

Resume

Chris Atkinson, Sc.D., Fellow ASME, Fellow SAE (Christopher M. Atkinson)

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EXPERTISE

Advanced mobility, transportation and vehicle technologies. Vehicle automation, vehicle connectivity, engine control, calibration and optimization; model-based, machine learning, AI, neural network and data-driven control, engine control software, calibration and optimization methodologies; diesel exhaust emissions reduction; fuel efficiency improvement and GHG reduction; alternative fuel and NG utilization; hybrid electric vehicle development. High-efficiency HVAC technologies. Technology assessment, technical due diligence, innovation, research and development, entrepreneurship and commercialization in advanced clean and sustainable energy technologies. Development and deployment of low GHG energy technologies.

I. PROFESSIONAL BACKGROUND

2020-present	Director, Smart Mobility & Professor of Mechanical and Aerospace Engineering, Ohio State University.
2014-2020	Program Director, Advanced Research Projects Agency – Energy (ARPA-E), US Department of Energy. Developing programs to fund high risk, high reward innovative energy technologies for generation, storage, distribution and usage.
2000-present	Founder, Atkinson LLC. Developer of innovative commercial methods for model-predictive control and calibration for engines and industrial processes.
2009-2011	Professor (with tenure), Department of Mechanical and Aerospace Engineering, West Virginia University. Director of the Center for Alternative Fuels, Engines and Emissions.

2002-2008	Member, International Scientific Advisory Board, Combustion Engine Research Center, Chalmers University, Gothenburg, Sweden.
2000-2002	Chief Engineer and Co-Founder, Calico Systems Inc.
1996-2000	Associate Professor (with tenure), Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV.
1991-1995	Assistant Professor, Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV.

II. EDUCATION

1991	Sc.D. (Doctor of Science in Mechanical Engineering), Massachusetts Institute of Technology.
1987	MS (Mechanical Engineering), West Virginia University.
1983	BS (Chemical Engineering), University of Natal, South Africa.

III. PROFESSIONAL ACHIEVEMENTS

Research and Development Program Management – Federal

Program Director, Advanced Research Projects Agency – Energy (ARPA-E), US Department of Energy. Program management of high risk, high reward innovative energy technologies for generation, storage, distribution and usage. Responsible for project commercialization, including demonstration projects and pilot deployments. Responsible for over \$120 million in project funding and oversight (2014-2017) including conceiving of and developing NEXTCAR, a \$35 million program in improving the energy efficiency of connected and automated vehicles. Responsible for several engine development projects, including ARPA-E's largest single project (opposed piston, gasoline compression ignition engine). Other projects funded include high-efficiency HVAC, passive cooling techniques, marine hydrokinetic energy and solar PV components.

Entrepreneurship and Business Development

Founded and developed two high technology companies (Calico Systems Inc. and Atkinson LLC) with over \$7.5M in total billing since 2000 from over 15 clients in engines, fuels, emissions reduction and energy, including multinational corporations and government agencies. Responsible for business development, proposal preparation and negotiation, contracting, business methods implementation and management, financial and business strategy functions.

Achieved Defense Contracts Audit Agency (DCAA) financial controls and audit system compliance for Atkinson LLC (2005), required for participation in federally-funded contracting.

Software Development, Commercialization and Technology Transfer

Developed and commercialized a rapid transient engine calibration system using data-driven computational techniques, allowing for off-line model-based engine calibration, a transformative technology in the engine control and calibration field. Launch customer for conventional diesel fuels and GTL fuels was Sasol Inc. (2013-2014).

Developed a data-driven model-based engine calibration process for Cummins Inc. for their flagship heavy-duty diesel engine (2012-2013) to reduce engine development time, costs and effort.

Developed an innovative neural network model-based virtual sensing development system for Caterpillar Inc. to reduce the diagnostics burden for advanced heavy-duty engines (2010-2012).

Developed and implemented a world-first model-based control system for diesel engines for Detroit Diesel Corporation (Daimler Trucks NA), for the US DOE-funded Super Truck program to improve fuel efficiency, reduce exhaust emissions and improve engine performance. This data-driven model-based control system represents a significant improvement over conventional control systems, reducing costs and complexity while improving all measureable engine performance outcomes, including over 50% peak engine brake thermal efficiency (2010-2014).

Developed a data-driven model-based calibration methodology for Volvo AB (Sweden) for their heavy-duty diesel truck range (2006-2008).

Developed and prototyped advanced engine control and calibration methods for next generation high efficiency, low emissions HCCI engines for Caterpillar Inc. incorporating variable compression ratio (2005-2006).

Performed engine calibration system development for International Truck and Engine Corporation (Navistar) (1999-2005).

Developed a model-based calibration optimization system for Detroit Diesel Corporation (Daimler GmbH). Developed a rapid transient calibration system to calibrate heavy duty diesel

engines to US EPA 2007 and 2010 exhaust emissions levels with a 75% reduction in the time to calibrate. Resulted in significant cost and time savings for the certification of new low emissions, high fuel efficiency engines (2005-2010).

Performed advanced engine calibration for Mack Trucks, reducing time and effort required to calibrate, and reducing corporate engine development costs (2000-2002).

Advanced Engine Technology Assessment

Performed technology assessment for potential diesel engines for BAE Inc. for the US Army Future Combat Systems (FCS) prototype unmanned ground vehicle MULE (2004).

Technology assessment for Argonne National Laboratory in advanced technology vehicle research (including diesels, hybrids and electric vehicles) (2002-2004).

Technology assessment for Halliburton for the design of next-generation engine-driven hydraulic fracturing pump systems (2005).

Alternative Fuels Development

Assisted PetroSA (South Africa) with its application to the US Department of Energy for gas-to-liquids (GTL) fuel to be designated as an alternative fuel under EPACT legislation (2000-2004).

Vehicle Fuel Efficiency Expert Assessment

Consulting Expert for USTDA-China Heavy Duty Commercial Vehicle Fuel Standards Study Tour (2013). Sponsored by the US Trade and Development Agency and managed by Tera International Group, Inc.

Diesel Engine Product Development, Project Management and Technology Transfer

Developed a small diesel engine propulsion system for Lockheed Martin's tactical unmanned ground vehicle (TUGV) for Marine Corps based on the Mercedes-Benz OM660 engine. This vehicle was successfully tested at the US Marine Corps Base at Quantico, VA (2002-2004).

Developed an innovative diesel engine drive system for a hybrid electric unmanned ground combat vehicle (UGCV) [capable of running inverted] for Lockheed Martin and MillenWorks. This vehicle was successfully tested at the US Army's Yuma Proving Grounds, AZ (2000-2002).

Mechatronic Sensor Development and Technology Transfer

Developed a production-ready artificial intelligence-based knock-sensing system for spark-ignition engines for DENSO R&D (Japan) to improve the fuel efficiency of gasoline vehicles (2000-2002).

Developed a mechatronic refrigerant flow sensor to reduce the energy consumption of automotive air conditioning systems for Ford Motor Company (1991-1993).

Developed an innovative mechatronic multiphase flow sensor for measuring gas and liquid flowrates in producing oil and gas wells for Halliburton Energy Services (1996-2000).

Hybrid Electric Vehicle Development

Designed, developed and tested four hybrid electric vehicles while at West Virginia University (1991-2000) that achieved world-class fuel economy, while retaining acceptable performance and utility. Won the US DOE-sponsored FutureTruck Advanced Vehicle Competition in 2000.

Designed an innovative torque and speed control transmission for hybrid electric vehicles for Nissan R&D (Japan) to evaluate its efficacy as a candidate for next-generation vehicle powertrains (1995-1997).

Designed and developed two prototype linear, free-piston engines for electrical power generation for the Department of Defense (1996-2000), one <1 kW spark-ignited (SI) and the other a 5-kW compression ignition (CI).

Emissions Reduction Development

Developed an innovative engine exhaust emissions reduction system for NO_x reduction (Transmural Catalysis) with N.N. Clark. US Patent 7,571,600 (issued August 11, 2009).

Expert Assessment and Litigation

Performed expert assessment for IP-related litigation concerning exhaust aftertreatment on behalf of Howard Rice Nemerovski Canady Falk & Rabkin (2005-2006).

Performed expert assessment for class action litigation concerning diesel passenger car exhaust aftertreatment and emissions on behalf of legal counsel (2016).

Academic Research and Teaching Accomplishments

Held a fully tenured professorship in mechanical engineering at West Virginia University. Recipient of 3 major honors from the American Society of Mechanical Engineers (ASME) [Member since 1991], Society of Automotive Engineers (SAE) [Member since 1991] and National Science Foundation (NSF). Responsible for over \$2.5M in research funding and expenditures (1991-2000 and 2009-2011) in the clean energy area. Author of 22 archival peer-reviewed journal papers and over 70 peer-reviewed conference papers.

IV. HONORS AND AWARDS

Fellow of the Society of Automotive Engineers (SAE). Elected 2018.

Fellow of the American Society of Mechanical Engineers (ASME). Elected 2016.

Recipient of National Science Foundation FutureCar Advisors Award (NSF), 1999 (in conjunction with the American Society for Engineering Education, ASEE).

Recipient of Ralph Teetor Award, Society of Automotive Engineers (SAE), 1994.

Recipient of Lewis F. Moody Award, American Society of Mechanical Engineers (ASME), 1993.

V. PATENTS AND PATENT APPLICATIONS

US Patent 7,571,600 (issued August 11, 2009). Method and apparatus for reducing pollutants in engine exhaust. Inventors: N.N. Clark and C.M. Atkinson. Assigned to West Virginia University Research Corporation.

US Application No. 20110264353 A1. Model-based optimized engine control. Inventors: C.M. Atkinson, M.C. Allain, A. Kropp. Assigned to Detroit Diesel Corporation. (Referenced by 18 international patents and patent applications).

US Application No. 20160160787 A1. Controller for controlling an internal combustion engine of a vehicle, in particular a commercial vehicle. Inventors: M.C. Allain, C.M. Atkinson, P. Attema. Assigned to Daimler AG.

VI. JOURNAL PUBLICATIONS

SPANGHER*, L., GORMAN*, W., BAUER*, G., XU, Y., and C. ATKINSON, "Quantifying the impact of US electric vehicle sales on light-duty vehicle fleet CO2 emissions using a novel agent-based simulation", Transportation Research Part D: Transport and Environment, Vol. 72, 2019, 358-377.

CLARK, N.N., J.M. KERN*, C.M. ATKINSON and R.D. NINE*, "Factors Affecting Heavy-Duty Diesel Vehicle Emissions", Journal of the Air and Waste Management Association, Vol. 52, 2002, pp. 84-94. [Cited 100 times in archival, peer-reviewed publications].

YACOUB*, Y. and C.M. ATKINSON, "Evaluation of Oxides of Nitrogen Emissions for the Purpose of their Transient Regulation from a Direct Injection Diesel Engine", International Journal of Vehicle Design: Heavy Vehicle Systems, Vol. 8, Nos. 3-4, 2001.

THOMPSON, G.J., C.M. ATKINSON, N.N. CLARK, T. LONG and E. HANZEVACK, "Neural Network Modeling of the Emissions and Performance of a Heavy-Duty Diesel Engine", Proceedings of the Institution of Mechanical Engineers. Part D, Journal of Automobile Engineering, Vol. 214, 1999, pp. 111-126. [Cited 105 times in archival, peer-reviewed publications].

CLARK, N.N., C.M. ATKINSON, G.J. THOMPSON and R.D. NINE*¹, "Transient Emissions Comparisons of Alternative Compression Ignition Fuels", Transactions of the Society of Automotive Engineers, Journal of Fuels and Lubricants, Vol. 108, 1999, pp. 468-482. [Cited 46 times in archival, peer-reviewed publications].

ATKINSON, C.M., G. J. THOMPSON, M.L. TRAVER* and N.N. CLARK, "In-Cylinder Combustion Characteristics of Fischer-Tropsch and Conventional Diesel Fuels in a Heavy Duty CI Engine" Transactions of the Society of Automotive Engineers, Journal of Fuels and Lubricants, Vol. 108, 1999, pp. 813-836. [Cited 62 times in archival, peer-reviewed publications].

CLARK, N.N., R. P. JARRETT* and C.M. ATKINSON, "Field Measurements of Particulate Matter Emissions and Exhaust Opacity from Heavy Duty Vehicles", Journal of the Air and Waste Management Association, Vol.49, 1999, pp. 76-84. [Cited 52 times in archival, peer-reviewed publications].

ATKINSON, C.M., S. PETREANU*, N.N. CLARK, R.J. ATKINSON, T. McDANIEL, S. NANDKUMAR*, and P. FAMOURI, "Numerical Simulation of a Two-Stroke Linear Engine-Alternator Combination", Transactions of the Society of Automotive Engineers, Journal of Engines, Vol. 108, 1999, pp. 1416-1430. [Cited 117 times in archival, peer-reviewed publications].

CAWTHORNE*, W.R., P. FAMOURI, J. CHEN*, N.N. CLARK, T. McDANIEL, R.J. ATKINSON, S. NANDKUMAR*, C.M. ATKINSON, and S. PETREANU*, "Development of a Linear Alternator-Engine for Hybrid Electric Vehicle Applications". IEEE Transactions on Vehicular Technology, Vol. 48, No. 6, 1999, pp. 1797-180. [Cited 92 times in archival, peer-reviewed publications].

R.D. NINE*, N.N. CLARK, J.J. DALEY*, and C.M. ATKINSON, "Development of a Heavy-Duty Chassis Dynamometer Driving Route", Proceedings Inst. Mechanical Engineers Part D, Journal of Automobile Engineering, Vol. 213, 1999, pp. 561-574. [Cited 46 times in archival, peer-reviewed publications].

YACOUB*, Y. and C.M. ATKINSON, "Modularity in Spark Ignited Engines: A Review of its Benefits, Implementation and Limitations", Transactions of the Society of Automotive

¹ * denotes student author.

Engineers, Journal of Engines, Vol. 107, 1998, pp. 2255-2266. [Cited 12 times in archival, peer-reviewed publications].

WAYNE, W.S., N.N. CLARK and C.M. ATKINSON, "A Parametric Study of Knock Control Strategies for a Bi-Fuel Engine", Transactions of the Society of Automotive Engineers, Journal of Engines, Vol. 107, 1998, pp. 1387-1393. [Cited 17 times in archival, peer-reviewed publications].

MCKAIN, D.L., N.N. CLARK, C.M. ATKINSON and R. TURTON, "Correlating Local Tube Surface Heat Transfer with Bubble Presence in a Fluidized Bed", Powder Technology, Vol. 79, No. 1, 1994, pp. 69-79. [Cited 17 times in archival, peer-reviewed publications].

ATKINSON, C.M. and H.K. KYTOMAA, "Acoustic Properties of Solid-Liquid Mixtures and the Limits of Ultrasound Diagnostics-1: Experiments", Journal of Fluids Engineering, Vol. 115, No. 44, 1993, pp. 665-675. [Cited 24 times in archival, peer-reviewed publications].

REIMOLD, S.C., C.M. ATKINSON, B. LUNA and R.T. LEE, "Influence of jet impingement on color Doppler parameters of aortic regurgitation", Echocardiography, Vol. 10, No. 2, 1993, pp. 113-9.

KYTOMAA, H.K. and C.M. ATKINSON, "Sound Propagation in Suspensions and Acoustic Imaging of their Microstructure", Mechanics of Materials, Vol. 16, No. 1-2, 1993, pp. 189-197.

ATKINSON, C.M. and H.K. KYTOMAA, "Acoustic Wave Speed and Attenuation in Suspensions", International Journal of Multiphase Flow, Vol. 18, No. 4, 1992, pp. 573-592. [Cited 109 times in archival, peer-reviewed publications].

KYTOMAA, H.K. and C.M. ATKINSON, "Microstructure and the Acoustic Properties of Suspensions", Advances in Micromechanics of Granular Materials, Elsevier, 1992.

LOREE, H.M., R.D. KAMM, C.M. ATKINSON and R.T. LEE, "Turbulent Pressure Fluctuations on the Surface of Model Vascular Stenoses", American Journal of Physiology, Vol. 261, No. 3, (Heart Circ. Physiol. 30), 1991, pp. H644-H650. [Cited 72 times in archival, peer-reviewed publications].

ATKINSON, C.M. and N.N. CLARK, "Gas Sampling from Fluidized Beds: A Novel Probe System", Powder Technology, Vol. 54, No. 1, 1988, pp. 59-70. [Cited 32 times in archival, peer-reviewed publications].

CLARK, N.N. and C.M. ATKINSON, "Amplitude Reduction and Phase Lag in Fluidized Bed Pressure Measurements", Chemical Engineering Science, Vol. 43, No. 7, 1988, pp. 1547-1557. [Cited 36 times in archival, peer-reviewed publications].

CLARK, N.N., R.L.C. FLEMMER and C.M. ATKINSON, "Turbulent Circulation in Bubble Columns", A.I.Ch.E. Journal, Vol. 33, No. 3, 1987, pp. 515-518. [Cited 64 times in archival, peer-reviewed publications].

CLARK, N.N and C.M. ATKINSON, "Effect of Solids Settling on Pachuca Tank Performance", Minerals and Metallurgical Processing, Vol. 4, No. 1, 1987, pp. 24-27.

VII. REFEREED CONFERENCE PUBLICATIONS

2016

P. Schaberg and C.M. Atkinson, "Calibration Optimization of a Heavy-Duty Diesel Engine with GTL Diesel Fuel", SAE Congress, SAE 2016-01-0622.

2014

C.M. Atkinson, "Fuel Efficiency Optimization using Rapid Transient Calibration", SAE Commercial Vehicle Congress, SAE 2014-01-2359.

2009

C.M. Atkinson, M. Allain, Y. Khalish and H. Zhang, "Model-Based Control of Diesel Engines for Fuel Efficiency Optimization", SAE Congress, SAE 2009-01-0727.

2008

C.M. Atkinson, M. Allain and H. Zhang, "Using Model-Based Rapid Transient Calibration to Reduce Fuel Consumption and Emissions in Diesel Engines", SAE Congress, SAE 2008-01-1365.

2005

C.M. Atkinson and G.E. Mott, "Dynamic Model-Based Calibration Optimization: An Introduction and Application to Diesel Engines", SAE Congress, SAE 2005-01-0026. [Cited 52 times in archival, peer-reviewed publications].

2001

C.M. Atkinson, S. Taylor*², J. Conley*, J. Smith*, B. Clay*, R. Waters* and C. Toth-Nagy*, "The Development of a Fourth-Generation Hybrid Electric Vehicle at West Virginia University", SAE Congress, SAE 2001-01-0682.

² * denotes student author.

1999

M.L. Traver*, R.J. Atkinson and C.M. Atkinson, "Neural Network-based Diesel Engine Emissions Prediction Using In-Cylinder Combustion Pressure". SAE Spring Fuels and Lubricants Meeting, Dearborn, MI, May 1999. (SAE 1999-01-1532).

C.M. Atkinson, G. J. Thompson, M.L. Traver* and N.N. Clark, "In-Cylinder Combustion Characteristics of Fischer-Tropsch and Conventional Diesel Fuels in a Heavy Duty CI Engine". SAE Spring Fuels and Lubricants Meeting, Dearborn, MI, May 1999. SAE Paper No. 1999-01-1472.

Y. Yacoub* and C.M. Atkinson, "An Air Cycle Analysis of Alternatives to Throttling in the Otto Cycle Engine", Published in the Proceedings of the 1999 ASME Spring Internal Combustion Engine Conference, Columbus, IN, April 1999.

C.M. Atkinson, S. Petreanu*, N.N. Clark, R.J. Atkinson, T. McDaniel, S. Nandkumar*, and P. Famouri, "Numerical Simulation of a Two-Stroke Linear Engine-Alternator Combination", SAE Congress, Detroit, MI, February 1999. SAE Paper No. 1999-01-0921.