

**MATTHEW WAGENHOFER, Ph.D, P.E., CFEI**

## **SUMMARY**

Dr. Wagenhofer is a practicing forensic engineer with over 20 years of experience conducting and participating in investigations encompassing a broad range of topics under the umbrella of mechanical engineering and materials performance accidents and failures. His expertise includes determining the role that materials and mechanical components play in such multidisciplinary events as fires, explosions, product failures, transportation accidents, business interruption losses, and personal injury and loss of life incidents.

## **EDUCATION**

Doctorate in Mechanical Engineering – University of Maryland, 2002

Master of Science in Mechanical Engineering – University of Maryland, 1999

Bachelor of Science in Mechanical Engineering – University of Maryland, 1996

## **REGISTRATIONS & CERTIFICATIONS**

Registered Professional Engineer:

- District of Columbia #PE920286
- Maryland #40525
- Virginia #0402059087

Bosch CDR Tool Technician Training – IPTM

Certified Fire and Explosion Investigator - National Association of Fire Investigators

Certified Marine Corrosion Advisor – American Boat & Yacht Council

OSHA 10 Hour General Industry Safety and Health Training

OSHA 30 Hour General Industry Safety and Health Training

## **PROFESSIONAL ASSOCIATIONS**

American Society of Mechanical Engineers (ASME)

American Society for Testing and Materials (ASTM)

American Welding Society (AWS)

ASM International (ASM)

Lecturer, University of Maryland – Fall 2005

National Association of Fire Investigators (NAFI)

National Society of Professional Engineers (NSPE)

## **CONTINUING EDUCATION**

Additional courses and certifications completed in the following:

- American Welding Society
  - Destructive Testing, June 2021
  - Metallurgy II, April 2021
  - The Science of Nondestructive Testing, June 2021
  - Understanding Welding Symbols, November 2021
  - Welding Fundamentals I, June 2021
  - Welding Fundamentals II, June 2021
- ASM International
  - Elements of Metallurgy, September 2022
- International Association of Arson Investigators, Inc. and CFITrainer.net
  - Fire Protection Systems, May 2019

- Physical Evidence at the Fire Scene, May 2019
- Introduction to Fire Dynamics and Modeling, May 2019
- Introduction to Evidence, May 2019
- Fire Chemistry, May 2019
- The Scientific Method for Fire and Explosion Investigation, May 2019
- Investigating Motor Vehicle Fires, October 2018
- Motor Vehicles: The Engine and the Ignition, Electrical, and Fuel Systems, October 2018
- Motor Vehicles: Transmission, Exhaust, Brake, and Accessory Systems, October 2018
- Documenting the Event, April 2018
- Explosion Dynamics, August 2017
- Residential Natural Gas Systems, August 2017
- Investigating Natural Gas Systems, August 2017
- Introduction to Evidence, July 2017
- The Scientific Method for Fire and Explosion Investigation, July 2017
- Continuing Education & Development, Inc.
  - Corrosion: Overview, January 2019
  - Basic Direct Current (DC) Theory, January 2019
  - Grounding System Theory and Practice, January 2019
  - Material Properties and Corrosion, May 2020
- Embry-Riddle Aeronautical University and Canvas Network
  - Aviation 101, February 2019
- Delft University of Technology and edX
  - TUDF-FE01x: Forensic Engineering: Learning from Failures, February 2019
  - DelftX-AEASM1x: Introduction to Aerospace Structures and Materials, March 2021
- J.J. Keller & Associates, Inc.
  - Entry-Level Driver Training Module 03: Pre- and Post-Trip Inspections, June 2021
  - Entry-Level Driver Training Module 20: Maintenance, June 2021
  - Loading & Unloading: Straight Truck Series, June 2021
  - Vehicle Inspections: Straight Truck Series, June 2021

## **INVESTIGATIVE AREAS OF SPECIALTY**

Dr. Wagenhofer has conducted and assisted in forensic investigations for the following fields:

- Aircraft Component Failures
- Automotive Fires and Component Failures
- Bearing Failures
- Bicycle Component Failures
- Casting Failures
- Commercial and Residential Fires and Explosions
- Consumer Product Failures, Fires, and Explosions
- Corrosion Failures
- Electric Power Generation and Distribution (up to 115-kV) Component Failures and Fires
- Fastener Failures
- Fire Protection Sprinkler Failures
- Fuel Gas Distribution Systems Failures and Fires
- Glass Panel and Window Glazing Failures
- Hand Truck Failures
- HVAC Air Handling and Scrubbing Equipment Failures and Fires
- HVAC Compressor Failures
- Industrial Accidents involving release of Hazardous Energy
- Industrial Equipment and Vehicle Failures and Fires
- Industrial Plumbing Failures
- Lithium Battery Fires
- Machine Guarding and Warning Analyses

# FORCON INTERNATIONAL

- Marine Vessel Component, Engine, and Systems Failure and Fires
- Material Composition and Property Analyses
- Metallurgical Analyses
- NDT of Coal-fired Electric Power Generation Plant Components
- NDT of Oil/Gas Pipeline Components
- Oil & Gas Industry Failures and Fires
- Petroleum Tank Failures, Fires, and Explosions
- Plastic and Rubber Component Failures
- Pressure Vessel Failures, Fires, and Explosions
- Residential Plumbing Failures
- Rotating Shaft Failures
- Transportation (Aviation, Maritime, Automotive) Accident Analyses
- Truck Liftgate Accidents and Failures
- Vehicle Lift Failures
- Weld and Weldment Failures
- Workplace, Recreational and Consumer Product Injuries

## **CAREER HISTORY**

### **FORCON International – Mechanical/Materials Engineer**

Conducting materials and mechanical engineering analyses for forensic investigations including, but not limited to, the aviation, construction, electric power, fuel gas, industrial equipment, consumer product, and medical device industries.

### **MW Forensic Engineering LLC – Mechanical/Materials Engineer**

Providing consulting forensic engineering and expert services.

### **RTI Group, LLC**

#### **Director of Engineering and Research/ Forensic Engineering Investigator, Mechanical/Materials**

Stevensville, MD

#### **Director of Mechanical Engineering / Mechanical and Materials Failure Analyst**

Annapolis, MD and Stevensville, MD

#### **Mechanical / Materials Failure Analyst and Industrial / Utility Accident Reconstructionist**

Annapolis, MD

Investigated product and mechanical systems component failures in support of insurance claim analysis and civil litigation. Led multidisciplinary teams conducting root cause analyses of complex losses. Provided technical and administrative oversight to staff and contract engineer-led investigations and research efforts.

### **Independent Mechanical/Materials Failure Consultant**

Investigated product and mechanical systems component failures in support of insurance claim analysis.

### **Independent Researcher**

Efforts focused on developing grant proposals to fund research on the use of dislocation mechanics and dynamics to improve the mesoscale characterization of polycrystalline material behavior for multiscale, physically-based fracture models. This included both heterogeneous plasticity characterization as well as its influence on the initiation and propagation of cleavage fracture.

### **Phoenix Engineering Associates, Inc. – Senior Scientist**

Senior Scientist Research focused on the development of a physically-based mesoscale computational model of the transition region fracture behavior of ferritic steels. Within the framework of cracked infinite body geometry, dislocation mechanics techniques were used as a basis for quantifying mesoscale phenomena and generating stress and strain fields while local macroscale failure criteria combined with equilibrium analyses were used to compute fracture loads.

## **Structural Integrity Associates – Engineering Consultant**

Engineer responsible for supporting existing projects and managing new projects related to core business of nondestructive evaluation and failure investigation of steel componentry used by the energy industry, especially power plant welds and piping. Responsible for analyzing existing technologies and developing new technologies to expand core services. Participated in field work at power plants and pipelines in Maryland, North Carolina, and Utah.

## **SEA Limited – Project Engineer, Mechanical**

Employed the scientific method and various engineering principles in the forensic investigation of equipment and materials failures/accidents over a broad range of industries.

## **PRESENTATIONS AND PANELS**

*“Forensic Failure Analysis”* guest lectures presented to ENME 427 – CSI Mechanical: Finding Reasons for Compromised Structural Integrity, University of Maryland College Park, Spring Semester 2021, 2022, 2023.

Panel Member, *“Restoring Jurors’ Faith in Science & Authorities”*, Virginia Association of Defense Attorneys Annual Meeting, October 2022.

*“Utilizing Forensic Engineers: Value Added From Date of Loss through Trial”* presented at the Virginia Association of Defense Attorneys Lunch & Learn, January 12, 2022.

*“Case Studies of Forensic Marine Investigations”* presented to the Mid-Atlantic Mariners Club Fall Fest Meeting and Seminar, October 10, 2018.

*“Eyes in the Sky: Working with Drones to Resolve Claims”* presented to the Southeast Electric Exchange Claims Section 2018 Spring Meeting, April 12, 2018.

*“Eyes in the Sky: Integrating Drones into Vehicle Accident Reconstructions”* co-presented to the VADA 2017 Annual Meeting Products and Toxic Torts/Auto & Transportation Liability Breakout Session, October 12, 2017.

Panel Member, *“Arbitrating the Case – Advocacy and Strategy”* and *“Arbitrating the Case – The Arbitrators Speak”*, AViCON 2017, September 15, 2017.

*“Let’s go to the videotape!; Engineering Analysis of Video Evidence”* co-presented at AViCON 2017, September 14, 2017.

*“Eyes in the Sky: Integrating Drones into the Natural Gas Industry”* presented to the Natural Gas Claims & Litigation Association 2017 Annual Meeting, March 20, 2017; also presented at RTI’s Lecture Series, August 16, 2017.

*“Introduction to the Forensic Investigation of Lithium Battery Failures at RTI”* presented to the Battery Safety Council Forum, January 12, 2017.

*“Lithium Batteries: The Good, the Bad, and the Regulatory”* presented to the Chicago Bar Association Aviation Law Committee, December 7, 2016; also presented at RTI’s Lecture Series, May 19, 2017.

*“If only it WAS elementary, Watson: Using Abductive and Inductive Reasoning in Forensic Investigations”* presented at RTI’s Lunch and Learn Lecture Series, January 9, 2015.

*“Animation and Its Use in Accident Investigations, Dispute Resolution, and Training”* presented to The Nautical Institute’s Future of Simulation in the Maritime Industry Seminar, March 30, 2012.

*“Radiation Primer”* presented to Maersk Line, Limited, March 22, 2011.

## PUBLICATIONS AND CONFERENCES

**Wagenhofer, M.**, "Possible vs. Probable: Striving for Engineering Certainty in Forensic Investigations," Georgia Defense Lawyer: A Magazine for the Civil Defense Trial Bar, Vol XV, Issue II, Fall 2018.

Erickson Kirk, M., **M. Wagenhofer**, P. Williams, Y. Shengjin, "Accounting for Crack Propagation in a Model to Predict Fracture Toughness in Ferritic Steels" proceedings of PVP2009 2009 ASME Pressure Vessel and Piping Division Conference, July 27-31, 2009 Prague, in the Czech Republic.

Erickson Kirk, M.A., **M. Wagenhofer**, "A Theoretically-based Statistical Model of Transition Toughness" submitted to Proceedings of PVP2007, ASME Pressure Vessels and Piping Division Conference July 22-26, 2007, San Antonio, Texas, USA.

**Wagenhofer, M.**, M. Erickson, "A Physically-Based, Quantitative Model of the Transition Region Fracture Behavior of Ferritic Steels" abstract accepted for the 34th ASTM National Symposium on Fatigue and Fracture Mechanics, November 16, 2003.

**Wagenhofer, M.** and Natishan, M. E., "A Model for Predicting the Fracture Toughness of Steels in the Transition Region from Hardness" 33rd Symposium on Fatigue and Fracture, ASTM STP-1417, W. Reuter, and R. Piascik, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2002.

**Wagenhofer, M.** and M. E. Natishan, "A Micromechanical Model for Predicting Fracture Toughness of Steels in the Transition Region" 33rd Symposium on Fatigue and Fracture, ASTM STP-1417, W. Reuter, and R. Piascik, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2002.

Natishan, M., Kirk, M., Gunawardane, H., and **Wagenhofer, M.**, "More Information from a Hardness Test than You Ever Thought Possible" Small Specimen Test Techniques: Fourth Volume, ASTM STP-1418, M. Sokolov, J. Landes, and G. Lucas, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2001.

**Wagenhofer, M.**, Gunawardane, H., and Natishan, M., "Yield and Toughness Transition Predictions for Irradiated Steels Based on Dislocation Mechanics" 20th International Symposium on the Effects of Irradiation on Materials, ASTM STP-1405, S.T. Rosinski, M.L. Grossbeck, T.R. Allen, and A.S. Kumar, Eds., American Society for Testing and Materials, 2001.

Kirk, M. T., Natishan, M. E., **Wagenhofer, M.**, "Microstructural Limits of Applicability of the Master Curve" 32<sup>nd</sup> Volume, ASTM STP-1406, R. Chona, Ed., American Society for Testing and Materials, Philadelphia, PA, 2001.

Natishan, M.E., and **M. Wagenhofer**, "Dislocation Mechanics Basis and Stress State Dependency of the Master Curve Shape for Fracture Toughness" Fatigue and Fracture, Vol. 31, ASTM STP1389, ASTM, West Conshohocken, PA, June 2000.

Armstrong, R.W., G.P. Chambers, M.A. Erickson-Natishan, H.W. Sandusky, **M. Wagenhofer** and F.J. Zerilli, "Deformation Properties of Al-Mg Alloy 5086 in Laboratory and Explosive Tests" Materials Science Forum, Vols. 331-337, pp. 501-506, 2000.

Natishan, M. E., **Wagenhofer, M.**, and Kirk, M. T., "Dislocation Mechanics Basis and Stress State Dependency of the Master Curve" Fracture Mechanics, 31st Symposium, ASTM STP 1389, K. Jerina and J. Gahallger, Eds., American Society for Testing and Materials, 1999.

**Wagenhofer, M.**, M.E. Natishan and R.W. Armstrong, "Influence of Strain Rate and Grain Size on Yield and Serrated Flow in Al-Mg Alloy 5086" Scripta Mater., Vol. 41, No. 11, pp. 1177-1184, 1999.

Natishan, M.E. and **M. Wagenhofer**, "Conditions Causing Intergranular Cracking in High Strength Nickel-Copper Alloys" Fatigue and Fracture Mechanics: Twenty-Ninth Volume, ASTM STP 1332, T.L. Panontin and S.D. Sheppard, Eds., American Society for Testing and Materials, West Conshohocken, PA, 1999.

Natishan, M.E. and **M. Wagenhofer**, "*Investigations of Stress Rupture Behavior of High Strength Nickel Alloys at Ambient Temperatures*" TMS Winter meeting, February, 1997.

## **RESEARCH EXPOSURE**

Graduate Research Assistant (Dissertation), University of Maryland – (Jan 1999 to Oct 2002)

Master's Thesis Research, University of Maryland – (Sept 1996 to Dec 1998)

Graduate Teaching Assistant, University of Maryland – (Aug 1996 to Dec 1998 & Sept 2001 to May 2002)

Undergraduate Research Assistant, University of Maryland – (May 1995 to Aug 1996)