



McSWAIN ENGINEERING

An  Company

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RICHARD H. MCSWAIN, PH.D., P.E., FASM

Curriculum Vitae

PRIMARY INTERESTS:

Failure analysis, fractography, fracture mechanisms and processes, scanning electron microscopy, metallography, and materials analysis and characterization.

EDUCATION:

1972: Auburn University - Bachelor of Materials Engineering

1974: Auburn University - Master of Science in Materials Engineering/minor in Computer Engineering

M.S. Thesis Title: Surface Phenomena and the Mechanism of Solidification of Gray and Ductile Iron

1985: University of Florida - Doctor of Philosophy in Materials Science and Engineering
Ph.D. Dissertation Title: Digital Fractographic Imaging Analysis

ENGINEERING REGISTRATION:

Registered Professional Metallurgical Engineer in the State of Florida – 1981. P.E. #31149

Registered Professional Metallurgical Engineer in the State of Alabama – 2006. P.E. #28077-E

EXPERIENCE:

1991 to Present President
McSwain Engineering, Inc.
Pensacola, Florida

Failure analysis and engineering investigation of failed and accident-related components for manufacturers, insurance companies, and legal counsel.

1982 to 1990	<p>Consulting Materials Engineer in Failure Analysis and Product Liability Failure analysis and materials characterization of automobile components, industrial equipment, aircraft components, medical implants, cranes, office/laboratory furniture, and exercise/sports equipment.</p>
1988 to 1990	<p>Head, Metallic Materials Engineering Branch Naval Aviation Depot Pensacola, Florida</p> <p>Supervisor of Metallic Materials Engineering Branch composed of three engineering groups responsible for Failure Analysis, Process Metallurgy and Nondestructive Inspection in support of US Navy and Marine Corps Helicopters and Fixed Wing Aircraft.</p>
1984 to 1988	<p>Group Leader for Failure Analysis/Accident Investigation Naval Aviation Depot Pensacola, Florida</p> <p>Technical direction of failure analysis of failed and crash damaged components from US Navy and Marine Corps Helicopter and Fixed Wing Aircraft.</p>
1977 to 1984	<p>Metallurgist Naval Aviation Depot Pensacola, Florida</p> <p>Failure analysis of failed components from US Navy Aircraft under engineering cognizance of Naval Air Rework Facility, Pensacola. Analysis of failed and crash damaged components has involved microstructural analysis, chemical analysis, and scanning and transmission electron microscopy.</p> <p>Responsible for acquisition and operation of scanning electron microscope facility and for scanning electron microscopy of metallic and non-metallic parts and components from various Navy aircraft.</p> <p>Development and supervision of nondestructive inspection procedures to detect material defects in US Navy aircraft prior to component failure.</p>
1974 to 1976	<p>Associate Metallurgist Southern Research Institute Birmingham, Alabama</p> <p>Development of digital data acquisition system for thermal analysis of solidification for ferrous alloys.</p> <p>Development of optical dilatometer and digital data analysis system for measurement of volumetric expansion during the solidification of gray and ductile irons.</p>

Microstructural analysis of carbon-carbon composite materials using optical and scanning electron microscopy for evaluation of fractured and ablated composite surfaces.

Analysis of material failures, casting defects and welding defects with optical microscopy, scanning microscopy and electron microprobe analysis.

Research on surface tension and interfacial energy of nickel-carbon eutectics in contact with highly oriented pyrolytic graphite.

1973 to 1974

Assistant Metallurgist
Southern Research Institute
Birmingham, Alabama

Research on interfacial forces that exist during solidification of gray and ductile cast iron.

1972 to 1973

Research and Teaching Assistant
Auburn University
Auburn, Alabama

Research on fiber-matrix debonding in glass reinforced epoxy composites, teaching physical metallurgy laboratory, and supervision of the Materials Engineering Laboratory.

1969 to 1970

Cooperative Education Student
Pan American World Airways
Cape Kennedy, Florida

Positions as an engineering and management trainee in support of the Air Force at Cape Kennedy.

MEMBERSHIPS IN TECHNICAL SOCIETIES:

ASM International

Fellow of ASM, 2019

Failure Analysis Society, 2016 to Present

Failure Analysis Handbook Committee, 1999 to 2002

(Author/Contributor to the 2002 edition of Vol. 11 Failure Analysis and Prevention Handbook)

(Author/Contributor to the 2020 edition of Vol. 11 Failure Analysis and Prevention Handbook)

Materials Testing and Quality Control Committee, 1995 to 2005

Failure Analysis Committee, 1986 to 2015

Co-Chairman Failure Analysis Committee, 1995 to 1997

Birmingham Chapter Education Chairman, 1975 to 1976

ASM Journal of Failure Analysis and Prevention Editorial Board, 2011 to Present

ASM Failure Analysis Society Publications Committee, 2016 to Present

ASTM International (formerly American Society for Testing and Materials)
Committee E04 / Metallography
SubCommittee E04.03/ Light Microscopy
Subcommittee E04.01 / Specimen Preparation
Subcommittee E04.11 / X-ray and Electron Metallography
Committee E30 / Forensic Sciences
Committee E58 / Forensic Engineering

International Metallographic Society

Microscopy Society of America

SAE International

National Association of Corrosion Engineers

American Welding Society

International Society of Air Safety Investigators

American Helicopter Society

American Academy of Forensic Sciences (Provisional Member)

Microanalysis Society

National Fire Protection Association

PRESENTATIONS AND CONFERENCE PARTICIPATION:

“Interfacial Energy Variations and Their Effect on the Iron Graphite Eutectic Reaction,” 7th Annual Spring Meeting TMS AIME, Toronto, Canada, May 18-22, 1975.

“Nodule Formation in Ductile Iron,” Ductile Iron Society Annual Meeting, Colorado Springs, CO, June 16-18, 1976.

“Detection of Hidden Corrosion by Low Frequency Eddy Currents,” 26th Department of Defense Conference on Nondestructive Testing, Seattle, WA, November 15 17, 1977.

“Fractographic Feature Identification and Characterization by Digital Imaging Analysis,” Symposium on Fractography of Modern Engineering Materials, American Society for Testing and Materials, Nashville, TN, November 18-19, 1985.

“Analysis of a Helicopter Blade Fatigue Fracture by Digital Fractographic Imaging Analysis,” International Conference and Exposition on Fatigue, Corrosion Cracking, Fracture Mechanics and Failure Analysis, American Society for Metals, Salt Lake City, UT, December 2-6, 1985.

“Consequences of Processing and Field Induced Corrosion in Navy Aircraft,” National Association of Corrosion Engineers Southeast Regional Meeting, Panama City, FL, October 19-22, 1987.

Failure Analysis Lab Protocol, Session Chairman, ASM Materials Week, Rosemont, IL, October 1994.

Fatigue Striation Analysis and Life Prediction, Session Chairman, ASM Materials Week, Indianapolis, IN, September 1997.

Failure Analysis 101: Panel Discussion, Panel Member, ASM Materials Week, Indianapolis, IN, September 1997.

Ask The Experts - Failure Analysis, ASM Materials Solution Conference, Rosemont, IL, October 1998.

Discussion on Current Issues and New Tools, Failure Analysis: Current Issues and Application of New Tools, ASM Materials Solution Conference, Cincinnati, OH, November 1-4, 1999.

“The Consequences of Design Material Selection on Restraint System Failure,” American Academy of Forensic Sciences, Annual Meeting, Reno, NV, February 2000.

“Digital Imaging in the Failure Analysis Laboratory,” ASM International Materials Solutions Conference and Exposition 2000, St. Louis, MO, October 9-12, 2000.

Failure Analysis: Tools and Techniques in Failure Analysis. “Stereographic Imaging in Failure Analysis.” Materials Science & Technology 2005 Conference and Exhibition, Pittsburgh, PA, September 25-28, 2005.

“Causation and Consequences of Spring Failure in RCF 67 Buckles.” American Academy of Forensic Sciences, Annual Meeting, San Antonio, TX, February 22, 2007.

“Application of Reverse Engineering Created Models to Failure Analysis Investigations (Invited),” R. H. McSwain, M. B. Hood, E. L. Van Iderstine, W. D. Carden, C. C. Coburn, McSwain Engineering Inc., Materials Science & Technology 2007 Conference and Exhibition, Detroit, MI, September 17, 2007.

“Contact and Non-Contact Dimensional Analysis in Forensic Investigations (Invited),” E. L. Van Iderstine, R. H. McSwain, W. D. Carden, C. C. Coburn, McSwain Engineering, Inc., Materials Science & Technology 2007 Conference and Exhibition, Detroit, MI, September 17, 2007.

“Causation and Consequences of Spring Failure in RCF 67 Buckles,” Richard H. McSwain, Mark B. Hood, William D. Carden, Eric L. Van Iderstine, McSwain Engineering, Inc., Materials Science & Technology 2007 Conference and Exhibition, Detroit, MI, September 17, 2007.

“Ford Probe Seat Collapse,” Richard H. McSwain, Mark B. Hood, William D. Carden, Eric L. Van Iderstine, McSwain Engineering, Inc., Materials Science & Technology 2011 Conference & Exhibition, Columbus, OH, October 16-20, 2011.

“Computerized Metrology, Small and Large Scale Laser Scanning, Real Time Radiography, Computed Tomography Radiography, and 3D Printing and Rapid Prototyping in Engineering Investigation and Materials Failure Analysis,” Richard McSwain, Eric Van Iderstine and William Carden, McSwain Engineering, Inc., Materials Science & Technology Conference, Columbus, OH, October 2015.

“History of Aircraft Carburetors and Carburetor Failures,” Richard McSwain, William Carden, and Eric Van Iderstine, McSwain Engineering, Inc., Materials Science & Technology Conference, Columbus, OH, October 2015.

“Failure Analysis and Engineering Investigation of a Failed Tower Crane Turntable Weld That Led to a Crane Collapse,” Richard McSwain, William Carden, Eric Van Iderstine, L. Scott Marshall, and Leah Godwin, McSwain Engineering, Inc., Materials Science & Technology Conference, Salt Lake City, UT, October 2016.

“DSC and TGA: Tools for Analyzing the Thermal Characteristics of Polymers,” Richard McSwain, Amy Wells, and William Carden, McSwain Engineering, Inc., Materials Science & Technology Conference, Salt Lake City, UT, October 2016.

“Failure Analysis of a Main-mast Hydraulic Backstay Adjuster Piston Rod from a High Performance, Long Range Sailing Yacht,” Richard McSwain, William Carden, and L. Scott Marshall, McSwain Engineering, Inc., Materials Science & Technology Conference, Salt Lake City, UT, October 2016.

“Investigation and Analysis of a High Performance Wake Boarding Boat Accident Using Instrumentation and Data Acquisition,” Richard McSwain, William Carden and Eric Van Iderstine, McSwain Engineering, Inc., Materials Science & Technology Conference, Salt Lake City, UT, October 2016.

“Helicopter Main Rotor Servo Disconnect Failure Due to Self-locking Nut Reuse,” Richard McSwain, William Carden and Leah Godwin, McSwain Engineering, Inc., Materials Science & Technology Conference, Portland, OR, September 2019.

“The Identification of Plastic Additives in a Failure Analysis Investigation,” Dr. Amy M. Wells, Dr. Richard McSwain, PE, FASM, and Mr. William Carden, MS, PE, McSwain Engineering, Inc. Materials Science & Technology Conference, Portland, OR, September 2019.

“Getting Answers from Off-Gassing – How TGA-IR is Utilized in the Failure Analysis of Polymers,” Dr. Amy M. Wells, Dr. Richard McSwain, PE, FASM, and Mr. William Carden, MS, PE, McSwain Engineering, Inc., ASM International Materials, Applications & Technologies Conference, St. Louis, MO, September 2021.

“Failure Analysis of a Reworked Aircraft Engine Cylinder,” William Carden and Richard McSwain, PE, FASM, McSwain Engineering, Inc., ASM International Materials, Applications & Technologies Conference, New Orleans, LA, September 2022.

“The Burning Question – Identifying Flame Retardants in a Failure Analysis Investigation,” Dr. Amy M. Wells, Dr. Richard McSwain, PE, FASM, and Mr. William Carden, MS, PE, McSwain Engineering, Inc., ASM International Materials, Applications & Technologies Conference, New Orleans, LA, September 2022.

PUBLICATIONS AND REPORTS:

Peer Reviewed

Richard H. McSwain, “Surface Phenomena and the Mechanism of Solidification of Gray and Ductile Iron.” Master's Thesis Submitted to Auburn University, 1974.

R. H. McSwain, C. E. Bates and W. D. Scott, “Iron-Graphite Surface Phenomena and Their Effects on Iron Solidification.” AFS Transactions, Vol. 82, 1974: 85-94.

- R. H. McSwain, C. E. Bates and W. D. Scott, "Iron-Graphite Surface Phenomena and Their Effects on Iron Solidification." AFS Cast Metals Research Journal, Vol. 10, No. 4, December 1974: 181-190.
- R. H. McSwain and C. E. Bates, "Surface and Interfacial Energy Relationships Controlling Graphite Formation in Cast Iron." The Metallurgy of Cast Iron, Georgi Publishing Company, St. Saphorin, Switzerland, 1975.
- R. H. McSwain and C. E. Bates, "Graphite Growth in Cast Iron." AFS International Cast Metals Journal, Vol. 1, No. 1, March 1976: 53-57.
- C. E. Bates, G. L. Oliver, and R. H. McSwain, "Volumetric Changes During Freezing of Ductile Cast Iron." AFS Transactions, Vol. 85, 1977: 289-298.
- Richard H. McSwain, Digital Fractographic Imaging Analysis. Ph.D. Dissertation, University of Florida, 1985.
- R. H. McSwain and R. W. Gould, "Analysis of a Helicopter Blade Fatigue Fracture by Digital Fractographic Imaging Analysis." Analyzing Failures: The Problems and the Solutions, American Society for Metals, 1986: 87-91.
- R. H. McSwain, E. B. S. Pardue, R. W. Hendricks, and M. V. Mathis, "X-Ray Stress Analysis of Nickel-Plated Components Using Different Radiation Wavelengths." Advances in X-Ray Analysis, Proceedings of the Thirty-fourth Annual Conference on Applications of X-Ray Analysis, Vol. 29, C.S. Barrett, J.B. Cohen, J. Faber, Jr., R. Jenkins, D.E. Leyden, J.C. Russ, and P.K. Predecki, Eds., Plenum Press, 1986: 49-55.
- Robert W. Gould and Richard H. McSwain, "Fractographic Feature Identification and Characterization by Digital Imaging Analysis." Fractography of Modern Engineering Materials: Composites and Metals, ASTM International STP 948, J. E. Masters and J. J. Au, Eds., American Society for Testing and Materials, 1987.
- E. B. S. Pardue and R. H. McSwain, "X-Ray Diffraction Stress Analysis As an NDE Technique," Review of Progress in Quantitative Nondestructive Evaluation, Volume 7B, D. O. Thompson and D. E. Chimenti, Eds., Plenum Press, 1988: 1421-1427.
- Richard H. McSwain, "Fatigue Fracture of a Helicopter Tail Rotor Blade due to Field-Induced Corrosion." Handbook of Case Histories in Failure Analysis, Volume 2, ASM International, 1993: 30-32.
- Richard H. McSwain, "Processing-Induced Fatigue Fracture of a Helicopter Tail Rotor Blade." Handbook of Case Histories in Failure Analysis, Volume 2, ASM International, 1993: 33-35.
- R. H. McSwain, "Fatigue Fracture of a Helicopter Tail Rotor Blade due to Field-Induced Corrosion." Solutions to Equipment Failures, ASM International, 1999: 39-43.
- R. H. McSwain, "Processing-Induced Fatigue Fracture of a Helicopter Tail Rotor Blade." Solutions to Equipment Failures, ASM International, 1999: 43-47.
- Andrew Gilberg, Mark Hood, Darrell McKinley, and Richard McSwain, "A Low Cost, High Performance Impact Test Facility." Paper No. 2002-01-0689, Society for Automotive Engineers, Inc., March 2002.

Richard H. McSwain, "Photography in Failure Analysis." ASM Handbook, Failure Analysis and Prevention, Volume 11, ASM International, 2002: 418-428.

Richard H. McSwain, "Digital Photography in Failure Analysis." Advanced Materials & Processes, Vol. 161, No. 3, March 2003: 31-34.

Andrew Gilberg, Jeremy Buckingham, Richard McSwain, Dirk Paulitz, and Mark Hood, "Door Latch Vulnerability to Rollover Induced Loads." Paper No. 2004-01-0737, Society for Automotive Engineers, Inc., March 2004.

Russell F. Dunn, Richard H. McSwain, Terry Mills, and Brian Malone, "Failure of Plastic Press Release Buttons in Automobile Seat Belts." Engineering Failure Analysis, Vol. 12, Issue 1, February 2005: 81-98.

Milo V. Kral, Cynthia M. Maher, Richard H. McSwain, "Failure Analysis of a Brazed, Stainless Steel Fuel Injection Line." Engineering Failure Analysis, Vol. 88, June 2018

Richard H. McSwain, "Visual Examination and Photography in Failure Analysis." ASM Handbook, Failure Analysis and Prevention, Volume 11, ASM International, 2020

Non-Peer Reviewed

R. H. McSwain and C. E. Bates, "Microstructural Relationships in 2.2.3 Carbon Reinforced Carbon Composites." Southern Research Institute Technical Report AFML-TR-75-117, September 1975.

Richard H. McSwain, "Graphite Growth in Cast Iron." Southern Research Institute Bulletin, Fall 1975: 10-14.

R. H. McSwain, C. E. Bates, H. E. Littleton, J. R. Koenig, C. D. Pears, "Scanning Electron Microscopy Characterization of Ablated 50 MW Arc Ramp Test Specimens." Southern Research Institute Informal Report to the Air Force Materials Laboratory, September 1975.

Richard H. McSwain, Gene L. Oliver, and Charles E. Bates, "Volumetric Changes During Freezing of Ductile Cast Iron." Southern Research Institute Report SORI-EAS-77-007 to The American Foundrymen's Society, January 7, 1977.

Richard H. McSwain and Eli F. Nicosia, "Detection of Hidden Corrosion by Low Frequency Eddy Current Inspection." Materials Engineering Laboratory Report, Naval Air Rework Facility, Pensacola, FL, May 25, 1977.

Tracy W. McFarlan, Eli F. Nicosia and Richard H. McSwain, "Low Frequency Eddy Current Test for Detection of Corrosion Beneath Aircraft Skin Surfaces." Presented at 1977 Airline Transport Association Nondestructive Testing Forum, September 13, 1977.

R. H. McSwain and E. F. Nicosia, "Detection of Hidden Corrosion by Low Frequency Eddy Currents." Proceedings, 26th Defense Conference on Nondestructive Testing, Department of Defense, Army Materials and Mechanics Research Center, November 15-17, 1977: 51-58.

R. H. McSwain and C. E. Bates, "Microstructural Relationships in 2.2.3 Carbon Reinforced Carbon Composites." Southern Research Institute Report AFML-TR-77-26, February 1978.

Blant N. Reeves, Kenneth Sanders, Dr. D. O. Knapp, Richard McSwain, "Coating Removal via Plastic Media Blasting." Materials Engineering Report, Naval Air Rework Facility, Pensacola, FL, July 18, 1984.

Richard H. McSwain and Robert W. Gould, "Taking the Fatigue Out of Fracture Surface Analysis." Metal Progress, Vol. 129, No. 4, March 1986: 27-29.

E. B. S. Pardue, R. H. McSwain, and B. S. Borie, "X-Ray Stress Analysis of Nickel-Plated Components." Proceedings of the 1987 SEM Spring Conference on Experimental Mechanics, Houston, TX, June 14-19, 1987.

Dennis W. Werth, Steven J. McDanel and Richard H. McSwain, "Synergistic Phenomena as a Causal Factor in Fatigue of Aircraft Components." International Symposium for Testing and Failure Analysis, Conference Proceedings, ASM International, 1990: 401-409.

Jack C. Lipscomb, Richard H. McSwain, Mark B. Hood, "The Silent Killer." ISASI Forum, Vol. 37, No. 4, October-December 2004: 21-23.

HONORS AND AWARDS:

Selection of "Volumetric Changes During Freezing of Ductile Cast Iron" as Outstanding Paper by the Ductile Iron Division of the American Foundrymen's Society for 1977

Listed in Marquis Who's Who in the South and Southwest

Listed in Who's Who in Technology Today

Listed in Jane's Who's Who in Aviation and Aerospace

Listed in Who's Who in Science and Engineering

Listed in Who's Who in America

Listed in American Men and Women of Science

Department of the Navy Special Achievement Award, 1979

Department of the Navy Outstanding Performance Award, 1980

Department of the Navy Outstanding Performance Award, 1984

Department of the Navy Outstanding Performance Award, 1988

Selection of Research Photograph for Front Cover of Southern Research Institute Bulletin, 1975

Selection of Research Photograph for Front Cover of International Cast Metals Journal, 1976

Selection of Research Photograph for Front Cover of Metals Progress, 1986

Naval Air Systems Command Lead Technology Engineer for Fractography and Scanning Electron Microscopy, 1982-1989

Member of Product Oriented Survey Audit Team for the Presidential Helicopter, 1988

Outstanding Alumnus Award, Auburn University, April 2003

Auburn Engineering Achievement Award, October 2003

HONOR SOCIETIES:

Tau Beta Pi, National Engineering Honor Society

Alpha Sigma Mu, International Metallurgical Honorary Society

Pi Tau Sigma, Honorary Mechanical Engineering Society

Sigma Xi, Scientific Research Society of North America

CONTINUING ENGINEERING EDUCATION:

<u>Course Title</u>	<u>Source</u>	<u>Date</u>
Eddy Current Inspection	Magnaflux Corporation	March 1977
Ultrasonic Testing	Automation Industries	April 1977
Analysis and Prevention of Material Failure	George Washington University	February 1978
Etec Corporation Seminar on Scanning Microscopy	Etec Corporation	July 1978
Quantex-Ray X-Ray Energy	KeveX Corporation Spectroscopy	January 1979
Level II Radiography	EI Dupont Corporation	February 1979
Genco II Decision Analysis	Kepner Tregoe	August 1979
8th Annual Institute on the Modern View of Fatigue and its Relation to Engineering Problems	Union College/General Electric	September 1979
Ferrograph Workshop	Technical Support Center DOD Joint Oil Analysis Program	March 1980
Mechanics of Composites	R.M. Jones Southern Methodist University	July 1980
Weld Quality and Inspection	American Society for Metals	August 1980
Techniques for Failure Analysis, Failure Prevention, and Risk Assessment	University of California at Los Angeles	December 1980
X-Ray Users Seminar	Perkin-Elmer Etec Corporation	February 1981
Helicopter Accident Investigation	University of Southern California	August 1981

<u>Course Title</u>	<u>Source</u>	<u>Date</u>
Heat Treating: Principles and Applications	George Washington University	October 1981
Weld Repair of Aircraft Gas Turbine Engines	General Electric	December 1983
Fracture Mechanics and Damage Tolerance	American Society for Metals	January 1984
Jet Engine Accident Investigation	U.S. Air Force Chanute AFB, Ill.	October 1985
Quantex-Ray III X-Ray Energy Spectroscopy	KeveX Corporation	April 1986
Fracture Mechanics, Failure Analysis and Product Liability	Lehigh University	June 1986
Analysis of Helicopters	Dr. Wayne Johnson	July 1986
Composite Materials	University of Kansas	August 1986
Damage Tolerance	University of Kansas	September 1986
Tools and Techniques for the Deming Method I	NADEP, Pensacola	April 1988
Tools and Techniques for the Deming Method II	NADEP, Pensacola	May 1988
Occupational Safety and Health for Supervisors	NADEP, Pensacola	September 1988
Applied Hazard Analysis	Naval Safety School	September 1989
Total Quality Management for Supervisors	NADEP, Pensacola	March 1990
Plastics Fracture Analysis Seminar	Society of Plastics Engineers L.J. Broutman & Assoc.	September 1992
Potential Failure Modes and Effects Analysis for Product Design and Development	SAE International	February 1993
Aluminum Welding Seminar	AWS	November 1993
FTIR Theory, Sample Handling and Spectral Interpretation	Nicolet Educational Services	September 1998
The Fundamentals of Fastening Technology & Bolted Joint Design	Clemson University	January 1999
Linear Elastic Fracture Mechanics	Metallurgical Research Consultants, Inc.	Oct-Nov 2001
Quartz XOne Training	Quartz Imaging Corporation	June 2002

<u>Course Title</u>	<u>Source</u>	<u>Date</u>
Basic Metallurgy for the Medical Device Engineer	ASM International	December 2004
Measurement Basics	SixDOF	December 2004
eDAQ Setup and Operation	SOMAT	March 2005
Fundamentals of Material Science	PDHonline.org, Inc.	January 2007
Microbial Contamination in Aviation Fuel and Aircraft Fuel Systems	SAE International Seminar, Course I.D.#C0728	December 2007
The Basics of Internal Combustion Engines e-Seminar	SAE International, Course I.D.# PD130404	December 2008
Failure Appraisalment	PDH Engineer	December 2009
Fire Protection Fundamentals	PDH Engineer	December 2009
Lubrication Fundamentals	PDH Engineer	December 2009
Fire and Explosion Investigation	Southern California Safety Institute, Inc.	August 2010
Thermo Noran NSS/NS7 Microanalysis	Unity Lab Services Part of Thermo Fisher Scientific	October 2013
Motor Vehicle Accident Reconstruction Special Topic 1 – Tire Failures	PDH Online.org Inc. / PDH Center	December 2014
Torsional Vibration of Rotary and Reciprocating Machines	No Bull Engineering	December 2017
Superalloys for Heavy-Duty and Aircraft-Type Gas Turbines	University of Florida	May 2018