Assistant Professor, *Mech. Eng. Dept., University of Arkansas*
2005 – 2010	Director, *Engineering Institute, LLC*
2002 – 2005	Senior Forensic Engineer, *Renfroe Engineering, Inc.*
2002 – 2005	Instructor, *ASM International*
1999 – 2002	Assistant Professor, *Mech. Eng. Dept., University of Arkansas*
1999	Forensic Engineer, *Hall Engineering*
1998 – 1999	Temporary Assistant Professor, *Mech. Eng. Dept., Iowa State University*
1997 – 1998	Instructor, *Mech. Eng. Tech. Dept., Michigan Technological University*
1994 – 1998	Graduate Student, *Michigan Technological University*
1994	Graduate Student, *GMI Engineering and Management Institute*
1990 – 1993	Manufacturing Engineer, *Ring Screw Works*
1990 – 2007	Ordnance Officer, *United States Army Reserve* honorable discharge into the retired reserves at the rank of Lieutenant Colonel
1986 – 1990	Ordnance Officer, *United States Regular Army* honorable discharge into the active reserves at the rank of First Lieutenant

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AFFILIATIONS

American Scientific Affiliation

American Society of Mechanical Engineers

Michigan Innocence Clinic (consultant)

National Academy of Forensic Engineers

National Society of Professional Engineers

Society of Automotive Engineers

Tau Beta Pi

FOREIGN LANGUAGE

German

PATENT

US 9,352,714, "Adjustable Side Under-Ride Guard for Sliding Axle Trailer," S. A. Batzer and P. K. Rogers, Filed Oct. 9, 2014, issued May 31, 2016.

HONORS AND SERVICE

Presentation judge, Old Guard Oral Competition, *ASME District E Student Professional Development Conference and Early Career Technical Conference*, University of Arkansas, Fayetteville, Arkansas, March 31 – April 2, 2011.

Session Chair and paper reviewer, *ICrash 2010*, Washington, D. C., September 22, 2010.

Panel member and proposal reviewer, *National Science Foundation*.

Judge, Oral Presentations, ASME Graduate Student Technical Conference, University of Arkansas, Fayetteville, Arkansas, April 7, 2006.

Technical reviewer, Kaplan's *Fundamentals of Engineering* national examination presentation and review materials, 2005.

Society of Manufacturing Engineers, Chapter 199:

- Chair, 2002
- Chair Elect, 2001
- Treasurer, 2000

Faculty Advisor, University of Arkansas Society of Manufacturing Engineering Student Chapter, S337, 2001.

Session Chair, Material Removal, North American Manufacturing Research Conference (NAMRC), University of Kentucky, Lexington, KY, 2000.

Advisor, Prairie Grove High School BEST (Boosting Engineering, Science and Technology) Team, 2000.

Jurist, University of Arkansas *Architecture in Extreme Environments* presentations, 1999.

Technical reviewer for the following peer-reviewed periodicals, papers at conferences, or books:

- *ASME International Mechanical Engineering Congress & Exposition* (IMECE)
- *ASME Journal of Mechanical Engineering Science*
- *ASME Transactions, Journal of Manufacturing Science and Engineering*
- *ASME Transactions, Journal of Vibrations and Acoustics*
- Black, J. T., and S. L. Hunter, "*Lean Manufacturing Systems and Cell Design*," Society of Manufacturing Engineers, ISBN 087263647X, 2003.
- *Frontiers in Education Conference*

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- *International Journal of Computer Integrated Manufacturing*
- *Journal of Machining Science and Technology*
- *Journal of the National Academy of Forensic Engineers*
- *SAE Commercial Vehicle Engineering Congress*
- *SAE Technical Papers*
- *Transactions of the North American Manufacturing Research Conference* of the SME (NAMRC)
- *Transportation Research Board*
- Wiercigroch, M. ed., "*Nonlinear Dynamics in Metal Cutting*," A theme volume of the Philosophical Transactions of the Royal Society of London: Part A 359 (1781), 2001.

MILITARY EDUCATION

1999	Associate Logistics Executive Development Course (ALEDC), *Ft. Lee, Virginia*
1997	Combined Arms Services Staff School (CAS^3); *Camp Ripley, Minnesota*
1994	Ordnance Officer's Advanced Course (OOAC); *Aberdeen Proving Ground, Maryland* *Honor Graduate*
1989	Nuclear, Biological and Chemical Defense Course (NBCDC); *Fort Hood, Texas* *Honor Graduate*
1987	Junior Officer's Maintenance Course (JMOC); *Fort Knox, Kentucky* *Honor Graduate*
1987	US Army Ordnance Officer's Basic Course (OOBC); *Redstone Arsenal, Alabama*

FORMAL CONTINUING EDUCATION

"Truck Underride Roundtable," Insurance Institute for Highway Safety, IIHS Vehicle Research Center, Ruckersville, Virginia, May 5, 2016.

"Ride -n- Drive," *Meritor Wabco*, Presentation detailing OnGuard™ Collision Safety Systems, SmarTrac™ Stability Control Systems including Electronic Stability Control (ESC), Roll Stability Control (RSC), Roll Stability Support (RSSplus), and SafetyDirect™ Fleet Performance System, Atlanta Motor Speedway, Hampton, GA, September 14, 2011.

"Laminated Glass: Design Considerations for Vehicle Door Systems Fast Track," *Society of Automotive Engineers*, on-line learning module, August 29, 2008.

"A Short Course on Axiomatic Design," Christopher A. Brown – instructor, *The Engineering Institute*, Farmington, Arkansas, September 12, 2006.

"Fracture Analysis of Glasses and Ceramics," James R. Varner – instructor, *NYS College of Ceramics at Alfred University*, Alfred, New York, February 9-10, 2006.

European Association for Accident Research and Analysis Conference, technical paper presentations and rollover demonstration of 4 sedans, Bratislava, Slovakia, October 20-22, 2005.

"Designing with Glass," Suresh T. Gulati – instructor, *Society of Automotive Engineers*, Troy, Michigan, May 4, 2005.

"Occupant and Vehicle Kinematics in Rollovers Seminar," David C. Viano and Chantal Parenteau – instructors, *Society of Automotive Engineers*, Detroit, Michigan, April 14-15, 2005.

"Automotive Glazing Materials Seminar," Siegfried Herliczek – instructor, *Society of Automotive Engineers*, Troy, Michigan, September 20-21, 2004.

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"PC-Crash and PC-Rect Training Workshop," William E. Cliff – instructor, *MacInnis Engineering Associates, Ltd.*, Las Vegas, Nevada, January 23-24, 2004.

"Material Selections in Design and the Cambridge Materials Selector," Michael F. Ashby – instructor, *ASEE/IEEE Frontiers in Education Conference*, Boston, Massachusetts, November 6-7, 2002.

"Heat Treating for Machining & Grinding Operations," David Pye – instructor, *Society of Manufacturing Engineers*, Cincinnati, Ohio, October 4-5, 1999.

REFEREED PUBLICATIONS

68. "Forensic Engineering Analysis of Roof Failure in Rollovers," Batzer, S. A., *Journal of the National Academy of Forensic Engineers*, Vol. XXVII, No. 1, 2013.
67. "Forensic Engineering Analysis of Side Glazing Failure in Rollover Collisions," Batzer, S. A., *Journal of the National Academy of Forensic Engineers*, Vol. XXVI, No. 2, 2012.
66. "Slouching Toward Disaster," Batzer, S. A., and J. S. Morse, *ASME International Mechanical Engineering Congress & Exposition*, Denver, Colorado, IMECE2011-62934, November 11-17, 2011.
65. "Understanding Why Codes and Standards Fail," Batzer, S. A., J. S. Morse, and D. Y. Lee, *ASME International Mechanical Engineering Congress & Exposition*, Denver, Colorado, IMECE2011-62037, November 11-17, 2011.
64. "Diving Injury Occurrence in Rollover Collisions: A Critical Analysis of Malibu I, Malibu II and CRIS," Batzer, S. A., *International Journal of Crashworthiness*, Taylor & Francis, Vol. 16. No. 2, April, 2011, pp. 219-232.
63. "Design and Evaluation of a New Portable Restraint for Motor Coach Rollover Occupant Safety," Thorbole, C. K., D. A. Renfroe, S. A. Batzer, and D. S. Tanwar, Symposium on International Automotive Technology, 2011-26-0093, January 19-21, 2011.
62. "Evaluation of Automotive Roof Strength and Pretensioner Performance on Occupant Neck Loading," Thorbole, C. K., S. A. Batzer, and D. A. Renfroe, IMECE2010-37744, Vancouver, British Columbia, November 12-18, 2010.
61. "Review of the Jordan Rollover System (JRS) vis-à-vis Other Dynamic Crash Test Devices," Chirwa, E. C., R. R. Stephenson, S. A. Batzer, and R. H. Grzebieta, *International Journal of Crashworthiness*, 15:5, pp. 553-569, 2010.
60. "Rollover Protective Structural Criteria for Heavy Trucks," Richardson, S., G. Rechnitzer, S. A. Batzer, C. K. Thorbole, S. Crocker, D. Salikram, T. Pok, N. Josevski, and A. Short, *ICrash 2010*, Washington, D. C., September 22-24, 2010.
59. "Design Elements of Steel Belted Radial Tires to Improve Belt Durability," Lee, D. Y., Y. H. Han, and S. A. Batzer, *Hazard Information Foundation, Inc.*, 2010 Conference, Houston, Texas, August 13, 2010.
58. "Performance Evaluation of a Portable Restraint for a Motor Coach Occupant in a Rollover Accident," Thorbole, C. K., S. A. Batzer, and D. A. Renfroe, *ASME International Mechanical Engineering Congress & Exposition*, Lake Buena Vista, Florida, IMECE2009-12885, 2009.
57. "Motor Coach/Bus Crashworthiness Systems – Occupant Retention," Batzer, S. A., D. Beltran, G. G. Herndon, C. K. Thorbole, and M. Ziejewski, *ASME International Mechanical Engineering Congress & Exposition*, Lake Buena Vista, Florida, IMECE2009-12424, 2009.
56. "Heavy Truck Roll Cage Effectiveness," Batzer, S. A., B. E. Enz, G. G. Herndon, C. K. Thorbole, R. Hooker, T. K. Parnell, and M. Ziejewski, *ASME International Mechanical Engineering Congress & Exposition*, Lake Buena Vista, Florida, IMECE2009-12423, 2009.
55. "Prevention Through Design – An Idea Whose Time Has Come," Morse, J. S., and S. A. Batzer, *ASME International Mechanical Engineering Congress & Exposition*, Lake Buena Vista, Florida, IMECE2009-12148, 2009.

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54. "Computational Analysis of a Near and Far Side Occupant Kinematics in a Vehicle Rollover with Different Restraints," Thorbole, C. K., D. A Renfroe, S. A. Batzer, D. Beltran, and G. Herndon, *21st International Safety Conference on the Enhanced Safety of Vehicles*, Paper No. 09-0491-W, Stuttgart, Germany, June 15-18, 2009.

53. "Occupant Protection via Frontal Crash Testing," Thorbole, C., and S. A. Batzer, *ASME International Mechanical Engineering Congress & Exposition*, Boston, Massachusetts, IMECE2008-68658, 2008.

52. "Automotive Side Glazing Ejection Mechanisms Part II – Review of Recent Glazing Literature," Batzer, S. A., G. G. Herndon, P. T. Semones, C. Thorbole, M. Ziejewski, and R. Hooker, *ASME International Mechanical Engineering Congress & Exposition*, Boston, Massachusetts, IMECE2008-68483, 2008.

51. "Automotive Side Glazing Ejection Mechanisms Part I – Model Development," Batzer, S. A., G. G. Herndon, P. T. Semones, C. Thorbole, M. Ziejewski, and R. Hooker, *ASME International Mechanical Engineering Congress & Exposition*, Boston, Massachusetts, IMECE2008-68482, 2008.

50. "Angular Velocity Analysis of SUV Rollover Collisions using PC-Crash," Semones, P. T., S. Andrews, M. Partain, C. Guthrie, and S. A. Batzer, *European Association for Accident Research and Analysis Conference*, Krakow, Poland, November 10, 2007.

49. "Evaluation of Dynamic Spit Tester Using Computational Biomechanics for Occupant Ejection Mitigation Research," Thorbole, C. K., S. A. Batzer, and D. A. Renfroe, *Proceedings of the Fifth IASTED International Conference on Biomechanics*, Honolulu, Hawaii, August 20-22, 2007.

48. "Injury Analysis of Laminated and Tempered Side Glazing," Batzer, S. A., C. K. Thorbole, G. G. Herndon, and D. Beltran, *20th International Safety Conference on the Enhanced Safety of Vehicles*, Paper No. 07-0101-W, Lyon, France, June 18-21, 2007.

47. "Biomechanical Modeling of Occupant Induced Centrifugal Loading on Automotive Glazing," Thorbole, C. K., S. A. Batzer, D. A. Renfroe, and D. S. Tanwar, *Proceedings of the 18th International Conference on Modeling and Simulation*, pp. 653-658, Montreal, Quebec, Canada, May 30 - June 1, 2007.

46. "Axiomatic Design of Automotive Roof Structures," Batzer, S. A., R. D. Burgess, and C. A. Brown, SAE 2007-01-0685, 2007. Also published within SAE's "Safety: Rear Impact, Rollover, Side Impact, Crashworthiness, Air Bags and Bumper Systems," ISBN 978-0-7680-1907-0, April, 2007.

45. "Automotive Side Glazing for Primary and Secondary Occupant Retention," Batzer, S. A., G. G. Herndon, C. K. Thorbole, H. Chamberlain, D. R. Phillips, and H. Yudenfriend, SAE 2007-01-1546, 2007. Also published within SAE's "Body Engineering and Design, Glass Applications, Corrosion Prevention and Design Tools," ISBN 978-0-7680-1859-2, April, 2007.

44. "Rollover Collisions: Injuries Related to Automotive Side Glass," Batzer, S. A., *Professional Safety, Journal of the American Society of Safety Engineers*, Vol. 52, No. 4, April, 2007, pp. 33-45.

43. "Automotive Side Glazing Failure due to Simulated Human Interaction," Herndon, G. G., K. A. Allen, H. A. Roberts, D. R. Phillips, and S. A. Batzer, *Engineering Failure Analysis*, Vol. 14, Issue 7, pp. 1701-1710, December, 2007. Paper was given at the *Second International Conference on Engineering Failure Analysis, ICEFA-II*, Toronto, Canada, September 12-15, 2006, with written abstract in the conference booklet, plus oral presentation by Alex Roberts.

42. "Failure Analysis of Seat-Belt Buckle Inertial Release," Roberts, H. A., M. Partain, S. A. Batzer, and D. A. Renfroe, *Engineering Failure Analysis*, Vol. 14, Issue 6, pp. 1135-1143, September, 2007. Paper was given at the *Second International Conference on Engineering Failure Analysis, ICEFA-II*, Toronto, Canada, September 12-15, 2006, with written abstract in the conference booklet, plus oral presentation by Alex Roberts.

41. "Automotive Side Glazing Related Injuries in Rollover Collisions," Batzer, S. A., *Fractography of Glasses and Ceramics V*, written abstract, plus conference presentation by Stephen Batzer, Rochester, New York, July 9-12, 2006.

40. "Failure Mechanisms of Automotive Side Glazing in Rollover Collisions," Batzer, S. A., *Journal of Failure Analysis and Prevention*, Vol. 6, No. 3, pp. 6-11 and 33-34, 2006.

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39. "Mechanical and Thermal Behavior for Machining Ti-6Al-4V With $AlMgB_{14}$ and WC-Co Tools," Deshayes, L., J. L. Evans, R. Ivester, D. G. Bhat, S. A. Batzer, and E. P. Whitenton, *ASME International Mechanical Engineering Congress & Exposition*, IMECE2005-81510, Orlando, Florida, November 5-11, 2005.

38. "Evaluation of Heavy Truck Rollover Crashworthiness," Evans, J. L., S. A. Batzer, S. B. Andrews, and R. M. Hooker, *ASME International Mechanical Engineering Congress & Exposition*, IMECE2005-81300, Orlando, Florida, November 5-11, 2005.

37. "Failure Analysis of Automotive Spot Welds," Evans, J. L., and S. A. Batzer, *Materials Science & Technology 2005 Conference and Exhibition*, Failure Analysis Symposium Proceedings, Pittsburgh, Pennsylvania, pp. 83-89, September 25-28, 2005.

36. "Performance of Automotive Side Glazing In Rollover Collisions," Batzer, S. A., *Materials Science & Technology 2005 Conference and Exhibition*, Failure Analysis Symposium Proceedings, Pittsburgh, Pennsylvania, pp. 81-91, September 25-28, 2005.

35. "A Failure Analysis of an Experimental $AlMgB_{14}$ Cutting Tool," Evans, J. L., L. Deshayes, D. G. Bhat, and S. A. Batzer, *Microscopy and Microanalysis 2005*, Honolulu, Hawaii, July 31-August 4, 2005.

34. "Biomechanical Analysis of Headform Impacts into Automobile Side Glazing," Batzer, S. A., J. E. Evans, K. A. Allen, M. R. Martin, and D. R. Phillips, ASME *2005 Summer Bioengineering Conference*, Vail Cascade Resort & Spa, Vail, Colorado, June 22-26, 2005.

33. "Dynamic Roof Crush Intrusion in Inverted Drop Testing," Batzer, S. A., and R. Hooker, *19th International Safety Conference on the Enhanced Safety of Vehicles*, Paper No. 05-0146, Washington, D. C., June 6-9, 2005. Also submitted to *NHTSA Docket 2005-22143-127; Roof Crush Resistance*, November 21, 2005.

32. "Evaluation of Heavy Truck Rollover Accidents," Evans, J. E., S. A. Batzer, and S. B. Andrews, *19th International Safety Conference on the Enhanced Safety of Vehicles*, Paper No. 05-0140, Washington, D.C., June 6-9, 2005.

31. "On-Line Monitoring Of Tool Pre-Failure During Micro-Drilling Of Ti-6Al-4V," Guo, A., D. G. Bhat, and S. A. Batzer, *16th International Plansee Seminar*, Reutte, Austria, May 29 - June 3, 2005.

30. "A Preliminary Study of Chemical Solubility of Ultra-Hard Ceramic $AlMgB_{14}$ in Titanium: Reconciliation of Model with Experiment," Bhat, D. G., V. Bedekar, and S. A. Batzer, *Journal of Machining Science and Technology*, Vol. 8, No. 3, pp. 341-355, 2004.

29. "Tool/Workpiece Chemical Transfer on Standard WC-Co Tool Inserts in Turning on Ti-6Al-4V," Semones, P. T., V. M. Bedekar, D. G. Bhat, and S. A. Batzer, *Journal of the Mechanical Behavior of Materials*, Vol. 15, Nos. 1-2, 2004.

28. "Substructure Analysis of a Flexible System Contact-Impact Event," Guo, A., and S. A. Batzer, *Trans. ASME, Journal of Vibrations & Acoustics*, Vol. 126, No. 1, pp. 126-131, January, 2004.

27. "Thermodynamic, Tribological and Chemical Interdiffusion Study of Ultra-Hard Ceramic $AlMgB_{14}$ in the Machining of Aerospace Alloys," Bedekar, V., D. G. Bhat, S. A. Batzer, L. Walker, and L. F. Walker, *ASME International Mechanical Engineering Congress & Exposition*, IMECE2003-42374, 2003.

26. "Time and Frequency Domain Investigation of the Static and Dynamic Characteristics of Micro-drilling," Guo, A., and S. A. Batzer, *ASME International Mechanical Engineering Congress & Exposition*, IMECE2003-42403, 2003.

25. "A Proof-of-Concept Study of the Use of Complex Borides for Disassembly of Decommissioned Nuclear Reactor Containment Vessels," Cook, B. A., J. L. Harringa, A. M. Russell, and S. A. Batzer, *Journal of Machining Science and Technology*, Vol. 7, No. 1, pp. 139-147, 2003.

24. "A Study Of Airborne Dust Emission and Process Performance During Dry Machining of Aluminum-Silicon Alloy with PCD and CVD Diamond Coated Tools," Arumugam, P. U., A. P. Malshe, S. A. Batzer, and D. G. Bhat, *Transactions of the North American Manufacturing Research Institution of SME*, Vol. 30, 2002, pp.501-508. Also printed as *SME Technical Paper MR02-0153*. Also printed in the *SME Journal of Manufacturing Processes*, Vol. 5, No. 2, pp. 163-170, 2003.

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23. "Nonlinear Dynamics of a Machining System with Two Interdependent Delays," Gouskov, A. M., S. A. Voronov, H. Paris, and S. A. Batzer, *Communications in Nonlinear Science and Numerical Simulation*, Vol. 7, pp. 207-221, 2002.

22. "Fabrication of A Micro Humidity Sensor On A Thin, Flexible Substrate," Ng, B., S. Tung, and S. Batzer, *Transactions of the North American Manufacturing Research Institution of SME*, Vol. 30, pp. 697-701. Also printed as *SME Technical Paper MS02-0184*, 2002.

21. "A Numeric Investigation Of The Rake Face Stress Distribution In Orthogonal Machining," McClain, B., S. A. Batzer, and G. I. Maldonado, *Journal of Materials Processing Technology*, Vol. 123, pp. 114-119, 2002.

20. "Capstone Design Project Coursework Using The Industrial Short Course Format," Batzer, S. A., and W. F. Schmidt, *32nd ASEE/IEEE Frontiers in Education Conference*, Boston, Massachusetts, November 6-9, 2002.

19. "Nonlinear Oscillations of a Tool Used in Deep Hole Drilling," Gouskov, A. M., S. A. Voronov, S. A. Batzer, and S. C. Sinha, *4th EUROMECH Nonlinear Oscillations Conference*, Moscow, Russia, August 19-23, 2002.

18. "Large Strain Constitutive Model Development for Application to Orthogonal Machining," Batzer, S. A., G. Subhash, W. W. Olson, and J. W. Sutherland, *Proceedings of the 5th CIRP International Workshop on Modeling of Machining*, Purdue University, West Lafayette, Indiana, pp. 31-40, May 20-21, 2002.

17. "Chemical Inter-Diffusion Effects at the Tool/Work interface: Implications for Cutting Tools Designed for Machining Aerospace Alloys," Bedekar, V., D. G. Bhat, and S. A. Batzer, *Proceedings of the 2nd Annual Tech Summit*, University of Arkansas, Fayetteville, Arkansas, pp. 9-11, April 26, 2002.

16. "Experimental Investigations of Micro-Drilling," Guo, A., and S. A. Batzer, *Proceedings of the 2nd Annual Tech Summit, University of Arkansas*, Fayetteville, Arkansas, pp. 15-17, April 26, 2002.

15. "Modeling Vibratory Drilling Dynamics," Batzer, S. A., A. M. Gouskov, and S. A. Voronov, *Trans. ASME, Journal of Vibrations & Acoustics*, Vol. 123, pp. 435-443, October, 2001.

14. "A Geometric Analysis Of Semi-Spiral Chip Morphology In Orthogonal Machining," Batzer, S. A., and J. W. Sutherland, *Journal Of Machining Science and Technology*, Vol. 5(1), pp. 63-76, 2001.

13. "Cylindrical Workpiece Turning Using Multiple-Cutter Tool Heads," Gouskov, A. M., H. Paris, S. A. Voronov, and S. A. Batzer, *ASME International Design Engineering Technical Conference*, PA, Pennsylvania, September 9 - 12, 2001.

12. "Dynamic Stability Of Rotating Abrasive Tool For Deep Hole Honing," Gouskov, A. M., S. A. Voronov, and S. A. Batzer, *ASME International Design Engineering Technical Conference*, Pittsburgh, Pennsylvania, September 9-12, 2001.

11. "Chatter Synchronization In Vibratory Drilling," Gouskov, A. M., S. A. Voronov, and S. A. Batzer, *IMECE DAS 2000*, Orlando, Florida, November 5-10, 2000.

10. "The Materials and Manufacturing Research Laboratories (MRL): A Cluster of Synergistic Laboratories to Progress Frontiers of Science and Engineering of Materials and Manufacturing," Malshe, A. P., W. F. Schmidt, S. A. Batzer, W. D. Brown, T. A. Railkar, and M. H. Gordon, *Proc. of 2000 Conference for Industry and Education Collaboration (CIEC)*, Orlando, Florida, January, 2000.

9. "Modeling the Vibratory Drilling Process," Batzer, S. A., A. M. Gouskov, and S. A. Voronov, DETC99/VIB-8024, *ASME International Design Engineering Technical Conference*, Las Vegas, Nevada, September 12-15, 1999.

8. "Effects of Cutting Fluid Type on the Dimensional Accuracy of Tapped Threads," Cao, T., S. A. Batzer, and J. W. Sutherland, *SME Technical Paper MS99-143*, May, 1999.

7. "An Analytical and Experimental Investigation Into Chip Morphology in Orthogonal Machining," Batzer, S. A., *Ph.D. Thesis*, Mechanical Engineering-Engineering Mechanics Department, Michigan Technological University, Houghton, Michigan, 1998.

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6. "Chip Morphology and Hole Surface Texture in the Drilling of Cast Aluminum Alloys," Batzer, S. A., D. M. Haan, P. D. Rao, W. W. Olson, and J. W. Sutherland, *Journal of Materials Processing Technology*, Vol. 79/1-3, pp. 72-78, 1998.
5. "Modeling of Chip Dynamics in Drilling," Olson, W. W., S. A. Batzer, and J. W. Sutherland, *Proceedings of the CIRP 1st International Workshop on Modeling of Machining*, May 19, Atlanta, GA, pp. 347-361, 1998.
4. "An Experimental Study of Cutting Fluid Effects in Drilling," Haan, D. M., S. A. Batzer, W. W. Olson, and J. W. Sutherland, *Journal of Materials Processing Technology*, Vol. 71/2, pp. 305-313, 1997.
3. "Chip Morphology and Bending Moment Models for Orthogonal Machining with Flat Faced Tools," Batzer, S. A., J. W. Sutherland, and W. W. Olson, *Transactions of the North American Manufacturing Research Institution of SME*, Vol. 25, pp. 231-236, 1997.
2. "Experimental Investigation of Tapped Thread Surface Roughness for Cast Aluminum Alloys," Cao, T., S. A. Batzer, and J. W. Sutherland, *Manufacturing Science and Engineering, ASME Bound Volume - MED*, Vol. 6-1, pp. 189-195, 1997.
1. "An Experimental Investigation of Chip Morphology in Drilling," Batzer, S. A., P. D. Rao, D. M. Haan, W. W. Olson, and J. W. Sutherland, *Proceedings of the 2nd S.M. Wu Symposium on Manufacturing Science*, pp. 102-107, 1996.

NON-REFEREED BOOK CONTRIBUTIONS, ARTICLES, AND PUBLIC COMMENTS

13. Batzer, S. A., and B. E. Enz Comments to *NHTSA Docket 2015-0118; Notice of Proposed Rulemamking; Federal Motor Vehicle Safety Standards 223 (Rear Impact Guards) & 224 (Rear Impact Protection) for Semi-Trailers.* Comments consisted of analysis and unpublished testing, February 12, 2016.
12. Batzer, S. A., Review of Dr. Jeffrey Koperski's "The Physics of Theism: God, Physics, and the Philosophy of Science," *Perspectives on Science and Christian Faith*, December, 2015.
11. Mangraviti, J. J., S. Babitsky, and N. N. Donovan, "How to Write an Expert Witness Report," SEAK, 2014, various uncredited text.
10. Babitsky, S., and J. J. Mangraviti, "The Biggest Mistakes Expert Witnesses Make," SEAK, 2008, various uncredited text.
8. Batzer, S. A., and M. Ziejewski Comments to *NHTSA Docket 2009-0183; Ejection Mitigation; Phase-In Reporting Requirements*. Comments consisted of analysis and refereed publications 48, 50, and 51 listed above, January 25, 2010. Note that Donald Phillips separately attached refereed publications 34 and 45 to the docket.
8. Batzer, S. A., Comments to *NHTSA Docket 2008-0015-029; Roof Crush Resistance*, letter and attached copy of slides given at National Press Club presentation, March 13, 2008.
7. Batzer, S. A., Comments to *NHTSA Docket 2005-22143-72; Roof Crush Resistance*; police report added as supplemental comments to September 29, 2005, docket comments, November 29, 2005.
6. Batzer, S. A., Comments to *NHTSA Docket 2005-22143-72; Roof Crush Resistance*, September 29, 2005. Supplemental comments to this letter submitted Nov. 29, 2005.
5. Batzer, S. A., and D. A. Renfroe, Comments to *NHTSA Docket 03-15400*; *FMVSS No. 139 - New Pneumatic Tires for Light Vehicles Tires - 49 CFR Part 71*, published December 22, 2004.
4. Batzer, S. A., and D. A. Renfroe, Comments to *NHTSA Docket 1999-5572-65*; *Roof Crush Resistance*, published September 17, 2003.
3. Batzer, S. A., "Blowing Hot and Cold," *Cutting Tool Engineering*, Vol. 54, No. 4, pp. 56-58, April 2002.
2. Batzer, S. A., Review of Greg Pahl's "The Complete Idiot's Guide to Saving the Environment," *Perspectives on Science and Christian Faith*, March, 2002.

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1. Batzer, S. A., and J. W. Sutherland, "The Dry Cure for Coolant Ills," *Cutting Tool Engineering*, Vol. 50, No. 4, pp. 34-44, June, 1998.

UNIVERSITY LEVEL COURSES TAUGHT

Course	School	Title (Semesters or Terms Presented)
ENGR-314	Calvin	Vibration Analysis (Spring, 16)
MEEG-3013	UAF	Mechanics of Materials (Spring, 12)
MEEG-4132	UAF	Professional Engineering Practices (Fall, 11; Spring, 12)
MEEG-3202	UAF	Laboratory I (Fall, 02; Spring, 03)
MEEG-5303	UAF	Physical Metallurgy (Fall, 01)
MEEG-5913	UAF	Advanced Topics in Manufacturing (Summer, 01)
MEEG-4913	UAF	World Class Manufacturing (Spring, 01)
MEEG-4913	UAF	Material Failure Mechanisms (Spring, 01; Fall, 02)
MEEG-4132	UAF	Creative Project Design I (Fall, 00; Spring, Fall 01; Spring, 02)
MEEG-4843	UAF	Environmentally Conscious Design and Manufacturing (Spring, 00)
MEEG-2303	UAF	Introduction to Materials (Fall, 99; Spring, 00; Fall, 00; Summer, 13)
ME-490	ISU	Special Topics in Mechanical Engineering (Summer, 99)
ME-321	ISU	Materials, Manufacturing and Design I (Fall, 98; Spring, 99)
ME-322	ISU	Materials, Manufacturing and Design II (Fall, 98)
MET-267	MTU	Mechanical Design 2 (Spring, 98)
EMT-130	MTU	Statics (Spring, 98)
ME-403	MTU	Material Removal Processes and Machine Tools (Winter, 97)
MAT-111	MTU	Technical Mathematics I (Winter, 97)
MET-154	MTU	Materials (Winter, 97)
MET-165	MTU	Computer Graphics (Winter, 97; Spring, 98)
ME-104	MTU	Engineering Spatial Analysis (Spring, 97)
ME-303	MTU	Introduction to Manufacturing Processes (Winter, 96)
ME-303	MTU	Introduction to Manufacturing Processes Laboratory (Fall, 96)
GN-150	MTU	Creative Thinking (Fall, 95)
IMSE-402	GMI	Welding Processes Laboratory (Spring, 94)
IMSE-101	GMI	Manufacturing Processes Laboratory (Winter, 93; Spring, 94)

PUBLIC PRESENTATIONS AND SHORT COURSES

"Mechanical Forensic Engineering," *Foxmoor Continuing Education, Division of Halfmoon Education, Inc.*, Livonia, Michigan, January 15, 2016.

"Case Studies in Forensic Engineering," *Calvin College Engineering Seminar*, Grand Rapids, Michigan, November 20, 2015.

"Forensic Engineering and Ethics," invited lecture to the Mechanical Engineering MEEG 4132, *Professional Engineering Practices* class, University of Arkansas, Fayetteville, Arkansas, October 24, 2013.

"An Engineer in the Courtroom," *Professional Development Seminars, Inc.*, Little Rock, Arkansas, September 9, 2013, also presented in Memphis, Tennessee on September 26, 2013.

"Case Studies in Forensic Engineering," *Professional Development Seminars, Inc.*, Little Rock, Arkansas, September 9, 2013, also presented in Memphis, Tennessee on September 26, 2013.

"Forensic Engineering Analysis of Foreseeable Failures," invited lecture to the Mechanical Engineering MEEG 491V, *Special Topics – Design For Safety* class, University of Arkansas, Fort Smith, Arkansas, April 12, 2013.

"Design, Warnings and Ethics," invited lecture to the Mechanical Engineering MEEG 4132, *Professional Engineering Practices* class, University of Arkansas, Fayetteville, Arkansas, November 26, 2012.

"Case Studies in Forensic Engineering, Parts I and II," *Professional Development Seminars, Inc.*, Little Rock, Arkansas, September 10, 2012.

"Forensic Engineering Analysis of *The Origin of Species*," *Professional Development Seminars, Inc.*, Dallas, Texas, September 6, 2012.

"Case Studies in Forensic Engineering," *Professional Development Seminars, Inc.*, Dallas, Texas, September 6, 2012.

"Forming Defensible Expert Opinions," *SEAK 21st Annual National Expert Witness Conference*, Falmouth, Massachusetts, August 23, 2012.

"How to be a Successful Expert Witness," Pre-Conference Seminar to the *SEAK 21st Annual National Expert Witness Conference*, Falmouth, Massachusetts, August 22, 2012.

"Case Studies in Forensic Engineering," invited lecture to the Mechanical Engineering MEEG 491V, *Special Topics – Design For Safety* class, University of Arkansas, Fort Smith, Arkansas, April 25, 2011.

"Mechanical Engineering PE Review - Ethics & Engineering Economics Module," University of Arkansas, Fayetteville, Arkansas, April 11, 2011.

"Mechanical Engineering PE Review - Ethics & Engineering Economics Module," University of Arkansas, Fayetteville, Arkansas, October 26, 2011.

"Leveraging Your Word Processor's Built-In Features to Make Your Reports Shine," *SEAK 20th Annual National Expert Witness Conference*, Naples, Florida, April 14, 2011.

"SUV Design for Rollover Crashworthiness," invited lecture to the Mechanical Engineering MEEG 491V, *Special Topics – Design For Safety* class, University of Arkansas, Fort Smith, Arkansas, April 6, 2011.

"SUV Design for Rollover Crashworthiness," invited lecture to the Mechanical Engineering ME-489 Vehicle Dynamics course, North Dakota State University, Fargo, North Dakota, March 7, 2011.

"Forensic Engineering Investigation of Roof Failure in Rollover Collisions," National Academy of Forensic Engineers, January Meeting, Tucson, Arizona, January 15, 2011.

"Rollover Protective Structural Criteria for Heavy Trucks," *ICrash 2010*, Washington, D. C., September 23, 2010.

"Making the Complex Understandable – 10 Insights, More or Less," *SEAK 19th Annual National Expert Witness Conference*, Chicago, Illinois, June 24, 2010.

"Recent Developments Relating to Vehicle and Heavy Truck Crashworthiness," 6th Annual National Workers' Compensation Subrogation Strategies ExecuSummit, Uncasville, Connecticut, June 15, 2010.

"Pendulum Animal Impact Testing," (guest presentation of technical paper authored by Stephen Forrest, et al.), *ASME International Mechanical Engineering Congress & Exposition* (IMECE), *Auto and Truck Safety and Consumer Product Safety*, November 18, 2009.

"Prevention Through Design – An Idea Whose Time Has Come," *ASME International Mechanical Engineering Congress & Exposition* (IMECE), *Safety Engineering, Risk Analysis and Reliability Methods* (SERAD), November 18, 2009.

"Motor Coach/Bus Crashworthiness Systems – Occupant Retention," *ASME International Mechanical Engineering Congress & Exposition* (IMECE), *Transportation Systems*, November 16, 2009.

"Heavy Truck Roll Cage Effectiveness," *ASME International Mechanical Engineering Congress & Exposition* (IMECE), *Transportation Systems*, November 16, 2009.

"Forensic Engineering Analysis of *The Origin of Species*," *University of Rhode Island Forensic Science Partnership Spring Seminar Program*, Kingston, Rhode Island, October 23, 2009.

"Case Studies in Forensic Engineering," *William E. Tolman High School*, Pawtucket, Rhode Island, October 23, 2009.

"Forensic Engineering Analysis of *The Origin of Species*," *Professional Development Seminars, Inc.*, Houston, Texas, September 1, 2009, and also with the same organization on September 18, 2009 in Little Rock, Arkansas.

"Case Studies in Forensic Engineering," *Professional Development Seminars, Inc.*, Houston, Texas, September 1, 2009, and also with the same organization on September 18, 2009 in Little Rock, Arkansas.

"Forensic Engineering Investigation of Glazing Failure in Rollover Collisions," National Academy of Forensic Engineers, July Meeting, St. Louis, Missouri, July 18, 2009.

"Safety and Automotive Engineering," Vocation presentation at Woodlands Junior High School, 3 lectures, April 22, 2009.

"SUV Design for Rollover Crashworthiness," invited lecture to the Mechanical Engineering Department ME-489 Vehicle Dynamics course, North Dakota State University, Fargo, North Dakota, February 27, 2009.

"Understanding Why Vehicles Fail," invited presentation to the College of Engineering, North Dakota State University, Fargo, North Dakota, February 26, 2009.

"Automotive Side Glazing Ejection Mitigation Mechanisms Part II – Review of Recent Glazing Literature," *ASME International Mechanical Engineering Congress & Exposition* (IMECE), *Safety Engineering, Risk Analysis and Reliability Methods* (SERAD), November 4, 2008.

"Automotive Side Glazing Ejection Mitigation Mechanisms Part I – Model Development," *ASME International Mechanical Engineering Congress & Exposition* (IMECE), *Safety Engineering, Risk Analysis and Reliability Methods* (SERAD), November 4, 2008.

"Principles of Occupant-Retention Side Glazing Design – *With Testing Validation*," invited presentation to the 'Glass Applications' Session of the *Society of Automotive Engineers 2008 World Congress*, Detroit, Michigan, April 14, 2008.

"Forensic Engineering of SUV Rollover Accidents with Serious Injuries," *University of Rhode Island Forensic Science Partnership Spring Seminar Program*, Kingston, Rhode Island, February 1, 2008.

"Winkelgeschwindigkeitsverlauf bei SUV-Überschlagskollisionen bei der Rekonstrution mit PC-Crash™ - *manuelle Analyse, Scharfsinnigkeiten, und Beispiele* -," (Angular Velocity Analysis of SUV Rollover Collisions using PC-Crash™, Manual Analysis, Insights and Examples), *European Association for Accident Research and Analysis Conference*, Krakow, Poland, November 10, 2007.

"Forensic Engineering of Automobile Accidents with Injuries," invited presentation to the *Society of Automotive Engineers MTU Student Group,* Michigan Technological University, Houghton, Michigan, October 12, 2007.

"Engineering Analysis of the Proposed FMVSS-216 Requirement," People Safe in Rollovers Foundation *Emergency World Summit*, Washington, D.C., July 20, 2007.

"Automotive Side Glazing for Occupant Containment in Rollovers," People Safe in Rollovers Foundation *Emergency World Summit*, Washington, D.C., July 20, 2007.

"Fundamentals of Crashworthiness –or– Why We Drive Volvos," *Volvo Club of America Midsommar Festival*, Kansas City, Missouri, June 23, 2007.

"Daubert Proofing your CV and Other Insights," *SEAK 16th Annual National Expert Witness Conference*, Hyannis, Massachusetts, June 21, 2007.

"Axiomatic Design of Automotive Roof Structures," *Society of Automotive Engineers 2007 World Congress*, Detroit, Michigan, April 17, 2007.

"Automotive Side Glazing for Primary and Secondary Occupant Retention," *Society of Automotive Engineers 2007 World Congress*, Detroit, Michigan, April 16, 2007.

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"Safety and Automotive Engineering," Vocation presentation at Woodlands Junior High School, 3 lectures, December 12, 2006.

"Forensic Engineering of Automobile Accidents with Injuries," *Professional Development Seminars, Inc.,* Memphis, Tennessee, September 26, 2006.

"Automotive Side Glazing Related Injuries in Rollover Collisions," *Fractography of Glasses and Ceramics V*, Rochester, New York, July 12, 2006.

"Understanding Why Vehicles Fail – A Safety Perspective," Alfred University College of Engineering, Alfred, New York, February 9, 2006.

"Engineering Analysis of the Proposed FMVSS-216 Requirement," Public Citizen *National Press Club* Presentation, Washington, D.C., http://www.citizen.org/pressroom/release.cfm?ID=2089, November 21, 2005.

"Besserer Insassenschutz beim Überschlag durch Verbesserung der Fahrzeugscheiben," (Occupant Containment Through Improved Glazing In Multiple Rollovers), *European Association for Accident Research and Analysis Conference*, Bratislava, Slovakia, October 22, 2005.

"Performance of Automotive Side Glazing In Rollover Collisions," *Materials Science & Technology 2005 Conference and Exhibition*, Failure Analysis Symposium, Pittsburgh, Pennsylvania, September 27, 2005.

"Forensic Engineering of Automobile Accidents with Injuries," *Professional Development Seminars, Inc.*, Little Rock, Arkansas, September 23, 2005.

"Biomechanical Analysis of Headform Impacts into Automobile Side Glazing," ASME *2005 Summer Bioengineering Conference*, Vail Cascade Resort & Spa, Vail, Colorado, June 25, 2005.

"Roof Crush, Glazing, Seatbacks, *and All That*…," University of Arkansas Law School, Fayetteville, Arkansas Campus, Invited Lecture, October 14, 2004.

Invited Expert Witness, Arkansas Trial Lawyers Association Mock Trial, Fayetteville, Arkansas, September 5, 2003.

"Practical Heat Treatment," ASM International World Headquarters, Materials Park, Ohio, July 21-25, 2003.

"Mechanical Engineering PE Review - Materials Science & Engineering Economics Module," Arkansas Technical University, Russellville, Arkansas, September 7, 2002.

"Skunk Works," Mechanical Engineering Department, Arkansas Technical University, Russellville, Arkansas, July 16, 2002.

"Design for Competitiveness," Rheem Manufacturing, Fort Smith, Arkansas, June 14, 2002.

"Design for Manufacturability," Baldor Electric Motors and Drives, Fort Smith, Arkansas, June 10-12, 2002.

"Practical Heat Treatment Insights," Danaher Tool Group, Springdale, Arkansas, April 15-16, 2002.

"Mechanical Engineering PE Review - Materials Science & Engineering Economics Module," Arkansas Technical University, Russellville, Arkansas, September 29, 2001.

"Material Failure Mechanisms and Forensic Engineering," Arkansas Technical University, Russellville, Arkansas, April 19, 2001.

"Development of Johnson-Cook Constitutive Models for Commercial O1 and L6 Tool Steel with Application to Machining," University of Missouri-Rolla, March 18, 1999.

"Dryish Machining at Ford," Workshop on Environmentally Conscious Machining, Ford Motor Company, Dearborn, Michigan, September, 1997.

"An Experimental Investigation of Chip Morphology in Drilling," 2nd S. M. Wu Symposium on Manufacturing Science, University of Michigan, Ann Arbor, Michigan, May, 1996.

"Synchronous Manufacturing," Ring Screw Works, Numerous manufacturing divisions and presentations, Troy, Michigan, 1992 -1993.

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GRADUATE COMMITTEE SERVICE

Arumugam, Prabhu U., "Dry Machining of Aluminum-Silicon Alloy Using PCD and CVD Diamond Tools: Analysis and Evaluation," MS Thesis, University of Arkansas, 2002.

Bedekar, Vikram, "An Analytic Experimental Study of Abrasive and Chemical Wear Mechanisms of $AlMgB_{14}$ in Machining of Titanium Alloys," MS Thesis, University of Arkansas, 2003.

Chinnakaruppan, Palaniappan, "Laser-Assisted Surface Engineering of Silicon Nitride to Minimize the Surface Defects Generated During Grinding Operation," MS Thesis, University of Arkansas, 2000.

Evans, Jeffrey L., "An Evaluation of $AlMgB_{14}$ as a Tool Material for the Machining of Ti-6Al-4V," MS Thesis, University of Arkansas, 2004. *Thesis Director.*

Evans, Jeffrey L., "Environment Assisted Crack Growth of Ni-base Superalloys at Elevated Temperature," Ph.D. Dissertation, University of Arkansas, 2008.

Guo, Anping, "Investigation of the Static and Dynamic Characteristics of Micro-Drilling," Ph.D. Dissertation, University of Arkansas, 2004.

McClain, Benjamin D., "Finite Element Simulation of Chip Formation in Orthogonal Metal Cutting Using the Langrangian Formulation in DYNA3D," MS Thesis, Iowa State University, 1999. *Thesis Director.*

Ng, Boon-Khai, "Fabrication and Testing of Micro-Size Capacitive Type Relative Humidity Sensor on a Flexible Substrate," MS Thesis, University of Arkansas, 2002. *Thesis Director.*

Semones, Paul T., "A Study of Tool Wear Phenomena on Commercially Available Tungsten Carbide Tool Inserts Used to Cut Ti-6Al-4V," MS Thesis, University of Arkansas, 2003. *Thesis Director.*

Yap, Chee Wei. "Design and Validation of a Novel Die Splitter Machine Tool," MS Thesis, University of Arkansas, 2003. *Thesis Director.*

RESEARCH AND INDUSTRIAL CONTRACTS AWARDED

"Development of $AlMgB_{14}$ for Amelioration of Milling-Induced Damage of Ti-6Al-4V in Aerospace Applications" S. A. Batzer, CAREER Award 0239257, National Science Foundation, 2003, $400,000.

"New Frontiers: Research Experience for Undergraduates in Space and Planetary Sciences," D. Sears, et al., Research Experience for Undergraduates, National Science Foundation, 2002-2005, $224,901.

"Manufacturing Engineering Technical Support," S. A. Batzer, Alcoa Aluminum - Kawneer Division, May, 2002, $16,268.

"Crosscutting Industrial Applications of a New Class of Ultra-Hard Borides," B. A. Cook, A. M. Russell, and S. A. Batzer, United States Department of Energy, Office of Industrial Technology, October, 2001, $445,000.

"Tool Bit Insert Interference Analysis," S. A. Batzer, Arkansas Science and Technology Authority, Spring, 2001, $5,000 total budget.

"Processing and Performance Research on Ultra-hard Borides for Next-Generation Hard-Facing Coatings" - Ames Laboratory PSI "Type I" Proposal, S. Batzer, B. Cook, and A. Russell, fall, 2000, $8,000.

"MEEG-2303 Materials Science Improvement via Hands-On Learning Opportunities," S. A. Batzer, 2000 Charles and Nadine Baum Teaching Grant, September, 2000, $1,300.

"Establishment of a Comprehensive Manufacturing Processes Multi-Media Resource Library," S. A. Batzer, and T. Collins, University of Arkansas Library Book Grant, December, 2000, $3,000 internal funding, $4,300.

"Novel Surface Engineering Methodology to Anneal the Surface Defects Generated During Grinding Operation for Silicon Nitride Ceramic Components for Heavy Duty Equipment and Engines," NSF - GOALIE, A. Malshe, S. A. Batzer, M. Gordon, and S. Yedave, 1 Apr 00, $225,000.

"On-Line Fault Detection in Micro-Drilling," S. A. Batzer, and J. Roth, SME Research Initiation Grant, June 5, 2000, $10,231.

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"Implementing a Student-Organized Web Based Curriculum Resource," Center for Teaching Excellence Award, with Pham (PI) et al., February, 1999, $25,000.

"Development of Fluidized Bed Furnaces to Heat Work Pieces for Hot Forging," Center for Advanced Technology Development Award, with Dr. Robert Brown, co-P.I., September 1998 - June 1999, $39,015.

"Raw Material Inspection Standards for Low-Carbon Steel," Iowa Company Assistance Program Contract, September, 1998, $1,754.

Batzer Engineering, Inc.

Subject: Fee Schedule

As Of: January 1, 2016

Item	Cost	Comments
Substantive Work	$350/Hr	Discovery, analysis, teleconferences, etc.
Deposition	$350/Hr	Transcript only; 4-hour minimum
Videotaped Deposition	$700/Hr	4-hour minimum
Trial Testimony	$350/Hr	4-hour minimum
Travel	$175/Hour	Portal to Portal
Technician Time	Varies	
Expenses	Varies	Not subject to markup
Testing	Varies	By agreement; time and material or flat fee

Airline fares are typically purchased coach. Per diem is normally not charged. Invoices are usually sent the first of each month. All invoices are payable upon receipt. The rates presented here are for payment received directly after invoicing; overdue accounts incur a 1% per month time price differential. The rates published herein are historically stable but are subject to change without notice.