

# Curriculum Vitae

**Michael J. Lawson**

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## Education

**2005: B.S. Virginia Tech, Mechanical Engineering**

**2006: M.S. Virginia Tech, Mechanical Engineering**

Advisor: Karen Thole

**2010: Ph.D. The Pennsylvania State University, Mechanical Engineering**

Advisors: Gary Settles and Eric Paterson

Dissertation: A Fundamental Study of the Airflow and Odorant Transport Phenomena of Canine Olfaction

## Experience

### **2018–Present: Senior Scientist**

Wind and Water Power Program. National Renewable Energy Laboratory. Boulder, CO

- Worked with a large multi-lab team to develop a blade-resolved wind farm simulation capability using the Nalu CFD code, with the ultimate goal of developing an exascale wind farm CFD modeling tool.
- Supported the DOE Water Power Technologies office in (1) the development of the DOE Marine and Hydrokinetic Program Strategy, (2) in the development of DOE funding opportunity announcements, and (3) in the management of industry projects.
- Studied bat barotrauma from an aerodynamics perspective to help determine the likelihood that barotrauma is a significant contributor to wind turbine-related bat fatalities.
- Studied wind turbine wake propagation under stable atmospheric conditions using the SOWFA CFD tool in order to understand wake physics with the objective of informing simplified wind farm wake models and developing wind farm control strategies.

### **2015–2017: Technical Advisor (Management and Operations Contractor)**

Wind and Water Power Technologies Office. U.S. Department of Energy. Washington, D.C.

- Provided technical support for the Department of Energy Wind Program's Atmosphere to Electrons (A2e) program. A2e has the objective of using modern high performance computing and experimental techniques to optimize the performance of wind plants in order to significantly reduce the cost of wind energy.
- Collaborated with Department of Energy staff to develop a U.S. strategy for the development of wave and tidal, ocean, and river current energy technologies.
- Developed funding opportunities to support the deployment of utility-scale wave and tidal/ocean/river current technologies and supported the evaluation of applications.
- Provided technical support for Department of Energy funded National Lab and industry projects.
- Supported the economic analysis and evaluation of wave and tidal/ocean/river current energy technologies.

### **2012–2014: Scientist**

Water Power Program. National Renewable Energy Laboratory. Boulder, CO

- PI on the team developing WEC-Sim, an open-source wave energy converter simulation tool that has been widely adopted by industry and academia. The WEC-Sim project was a 4-year NREL-Sandia collaboration. I was the NREL lead developing the WEC-Sim project proposal and once the project was awarded I helped managing an NREL budget of more than \$1M per year and coordinating work between researchers at NREL and Sandia.
- Co-PI on an LDRD project with the objective of developing WEC technologies that have the ability to utilize advanced control strategies to improve performance and reduce loads on wave energy converters. I was the lead on the proposal development team and was responsible for management of the 3-year / \$750K project
- Designed and analyzed a wave energy converters and tidal/ocean current turbines using experimental methods and computational fluid dynamics (CFD) simulations as Part of the DOE Reference Model Project.
- Performed a techno-economic assessment of wave and tidal current energy technologies for the United States.

### 2010–2012: Postdoctoral Researcher

Water Power Program. National Renewable Energy Laboratory. Boulder, CO

- Developed a new version of the axial-flow rotor optimization code HARP-Opt.
- Developed computational fluid dynamics (CFD) methods to simulate tidal current turbines.
- Developed a discrete vortex method code to simulate vertical axis turbines.

### 2007–2010: National Defense Science and Engineering Graduate Fellow

Gas Dynamics Lab and U.S. Navy Applied Research Lab. Penn State. University Park, PA.

- Studied the fluid dynamics and odorant transport of canine olfaction.

### 2006–2007: Contractor

Aerodynamics Division. BMW. Munich, Germany

- Performed vehicle aerodynamics research using CFD techniques.

### 2005–2006: Graduate Research Assistant

Experimental and Computational Combustion Lab. Virginia Tech. Blacksburg, VA

## Journal Publications

1. **Lawson, M., Jenne, D. Thresher, R., Houck, D.** In Preparation - Expected 2018, “Wind Turbines and Bat Mortality: Investigating the Bat Barotrauma from an Aerodynamics Perspective”, Planned Submission to: *PLOS One*
2. **Fleming, P., Annoni, J., Churchfield, M., Martinez, T., Gruchalla, K., Lawson, M.,** 2017, “From wake steering to flow control”, *Wind Energy Sciences*, <https://doi.org/10.5194/wes-3-243-2018>.
3. **Tom N., Lawson, M., Yu, Y., Wright, A.,** 2016. “Spectral Modeling of an Oscillating Surge Wave Energy Converter with Control Surfaces”. *Applied Ocean Research*, <https://doi.org/10.1016/j.apor.2016.01.006>.
4. **Tom N., Lawson, M., Yu, Y., Wright, A.,** 2016. “Development of a Nearshore Oscillating Surge Wave Energy Converter with Variable Geometries”. *Renewable Energy*, <https://doi.org/10.1016/j.renene.2016.04.016>.
5. **Lawson, M., Craven, B., Paterson, E., and Settles, G.,** 2012. “A Computational Study of Odorant Transport and Deposition in the Canine Nasal Cavity: Implications for Olfaction”. *Chemical Senses*, <https://doi.org/10.1093/chemse/bjs039>.
6. **Hargather, M., Lawson, M., Settles, G., and Weinstein, L.,** 2011. “Seedless Velocimetry Measurements by Schlieren Image Velocimetry”. *American Institute of Aeronautics and Astronautics Journal*, <https://doi.org/10.2514/1.J050753>.
7. **Craven, B., Paterson, E., Settles, G., and Lawson, M.,** 2009. “Development and Verification of a High-fidelity Computational Fluid Dynamics Model of Canine Nasal Airflow”. *Journal of Biomechanical Engineering*, <https://doi.org/10.1115/1.3148202>.
8. **Lawson, M., and Thole, K.,** 2008. “Heat Transfer Augmentation Along the Tube Wall of a Louvered Fin Heat Exchanger Using Practical Delta Winglets”. *International Journal of Heat and Mass Transfer*, <https://doi.org/10.1016/j.ijheatmasstransfer.2007.08.016>.

## Conference Publications

1. **Lawson, M., Barahona Garzon, B., Wendt, F., Yu, Y., Michelen, C.,** 2016. “COER Hydrodynamic Modeling Competition: Modeling the Dynamic Response of a Floating Body Using the WEC-Sim and FAST Simulation Tools”. *Proceedings of the ASME 35th International Conference on Ocean, Offshore and Arctic Engineering*, Paper No. OMAE2015-42288.
2. **Tom N., Yu, Y., Wright, A., Lawson, M.,** 2016. “Balancing Power Absorption and Fatigue Loads in Irregular Waves for an Oscillating Surge Wave Energy Converter”. *Proceedings of the ASME 35th International Conference on Ocean, Offshore and Arctic Engineering*, Paper No. OMAE2016-55046.
3. **Quon, E., Platt, A., Yu, Y., Lawson, M.,** 2016. “Application of the Most Likely Extreme Response Method for Wave Energy Converters”. *Proceedings of the ASME 35th International Conference on Ocean, Offshore and Arctic Engineering*, Paper No. OMAE2016-54751.
4. **Tom N., Lawson, M., Yu, Y.,** 2015. “Recent Additions in the Modeling Capabilities of an Open-Source Wave Energy Converter Design Tool”. *Proceedings of the Twenty-Fifth International Ocean and Polar Engineering Conference*, pp. 835-842.
5. **Yu, Y., Van Rij, J., Coe, R., Lawson, M.,** 2015. “Preliminary Wave Energy Converters Extreme Load Analysis”. *Proceedings of the ASME 34th International Conference on Ocean, Offshore and Arctic Engineering*, Paper No. OMAE2015-41532.

6. **Lawson, M., Yu, Y., Nelessen, A., Ruehl, K., Michelen, C.**, 2014. "Implementing Nonlinear Buoyancy and Excitation Forces in the WEC-Sim Wave Energy Converter Modeling Tool". *Proceedings of the ASME 33rd International Conference on Ocean, Offshore and Arctic Engineering*, Paper No. OMAE2014-24445.
7. **Ruehl, K., Michelen, C., Kanner, S., Lawson, M., Yu, Y.**, 2014. "Preliminary Verification and Validation of WEC-Sim, an Open-Source Wave Energy Converter Design Tool". *Proceedings of the ASME 33rd International Conference on Ocean, Offshore and Arctic Engineering*.
8. **Lawson, M., Li, Y., and Sale, D.**, 2011. "Development and Verification of a Computational Fluid Dynamics Model of a Horizontal-Axis Tidal Current Turbine". *Proceedings of the 30th International Conference on Ocean, Offshore, and Arctic Engineering*, Paper No. OMAE2011-49863.
9. **Bir, G., Lawson, M., and Li, Y.**, 2011. "Structural Design of a Horizontal-axis Tidal Current Turbine Composite Blade". *Proceedings of the 30th International Conference on Ocean, Offshore, and Arctic Engineering*, Paper No. OMAE2011-50063.
10. **Hargather, M., Lawson, M., Settles, G., Weinstein, L., and Gogineni, S.**, 2009. "Focusing-Schlieren PIV Measurements of a Supersonic Turbulent Boundary Layer". *47th AIAA Aerospace Sciences Meeting Including The New Horizons forum and Aerospace Exposition*, Paper No. AIAA 2009-69
11. **Lawson, M., Sanders, P., and Thole, K.**, 2006. "Computational and Experimental Comparison of Tube Wall Heat Transfer Augmented by Winglets in Louvered Fin Heat Exchangers". *ASME 2006 International Mechanical Engineering Congress and Exposition*, Paper No. IMECE2006-14452

## Technical Reports

1. **Batty, H., Lawson, M.**, Planned Publication in 2018. U.S. "Department of Energy Water Power Technologies Office: Strategy for Marine and Hydrokinetic (MHK) Technologies R&D".
2. **Yu, Y., Lawson, M., Li, Y., Previsic, M., Epler, J., Lou, J.**, 2015. "Experimental Wave Tank Test for Reference Model 3 Floating-Point Absorber Wave Energy Converter Project", Dept. of Energy Report DOEGO-102014-4450.
3. **V. Neary, M. Previsic, R. Jepsen, M. Lawson, Y. Yu, A. Copping, A. Fontaine, K. Hallett, D. Murray**, 2014. "Methodology for Design and Economic Analysis of Marine Energy Conversion (MEC) Technologies". SAND2014-9040
4. **Lawson, M., Yu, Y., Weber, J., Coe, R., Neary, V.**, 2014. "Extreme Conditions Modeling Workshop Report", Dept. of Energy Report, DOEGO-102014-4450.
5. **Musial, W., Lawson, M., Rooney, S.**, 2013. "Marine and Hydrokinetic Technology (MHK) Instrumentation, Measurement, and Computer Modeling Workshop", NREL Report NRELTP-5000-57605.
6. **Beam, M., Kline, B., Elbing, B., Fontaine A., Lawson M., Thresher, R., and Li, Y.**, 2012. "Marine Hydrokinetic Turbine Power-Take-Off Design for Optimal Performance and Low Impact on Cost-of-Energy", NREL Report No. CP-5000-54410.

## Selected Presentations

1. **Lawson, M., Paterson, E., and Settles, G.**, 2009. "Flow Visualization Experiments In A 4:1 Scale Model of The Canine Nasal Cavity". *American Physics Society - Division of Fluid Dynamics Conference*.
2. **Lawson, M., and Settles, G.**, 2007. "Focusing-schlieren PIV for the measurement of 3-D turbulent flows". *American Physics Society - Division of Fluid Dynamics Conference*.
3. **Settles, G., Lawson, M., Hargather, M., and Bigger, R.**, 2007. "Belt-Snap and Towel-snap Shock Waves". *American Physics Society - Division of Fluid Dynamics Conference*.