



## **Eric S. Winkel, Ph.D., P.E., CFEI, CVFI**

### **Professional Specialization**

Specializes in marine engineering design, vessel and component design analysis, and failure investigation related to marine incidents. Performed accident investigation and accident reconstruction involving watercraft ranging from personal watercraft to large commercial vessels. Extensive experience designing and executing experimental research to evaluate full vehicle, system-level, and component-level performance on everything from watercraft to motorcycles to passenger vehicles. Also specializes in fluid mechanics, acoustics, dynamics and vibrations, structural analysis, and fracture mechanics along with other mechanical and marine engineering disciplines. Expertise and experience as a fire and explosion investigator.

Investigated, studied, and published on human kinematics and injury mechanics related to marine, automotive, and motorsports incidents. Past investigations related to injury causation analysis have ranged from spinal injuries to propeller strikes to slip and fall incidents.

Authored numerous technical articles on a variety of engineering disciplines and presented the results to various professional associations. Worked on the development of instructional materials and information systems such as operator manuals and warning labels, related to recreational watercraft and motorsports products.

### **Professional Background**

B.S.E. (Mechanical Engineering) University of Michigan - Ann Arbor, 2003

M.S.E. (Mechanical Engineering) University of Michigan - Ann Arbor, 2004

Ph.D. (Mechanical Engineering) University of Michigan - Ann Arbor, 2007

### **Senior Project Engineer**

Design Research Engineering, 2010-present

### **Project Engineer**

Design Research Engineering, 2007- 2010

### **Research Assistant**

Department of Mechanical Engineering, University of Michigan - Ann Arbor, 2003-2007

### **Undergraduate Research Assistant**

Department of Mechanical Engineering, University of Michigan - Ann Arbor, 2001-2003

### **Professional Licensure and Certification**

Registered Professional Mechanical Engineer, Michigan, #6201061021

Certified Fire and Explosion Investigator (CFEI) #22182-12732

Certified Vehicle Fire Investigator (CFVI) #22182-12732v

Certified Technician, American Boat and Yacht Council (Marine Electrical)

Certified Technician, American Boat and Yacht Council (Marine Systems)

### **Honors**

Magna cum Laude, University of Michigan

Rackham Merit Fellowship, University of Michigan

### **Memberships and Affiliations**

Member, Acoustical Society of America

Member, Society of Automotive Engineers

Member, Society of Naval Architects

Member, National Association of Fire Investigators

Member, American Boat and Yacht Council

Technical Paper Reviewer, Society of Automotive Engineers

Technical Paper Reviewer, Traffic Injury Prevention

### **Continuing Education**

- NASBLA Staged Boat Collisions (Sep 2007, Sep 2008, May & Sep 2009, Chester, VA)
- Training Seminar and Certification for the English XL Tribometer (Jan 2008, Tampa, FL)
- ASTM Conference on Pedestrian Safety (Jan 2008, Tampa, FL)
- NTSB Marine Accident Investigation – MS101 (Jan 2009)
- Faro Laser Scanner LS – Training Program (Dec 2009, Novi, MI)
- Chesapeake Power Boat Symposium (Mar 2010, Annapolis, MD)
- International Boatbuilder’s Exhibition and Conference, Boating Industry Risk Management Council meetings (Oct 2010, Louisville, KY)
- West Systems, Professional Level Workshop on Boat Repair (Oct 2011)
- International Boatbuilder’s Exhibition and Conference, 3-day Educational Seminars (Oct 17-19, 2011)
- Advanced Marine Fire Investigation Course (May 29-30, 2014, Sayreville, NJ)
- SAE 2015 World Congress & Exhibition (Apr 21-23, 2015, Detroit, MI) – *technical paper presented*
- ABYC Marine Electrical Certification (Apr 19-22, 2016, Norfolk, VA)
- ABYC Marine Systems Certification (Aug 13-16, 2016, Sturtevant, WI)
- National Fire investigator Training Program (Mar 13-16, 2017, Richmond, KY)
- NAFI – Vehicle Fire Arson & Explosion Investigation Science & Technology Seminar (Sep 18-20, 2017, Lexington, KY)
- NASBLA GPS Forensics (Nov 15, 2018, Annapolis, MD)

### **Papers - Refereed Journals, Conferences and Symposium Proceedings**

- “Focus Headform Testing Used to Evaluate Head Injury Risk for Ejected Riders of Personal Watercraft,” Proceedings of the International Mechanical Engineering Congress & Exposition, American Society of Mechanical Engineers, IMECE 2017-72676, Nov 2017, Tampa, Florida (with C. Mkandawire, N. White, E. Schatz) (as submitted for press)
- “Evaluation of Air Bag Electronic Sensing System Collision Performance through Laboratory Simulation,” Society of Automotive Engineers World Congress & Exhibition Occupant Protection: Safety Test Methodology, 2015 (with D. Toomey, R. Krishnaswami)
- “Assessment of Compressive Thoracolumbar Injury Potential and Influence of Seat Cushions on Vertical Impact Loading of a Seated Occupant,” *Society of Automotive Engineers International Journal of Passenger Cars – Mechanical Systems*, 2015 (with D. Toomey, R. Taylor)
- “Turbulence Profiles from a Smooth Flat-Plate Turbulent Boundary Layer at High Reynolds Number,” *Experimental Thermal and Fluid Science*, 2012 (With J. Cutbirth, M. Perlin, S. Ceccio, D. Dowling)
- “The Mean Velocity Profile of a Smooth Flat-Plate Turbulent Boundary Layer at High Reynolds Number,” *Journal of Fluid Mechanics*, 2010 (with G. Oweis, J. Cutbirth, S. Ceccio, M. Perlin, D. Dowling)
- “High-Reynolds-number Turbulent-Boundary-Layer Wall Pressure Fluctuations with Dilute Polymer Solutions,” *Physics of Fluids*, 2010 (with B. Elbing., S. Ceccio, M. Perlin, D. Dowling).
- “Vehicle Chassis, Body, and Seat Buckle Acceleration Responses in the Vehicle Crash Environment,” *Society of Automotive Engineers International Journal of Passenger Cars – Mechanical Systems*, 2(1): 1151-1170, 2009 (with D. Toomey, E. Paddock, R. Burnett)
- “High-Reynolds-Number Turbulent Boundary Layer Friction Drag Reduction from Wall-Injected Polymer Solutions,” *Journal of Fluid Mechanics*, 2009 (with G. Oweis, S. Vanapalli, D. Dowling, M. Perlin, M. Solomon, S. Ceccio)
- “Degradation of Homogeneous Polymer Solutions in Large Diameter, High Shear Turbulent Pipe Flow,” *Experiments in Fluids*, 2009 (with B. Elbing, M. Solomon, S. Ceccio)
- “Bubble-Induced Skin-Friction Drag Reduction and the Abrupt Transition to Air-Layer Drag Reduction,” *Journal of Fluid Mechanics*, 2008 (with B. Elbing, K. Lay, S. Ceccio, D. Dowling, M. Perlin)
- “High-Reynolds-Number Turbulent-Boundary-Layer Wall Pressure Fluctuations with Skin-Friction Reduction by Air Injection,” *Journal of the Acoustical Society of America*, 2008 (with B. Elbing., S. Ceccio, M. Perlin, D. Dowling).
- “Investigation of Drag Reduction Methods by Air Injection beneath a Turbulent Boundary Layer at High-Reynolds-Number,” 6<sup>th</sup> International Conference on Multiphase Flow, Leipzig, Germany, 2007 (with B. Elbing, M. Perlin, D. Dowling, S. Ceccio)
- “On Using Cross-correlations of Turbulent Flow-induced Ambient Vibrations to Estimate the Structural Impulse Response: Applications to Structural Health Monitoring,” *Journal of the Acoustical Society of America*, 2007 (with K. G. Sabra, D. Bourgoyne, B. Elbing, S. Ceccio, M. Perlin, D. Dowling).

- “Friction Drag Reduction at High Reynolds Numbers with Wall Injected Polymer Solutions,” 26<sup>th</sup> Naval Hydrodynamics Symposium, Sep 2006, Rome, Italy (with G. Oweis, S.A. Vanapalli, D. Dowling, M. Perlin, M. Solomon, S. Ceccio).
- “Bubble Friction Drag Reduction in a High Reynolds Number Flat Plate Turbulent Boundary Layer,” *Journal of Fluid Mechanics*, Volume 552, 2006 (with W. Sanders, D. Dowling, M. Perlin, S. Ceccio).
- “High-Reynolds-Number Turbulent-Boundary-Layer Surface Pressure Fluctuations with Bubble or Polymer Additives,” International Mechanical Engineering Congress and Exposition, American Society of Mechanical Engineers, 2005, Orlando, FL (with B. Elbing, D. Dowling, M. Perlin, S. Ceccio).
- “Turbulent Boundary Layer Drag Reduction at High Reynolds Numbers with Wall-Injected Polymer Solution,” International Conference on Fast Sea Transport, June 2005, St. Petersburg, Russia (with D. Dowling, M. Perlin, S. Ceccio).
- “Influence of Bubble Size on Micro-Bubble Drag Reduction,” International Conference on Fast Sea Transport, June 2005, St. Petersburg, Russia (with X. Shen, S. Ceccio, M. Perlin).
- “Drag Reduction by a Homogenous Polymer Solution in Large Diameter, High Shear Pipe Flow,” 2<sup>nd</sup> International Symposium on Seawater Drag Reduction, May 2005, Busan, Korea. (with G. Garwood, S. Vanapalli, B. Elbing, D. Walker, S. Ceccio, M. Perlin, M. Solomon)
- “Bubble-size Distributions Produced by Wall Injection of Air into Flowing Freshwater, Saltwater, and Surfactant Solutions,” *Experiments in Fluids*, Volume 37, 2004 (with S. Ceccio, D. Dowling, M. Perlin)
- “Bubble Drag Reduction at Large Scales and High Reynolds Numbers,” 25<sup>th</sup> Symposium on Naval Hydrodynamics, Aug 2004, St. Johns, Newfoundland (with W. Sanders, J. Cho, E. Ivy, R. Etter, D. Dowling, M. Perlin, S. Ceccio).

#### **Papers & Presentations - Conferences, Meetings, Symposiums**

- “Mean Profile of a high-Reynolds-number Smooth-flat-plate Turbulent Boundary Layer,” American Physical Society – Division of Fluid Dynamics, 2010, Long Beach, CA (with D. Dowling, G. Oweis, J. M. Cutbirth, S. Ceccio, M. Perlin)
- “Air Layer Drag Reduction,” American Physical Society, Division of Fluid Dynamics, 2008, San Antonio, TX (with S. Ceccio, B. Elbing, D. Dowling M. Perlin).
- “Air Layer Drag Reduction,” American Physical Society – Division of Fluid Dynamics, 2007, Salt Lake City, UT (with B. Elbing, M. Perlin, D. Dowling, S. Ceccio).
- “Near-wall PTV Measurements in a High-Reynolds-Number Flat-plate Turbulent Boundary Layer,” American Physical Society, Division of Fluid Dynamics, 2007, Salt Lake City, UT (with G. Oweis, M. Perlin, S. Ceccio, D. Dowling).
- “High-Reynolds-Number Flat-Plate Turbulent Boundary Layer Measurements,” American Physical Society, Division of Fluid Dynamics, November 2006, Tampa Bay, FL (with J. M. Cutbirth, M. Perlin, S. Ceccio, D. Dowling).
- “Structural Monitoring from Noise Cross-Correlation,” Acoustical Society of America, Summer Meeting, Jun 2006, Providence, RI (with K. G. Sabra, D. Bourgoyne, D. Dowling, S. Ceccio, M. Perlin, W. Kuperman).
- “PIV and LIF Measurements of a Turbulent Boundary Layer with Injected Drag-reducing Polymers at High Reynolds Numbers,” American Physical Society, Division of Fluid Dynamics, 2005, Chicago, IL (with G. Oweis, D. Dowling, M. Perlin, and. Ceccio).
- “Development of a micro-PIV/ LIF System for the Study of High Reynolds Number Turbulent Boundary Layers,” American Physical Society, Division of Fluid Dynamics, Nov 2004, Seattle, WA (with G. Oweis, D. Dowling, S. Ceccio).
- “Bubble Size Measurements for Air Injected into a Turbulent Boundary Layer in Fresh Water, Salt Water, and Surfactant Solutions,” American Physical Society, Division of Fluid Dynamics, Nov 2004, Seattle, WA (with S. Ceccio, D. Dowling, M. Perlin).
- “Drag Reduction in High Shear Turbulent Pipe Flow,” American Physical Society, Division of Fluid Dynamics, Nov 2004, Seattle, WA (with G. Garwood, D. Walker, S. Ceccio)
- “High-Reynolds-Number Turbulent Boundary Layer Pressure Fluctuations With and Without Bubbles,” American Physical Society, Division of Fluid Dynamics, Nov 2003, East Rutherford, NJ (with W. Sanders, S. Ceccio, D. Dowling, M. Perlin).

“Bubble Friction Drag Reduction at High Reynolds Number,” American Physical Society, Division of Fluid Dynamics, Nov 2003, East Rutherford, NJ (with W. Sanders, E. Ivy, J. Cho, S. Ceccio, D. Dowling, M. Perlin).

“Flat Plate Turbulent Boundary Layer Measurements at High Reynolds Numbers,” American Physical Society Division of Fluid Dynamics, Nov 2002, Austin, TX (with W. Sanders, C. Judge, E. Ivy, S. Ceccio, D. Dowling, M. Perlin).

“Turbulent Boundary Layer Pressure Fluctuations at Large Scales and High Reynolds Number,” Acoustical Society of America, Jun 2002, Pittsburgh, PA (with W. Sanders, C. Judge, D. Dowling, M. Perlin, S. Ceccio)

**University Reports (non-refereed)**

“Air-layer Induced Skin-friction Drag Reduction,” University of Michigan Department of Naval Architecture and Marine Engineering, 2007, Report 352 (with B. Elbing, K. A. Lay, S. Ceccio, D. Dowling, M. Perlin).

**Doctoral Dissertation**

“High Reynolds Number Turbulent Boundary Layer Measurements and Skin-friction Drag Reduction with Gas or Polymer Injection,” The University of Michigan, Ann Arbor, MI, January 2007.