

Curriculum Vitae

S. SCOTT GOLDSBOROUGH

Assistant Professor
Department of Mechanical Engineering
Marquette University
Milwaukee, WI 53201-1881
Ph: 414-288-6641, Fax: 414-288-7790
scott.goldsborough@mu.edu

EDUCATION

Ph.D. Mechanical Engineering, Colorado State University (Fort Collins, CO)	2002
M.S. Mechanical Engineering, Colorado State University (Fort Collins, CO)	1998
B.S. Mechanical Engineering, University of Maryland Baltimore County (Baltimore, MD)	1992

HONORS AND AWARDS

Ralph R. Teetor Educational Award, Society of Automotive Engineers, 2009.
Harry L. Horning Memorial Award, Society of Automotive Engineers, 1998.
College of Engineering Junior Faculty Award, Marquette University, 2007.
Way-Klinger Endowment Summer Research Award, Marquette University, 2005.
Tau Beta Pi, National Engineering Honor Society, 1989. UMBC chapter president, 2 years.
Student Leadership Award, College of Engineering, UMBC, 1991.

WORK EXPERIENCE

Assistant Professor , Department of Mechanical Engineering, Marquette University	08/2003 – present
Research Assistant , Sandia National Laboratories, Livermore, CA Rapid Combustion Linear Generator group	05/1995 – 07/2003
Graduate Research Fellow , Associated Western Universities	05/1995 – 05/1998
Teaching Assistant , Colorado State University, Fort Collins, CO	08/1994 – 05/1995
Intern , Environmental Engineering Lab, Toshiba Corporation, Kawasaki City, Japan	01/1993 – 07/1993
Supervisor , Load Operations, UPS, Baltimore, MD	01/1988 – 07/1994

PROFESSIONAL AFFILIATIONS

The Combustion Institute, Member (2004-present)
Society of Automotive Engineers, Member (2002-present)
American Chemical Society, Member (2008-present)
American Society of Mechanical Engineers, Member (1989-present)
Society for Industrial and Applied Mathematics, Member (2005-present)

RESEARCH SUMMARY

Direct and conduct computational and experimental projects utilizing custom-built software and apparatuses, and commercial versions including HCT (Hydrodynamics Chemistry Transport), HCT-GA, KIVA3V/CHEMKIN™, StarCD™, Converge™, Flux2D™; cluster computing with distributed and parallel applications, evolutionary algorithms, Rapid compression machines (RCMs), dense aerosol generation and transport systems, single-cylinder IC engines, pollutant characterization, PIV, PDA, laser shadowgraphy.

Expertise and Interests include: internal combustion (IC) engines; advanced combustion processes; renewable/alternative fuels; fuel chemistry – production, and low temperature ignition and pollutant formation kinetics; fuel-engine interactions and design of next-generation fuels; model evaluation / validation techniques, high level sensitivity analyses and cause/effect behavior; two-phase flows; spray and aerosol dynamics; multi-scale, multi-physics transport; process-intensified catalytic systems; reacting flow simulation tools; evolutionary programming; bio-inspired and constructal-law based design; energy utilization and sustainable energy

Curriculum Vitae

development; alternative power systems; flow visualization; scientific / high performance computing; appropriate technology; sustainable design metrics / life-cycle analyses.

RESEARCH GRANTS

PI, "Ignition and pollutant chemistry of next-generation biodiesels," National Science Foundation, \$300,000 in collaboration with LLNL, NUIG, ANL, Reaction Design and USDA NCUAR.	06/2010 – 05/2013
PI, "Design of a fueling system to enable utilization of biodiesels and biodiesel surrogates in a twin-piston RCM," Argonne National Laboratory, \$20,860.	05/2010 – 12/2010
Co-PI, "MRI: Acquisition of a Parallel Computer Cluster and Storage for the Marquette University Grid (MUGrid)," National Science Foundation, \$560,000.	09/2009 – 08/2010
Co-PI, "Cost-competitive, fuel-flexible, multi-firing-rate-capable, low-NOx burners," Southeast Wisconsin Energy Technology Research Center (US DOE NETL funded), \$85,000.	07/2009 – 05/2010
PI, "A 60% efficient ICRE – operating cycle analysis using state-of-the-art simulation software," Energy Transition Technology Inc., \$43,333.	06/2009 – 12/2010
PI, "Novel Experimental Techniques to Investigate the Combustion Chemistry of Biodiesels," Marquette University, \$6,000.	01/2009 – 06/2009
PI, "IREE: Collaborative research on the low/intermediate temperature chemistry of involatile fuels: biodiesel surrogate applications," National Science Foundation, \$30,000, Marquette University match \$5,500. Collaboration with National University of Ireland Galway.	08/2007 – 08/2010
Co-PI, "Impact and Shock Effects on Nano-Scale Multi-Phase Energetic Materials," National Science Foundation, \$216,630.	09/2006 – 08/2008
PI, "Combustion characteristics of alternative fuels," Marquette College of Engineering, \$33,000.	01/2007 – 12/2007
Co-PI, "Anaerobic biotechnology and combustion for renewable energy," Marquette University, \$12,000.	01/2007 – 08/2007
PI, "The evolution of pressure, temperature and concentration fronts due to pressure driven gas flow within a packed bed," Sandia National Laboratories, \$25,000.	10/2006 – 09/2007
PI, "Acquisition of a Linux Cluster to Support College-wide Research & Teaching Activities," National Science Foundation, \$154,395.	09/2005 – 08/2006
PI, "Investigating Gas Flow and Diffusion in a Packed Bed," Sandia National Laboratories, \$41,333.	06/2005 – 09/2006
Co-PI, "Acquisition of High Speed Camera and Instrumentation Suite for Visualization and Three Dimensional Field Reconstruction," National Science Foundation, \$137,786.	09/2004 – 08/2006
PI, "Investigating the Scavenging Characteristics of a Free Piston, HCCI based 5kW High Pressure Compressor," Sandia National Laboratories, \$35,824.	05/2004 – 09/2005

PEER-REVIEWED PUBLICATIONS

1. Goldsborough, S.S., Johnson, M.V., Zhu, G.S., Aggarwal, S.K., "Gas phase saturation and evaporative cooling effects during wet compression of a fuel aerosol under RCM conditions," submitted to *Combustion and Flame*.
2. Johnson, M.V., Zhu, G.S., Aggarwal, S.K. and Goldsborough, S.S., "Droplet evaporation characteristics due to wet compression under RCM conditions," *International Journal of Heat and Mass Transfer*, 53:1100-1111, 2010.
3. Johnson, M.V., Goldsborough, S.S., Larkin, E., O'Malley, G., Serinyel, Z., O'Toole, P. and Curran, H.J., "A shock tube study of n- and iso-propanol," *Energy and Fuels*, 23:5886-5898, 2009.
4. Goldsborough, S.S., "A chemical kinetically based ignition delay correlation for iso-octane covering a wide range of conditions including the NTC region," *Combustion and Flame*, 156:1248-1262, 2009.
5. Goldsborough, S.S., "On the rate of heat release for high boost, low temperature combustion schemes: assessing compressibility effects," *Combustion Science & Technology*, 181:729-755, 2009.
6. Johnson, M.V. and Goldsborough, S.S., "Constructing a small-scale flow rig for swirl studies of a single-valve, reverse uniflow 2S engine," SAE 2008-01-0609; also in *Advanced Concepts, 2008*, SAE SP-2180, 2008.

Curriculum Vitae

7. Bosman, C.B. and Goldsborough, S.S., "Developing a 10cc single-valve, reverse uniflow, 2S engine," SAE 2008-01-0953; also in Multi-Dimensional Engine Modeling, 2008, SAE SP-2171, 2008.
8. Goldsborough, S.S., "A crevice blow-by model for a Rapid Compression Expansion Machine used for chemical kinetic (HCCI) studies," *SAE 2007 Transactions, Journal of Engines*, 116:3, pp. 632-651; also in CI and SI Power Cylinder Systems 2007, SAE SP-2073, 2007.
9. Goldsborough, S.S. and Potokar, C., "The influence of crevice flows and blow-by on the charge motion and temperature profiles within a Rapid Compression Expansion Machine used for chemical kinetic (HCCI) studies," SAE 2007-01-0169, 2007.
10. Goldsborough, S.S., "Evaluating the Heat Losses from HCCI Combustion within a Rapid Compression Expansion Machine," SAE 2006-01-0870; also in Homogeneous Charge Compression Ignition (HCCI) Combustion 2006, SAE SP-2005, 2006.
11. Goldsborough, S.S. and Van Blarigan, P., "Optimizing the Scavenging System for a Two-Stroke Cycle Free Piston Engine for High Efficiency and Low Emissions: A Computational Approach," *SAE 2003 Transactions, Journal of Engines*, 112:3, pp. 1-20, 2004.
12. Goldsborough, S.S. and Van Blarigan, P., "A Numerical Study of a Free Piston IC Engine Operating on Homogeneous Charge Compression Ignition Combustion," *SAE 1999 Transactions, Journal of Engines*, 108:3, pp. 959-972, 2000.
13. Van Blarigan, P., Paradiso, N. and Goldsborough, S., "Homogeneous Charge Compression Ignition with a Free Piston: A New Approach to Ideal Otto Cycle Performance," SAE Paper 982484; also in SI Engines: Combustion and Emissions Formation, SAE SP-1393, 1998. **Horning Memorial Award Paper.**

CONFERENCE PRESENTATIONS

1. Goldsborough, S.S., Johnson, M.V. and Aggarwal, S.K., "Droplet evaporation due to gas-phase volumetric compression," in *Proceedings of the Fall Technical Meeting of the Eastern States Section of the Combustion Institute*, College Park, MD, 18-21 October, 2009.
2. Johnson, M.V., Goldsborough, S.S., Larkin, E., O'Malley, G., Serinyel, Z., O'Toole, P. and Curran, H.J., "Propanol ignition at shock tube conditions," in *Proceedings of the Fall Technical Meeting of the Eastern States Section of the Combustion Institute*, College Park, MD, 18-21 October, 2009.
3. Johnson, M.V., Goldsborough, S.S., Larkin, E., O'Malley, G., Serinyel, Z., O'Toole, P. and Curran, H.J., "Ignition delay measurements of n-propanol and iso-propanol in a shock tube," in *Proceedings of the 6th US Combustion Meeting*, Ann Arbor, MI, May, 2009.
4. Goldsborough, S.S., "A chemical kinetically based ignition delay correlation for iso-octane covering a wide range of conditions," in *Proceedings of the 6th US Combustion Meeting*, Ann Arbor, MI, May, 2009.
5. Johnson, M.V. and Goldsborough, S.S., "Constructing a small-scale flow rig for swirl studies of a single-valve, reverse uniflow 2S engine," at the *2008 SAE International Congress and Exposition*, Cobo Center, Detroit, MI, 14-17 April, 2008.
6. Bosman, C.B. and Goldsborough, S.S., "Developing a 10cc single-valve, reverse uniflow, 2S engine," at the *2008 SAE International Congress and Exposition*, Cobo Center, Detroit, MI, 14-17 April, 2008.
7. Goldsborough, S.S., "Autoignition of lean iso-octane – air charges in an RCEM," in *Proceedings of the Fall Technical Meeting of the Western States Section of the Combustion Institute*, Livermore, CA, 16-17 October, 2007.
8. Goldsborough, S.S., "A crevice blow-by model for a Rapid Compression Expansion Machine used for chemical kinetic (HCCI) studies," at the *2007 SAE International Congress and Exposition*, Cobo Center, Detroit, MI, 16-19 April, 2007.
9. Goldsborough, S.S. and Potokar, C., "The influence of crevice flows and blow-by on the charge motion and temperature profiles within a Rapid Compression Expansion Machine used for chemical kinetic (HCCI) studies," at the *2007 SAE International Congress and Exposition*, Cobo Center, Detroit, MI, 16-19 April, 2007.
10. Goldsborough, S.S., "A Rapid Compression Expansion Machine for Chemical Kinetic (HCCI) studies," in *Proceedings of the 5th U.S. Combustion Meeting*, San Diego, CA, 25-28 March, 2007.
11. Goldsborough, S.S., "Autoignition of H₂ – air mixtures under dynamic conditions using an RCEM: investigating Transitions from Rapid Ignition to Slow Oxidation," in *Proceedings of the 5th U.S. Combustion Meeting*, San Diego, CA, 25-28 March, 2007.
12. Goldsborough, S.S., "Evaluating the Heat Losses from HCCI Combustion within a Rapid Compression Expansion Machine," at the *2006 SAE International Congress and Exposition*, Cobo Center, Detroit, MI, 03-06 April, 2006.

Curriculum Vitae

13. Goldsborough, S.S., "Assessing the HCCI Characteristics of Natural Gas using a Free Piston Rapid Compression Expansion Machine," in *Proceedings of the 2005 Spring Technical Conference, ASME Internal Combustion Engine Division*, Paper no. 2005-ICES-1085, Chicago, IL, 05-07 April, 2005.
14. Goldsborough, S.S. and Van Blarigan, P., "Evaluating the HCCI Characteristics of n-hexane and n-pentane using a Free Piston Rapid Compression Expansion Machine," in *Proceedings of the 2005 Fall Technical Meeting of the Western States Section of the Combustion Institute*, Stanford, CA, 17-18 October, 2005.
15. Goldsborough, S.S., "Assessing the HCCI Characteristics of n-heptane using a Free Piston Rapid Compression Expansion Machine," in *Proceedings of the 4th Joint Meeting of the U.S. Sections of the Combustion Institute*, Philadelphia, PA, 20-23 March, 2005.
16. Van Blarigan, P. and Goldsborough, S., "Free Piston Generator/Turbine Systems - Advanced Hybrid Systems," in *Proceedings of the 14th Annual U.S. Hydrogen Meeting: Energy Security through Hydrogen*, National Hydrogen Association, Washington, DC, 04-06 March, 2003.
17. Goldsborough, S.S. and Van Blarigan, P., "Optimizing the Scavenging System for a Two-Stroke Cycle Free Piston Engine for High Efficiency and Low Emissions: A Computational Approach," in *Proceedings of the 13th International Multidimensional Engine Modeling User's Group Meeting*, Marriott Hotel, Detroit, MI, 02 March, 2003.
18. Van Blarigan, P., Paradiso, N. and Goldsborough, S., "Homogeneous Charge Compression Ignition with a Free Piston: A New Approach to Ideal Otto Cycle Performance," at the *SAE International Fall Fuels and Lubricants Meeting and Exhibition*, Fairmont Hotel, San Francisco, CA, October, 1998.

INVITED TALKS AND POSTERS

1. "Advanced combustion/modeling and analysis toward HCCI/PCCI in a 60% efficient free-piston engine," (with ETTI, Inc.) poster for *US DOE DEER Conference*, Dearborn, MI, August, 2009.
2. "Understanding boost pressure effects on the ignition behavior of iso-octane and related fuels," for Ford Motor Company, Research and Innovation Center, Dearborn, MI, 21 May, 2009.
3. "Kinetic mechanism evaluation using a functional dependency approach," poster for *6th US Combustion Meeting*, Ann Arbor, MI, May, 2009.
4. "Towards predictive combustion simulations for advanced IC engine design," for Marquette University High Performance Computing Seminar, Milwaukee, WI, 14 November, 2008.
5. "Development of a chemical kinetically based ignition delay correlation," for University of Michigan, Ann Arbor, MI, 15 October, 2008.
6. "Understanding and designing for combustion at extreme pressures," for Michigan State University, East Lansing, MI, 14 October, 2008.
7. "Development of an aerosol-based charging system for rapid compression machines," for Combustion Chemistry Centre, National University of Ireland Galway, Ireland, 18 June, 2008.
8. "Biofuels Research at Marquette University," for 2008 Wisconsin Renewable Energy Summit, Milwaukee, WI, 12-14 April, 2008.
9. "RC(E)Ms for Ignition / Oxidation Studies of Kinetically-Driven Combustion Modes & Alternative Fuels" for Stanford University, Palo Alto, CA 15 October, 2007.
10. "The RCEM: A Dynamic Chemical Reactor for Characterizing Alternative Fuels & New Combustion Modes," for Colorado State University, Fort Collins, CA 9 April, 2007.
11. "Developing a test stand to study homogeneous autoignition during catalytic combustion of H₂-CH₄-air mixtures on heat exchange surfaces," poster for *5th U.S. Combustion Meeting*, San Diego, CA, 25-28 March, 2007.
12. "Sustainable Energy Initiatives at Marquette University," for 3rd Annual Green Colleges Workshop, Milwaukee Area Technical College, Mequon, WI, 20 April, 2007.
13. "Integrating Sustainability Initiatives and International Service Learning at Marquette University," for 2nd Annual Green Colleges Workshop, Milwaukee Area Technical College, Mequon, WI, 28 April, 2006.
14. "Research Activities within the Combustion Science and Energy Conversion Laboratory," for Modine Manufacturing Company, Racine, WI, 16 March, 2006.
15. "Towards the Development of an HCCI-based IC Engine-Generator: Utilizing a Rapid Compression Expansion Machine," for Argonne National Laboratory, Transportation Technology R&D Center, Argonne, IL, 24 February, 2005.
16. "Engineering Air Quality," for Student Environmental Action Coalition, Marquette University, Milwaukee, WI, 27 October, 2004.

Curriculum Vitae

17. "Ideal Otto Cycle Implementation of HCCI Combustion," for US DOE HCCI University Working Group Meeting, Sandia National Laboratories, Livermore, CA, 30 January, 2003.

PROFESSIONAL SERVICE

Reviewer for National Science Foundation Combustion, Plasma and Fire Systems, 33rd International Symposium on Combustion, *Combustion and Flame*, *Combustion Science & Technology*, *International Journal of Thermal Sciences*, *International Journal of Engine Research*, SAE World Congress and International Powertrains, Fuels & Lubricants Meetings, ASME Internal Combustion Engine Division, *Journal of Engineering for Gas Turbines and Power*, *Journal of Energy Resources Technology*, US Civilian Research and Development Foundation, University of California Energy Institute.

Organizer / Session Chair for SAE 2010 World Congress, *Kinetically Controlled CI Combustion (HCCI) Sessions*; ASME 2010 ICED Fall Technical Conference *Advanced Combustion: Low Temperature Combustion / HCCI / PCCI Session*; Combustion Institute 2009 Fall Technical Meeting, Eastern States Section of the Combustion Institute, *Reaction Kinetics Session*; Combustion Institute 6th US Combustion Meeting, *Engine Combustion Session*; SAE 14th Asia Pacific Automotive Engineering Conference, *Engine Design Session*; SAE, 2006 Powertrain & Fluid Systems Conference, *Diesel Gaseous Emissions Session*; Wisconsin Space Grant Consortium, 16th Annual Wisconsin Space Conference, *Engineering Session*.

Lecturer for FE and PE review sessions in thermodynamics, fluid mechanics and combustion.

TEACHING EXPERIENCE

Course Instructor (Primary), Thermodynamics 1 (U), Fundamentals of Heat Transfer (U), Thermodynamics 2 (with lab) (U), Internal Combustion Engines (U/G), Intermediate Thermodynamics (U/G), Principles of Combustion (G), Intermediate Fluids (G), HCCI Combustion (G), Combustion Chemistry (G); Marquette University.

Teaching Assistant, Introduction to Thermal Sciences (U), Colorado State University.

Design/Race Team Advisor, ASME Human Powered Vehicle Challenge (2003-2008), twice placed 3rd in national competition, Marquette University.

STUDENT ADVISING

Graduate Research Assistants

Alex Polley, "Droplet behavior in dense, low velocity fuel aerosols," MS expected May 2011.

Jon Wrobel, "Simulations of a natural gas fired, pancake-style burner for residential water heaters," MS expected May 2011.

Kenneth Jordan, "Entropy modeling in porous/granular materials under shock loading," PhD expected 2011 (John P. Borg, primary advisor).

Daniel Sherwin, "Fluid mechanics of a natural gas fired, pancake-style burner for residential water heaters," MS expected May 2010 (Jon D. Koch, primary advisor).

Colin Bosman, "A feasibility study of a two-stroke, reverse uniflow scavenging system for a small-scale, free piston gas compressor," MS expected December 2010. (part-time, currently at CD-Adapco)

Adam Kimmel, "Heat and mass transfer correlations for non-adiabatic, process-intensified catalytic reactors," MS expected December 2010. (part-time, currently at Modine Manufacturing Company)

Christopher Potokar, "Transient flow development in a pressure-driven reacting packed bed," MS expected May 2010. (part-time, currently at GE Aviation)

Jereon Valensa, "Development and Validation of a Mixed-Dimensionality Approach to Modeling the Interaction of Heterogeneous Steam Reforming Reactions and Heat Transfer," MS awarded December 2009 (currently at Modine Manufacturing Company).

Michael Johnson, "Ignition studies of bio-derived fuels," MS awarded August 2009, (currently at Argonne National Laboratory).

Tom Downs, MS awarded December 2005 (John P. Borg, primary advisor).

Curriculum Vitae

Undergraduate Research Assistants

Michael Denk, "Characterization of two aerosol generation systems," BS 2009 (currently MS student at Georgia Tech).

John Bustamante, "Biofuels charging system for a rapid compression machine," BS 2008 (currently PhD candidate at Georgia Tech).

Michael Johnson, "Investigation of a high-swirl, reverse uniflow scavenging system for a small-scale, free piston gas compressor," BS 2007.

Senior Design Teams

Matthew Kaminecki, Amanda Tijerina, Emily Mullen, Brandon Vogt, Emily Seiler, Jack Eaves, Kevin Dwyer, Kevin Duggan, 2007-2008 ASME Human Powered Vehicle Team, achieved 3rd place at East Coast Competition.

Mark Reisberg, Nick Madonia, Ed Erickson, Paul Meuler, John Zimmerman, Andrew Dolder, 2006-2007 ASME Human Powered Vehicle Team, achieved 3rd place at East Coast Competition.

Michael Gorilla, Matt Davis, John Dupree, Khairuzzaman Zakaria, Norazman Jusof, Doug Temeyer, 2005-2006 ASME Human Powered Vehicle Team, achieved 5th place at East Coast Competition.

Brian Bagley, Kevin Bobb, Antonio Agullo, Phil Spangler, Jorge Martinez, 2004-2005 ASME Human Powered Vehicle Team, achieved 7th place at East Coast Competition.

Revised April 2010.