SAE INTERNATIONAL

PROFESSIONAL DEVELOPMENT

GROUND VEHICLE ON DEMAND COURSES

SAE CORPORATE LEARNING CLIENTS

3M Co.
A & D Technology, Inc.
Aaron's Automotive Products
Abbott Diagnostics
ACH LLC
Actia Corp.
Agco Corp.
Aisin World Corporation of America
Algonquin Automotive
AlliedSignal Inc.
Aluminum Precision Products
American Axle
Anchor Swan
Andover Industries
Arctic Cat Inc.
Armstrong Forensic Engineers
Arvin Industries, Inc.
ArvinMeritor
ASC Exterior Technologies
Aselsan, Inc.
Athena Technologies Inc.
Astronics AES
Atlantic Auto Components
Autocam Corp.
Autoliv N.A.
Auto Transtech
Azure Dynamics Inc.
BAE Systems
Bayer Polymers
Becton Dickenson
Behr America, Inc.
Bendix Corp.
Benedict Engrg.
Bethlehem Steel Corp.
Biomechanical Consultants of California
Bobcat Co.
Bombardier R&D
Borg-Warner Automotive
Bosch Braking
Bose Corporation
Bowles Fluidics
Bridgestone Firestone Inc.
Briggs & Stratton Corp.
Britax Child Safety Inc.
California Air Resources Board
Caltrans, CA Dept. of Transportation
Carborundum
Cardell Corp.
Cardinal Health Inc.
Cardone Industries
Carlisle Brake & Friction
Case Corp.
Caterpillar Inc.
Cherry Automotive
Chrysler Group LLC
Cinch Connectors
Clark Material Handling Co.
Club Car Inc.
CNH Industrial
Coachman Industries
Cobasys LLC
Colorado State Patrol Academy
ConocoPhillips
Continental Teves Inc.
Cooper Standard Automotive
Cooper Tire
Corning Inc.
CSI S.p.A.
Cummins, Inc.
Cutler Hammer Corp.
DaimlerTrucks
Dana Corp.
Deere & Co.
Daimler Trucks
Delphi Corp.
Delta-Q Technologies
Denso Int'l. America, Inc.
Denton ATD
Denver Automotive and Diesel College
Dexter Corp.
Directed Technologies, Inc.
Douglas Autotech
Dresser-Rand Co.
Dura Automotive Systems
Dura Automotive Systems Canada LTD
Durakon Industries Inc.
Eastman Kodak Co.
East Penn Manufacturing Co. Inc.
Eaton Corp.
Edison Welding Institute
Elgin Sweeper
Emerson Electric
Engelhard Corp.
Engineering Systems Inc.
Engineered Machined Products
Environment Canada
Environmental Systems Products
EWD
Exco Engineering
ExxonMobil Corp.
Faurecia Automotive
Federal Mogul Corp.
Fel-Pro Inc.
Ficosa North America
Flexfab LLC
Flexible Metal, Inc.
Fontaine Trailer Co.
Ford Motor Co.
Forensic Engineering Technologies, LLC
Forest Engineering Research Institute of Canada
Freightliner Corp.
Freudenberg-Nok
Ftech R&D North America
Fujitsu Network Communications
Gables Engineering Inc.
Gates Power Drive Products
Gates Rubber Inc.
GE Lighting
General Dynamics Corp.
General Motors Corp.
General Motors de Mexico
General Seating
Gibbs Technologies
Global Thermoelectric, Inc.
Goodyear Tire & Rubber Co.
Graco Children's Products
Grand Haven Stamped Products (GHSP)
Grote Industries, LLC
Grupo Antolin N.A.
H2Gen Innovations, Inc.
Harley-Davidson Motor Co.
Hayes-Lemmerz Int'l. Inc.
Heil Environmental
Heller Machine Tools
Hendrickson Truck Suspension Systems
Henkel Technologies
Honda of America Inc.
Honda of Canada, Inc.
Honeywell
HRYCAY Consulting Engineers Inc.
Husky Corp.
Husqvarna Turf Care
Hybrid Design Services, Inc.
HyClone Laboratories
HydrogenSource
Hyundai America Technical Center
IMMI Inc.
Imperial Oil
INA Engine Components
Industrial Technology Centre
Infineum USA LP
Inland Truck Parts Co.
Intertek Carnot Emissions Services
Intier Automotive Inc.
Isuzu Motors America Inc.
ITT Industries Inc.
J & L Development, Inc.
JBM Sherman Carmel
Johns Manville
Johnson Controls
Karl Schmidt Unisia
KB Bendix Mexico Operations
Kellogg Crankshaft Co.
Keykert USA
King Abdullah II Design & Development Bureau
Knoll Inc
Kohler Engines
Komatsu Mining Systems Inc.
Kostal of America Inc.
Lacks Enterprises, Inc.
Lear Corp.
Linamar Driveline Systems Group
Lord Corporation
Lubrizol Corp.
Luk USA LLC
Magna Powertrain Engine Technologies Group
Magna Steyr
Magneti Marelli
Mahindra & Mahindra
Mahle Technology, Inc.
Mark IV Automotive
MascoTech
Matsushita Communications Indus. Corp.
Mazda Canada
Mercedes-Benz USI
Mercury Marine
Meritor Automotive Inc.
Metaldyne Sintered Components
Methode Electronics
Mitsubishi Motors R&D America
MICO, Inc.
Motorola, Inc.
MTS Systems Corp.
Nachi Robotics Systems, Inc.
National Renewable Energy Laboratory
National Research Council of Canada
National Security Agency
Navistar
Neapco
Nelson Metal Products
New Hampshire Ball Bearing
New Venture Gear Inc.
Neway Anchorlok
Nexteer Automotive
NHTSA
NREL
NxtGen Emission Controls
Nissan Motor Co.
Norcold Inc.
Novabus Inc.
NSK Corp.
Optis
Oshkosh Corporation
PACCAR Inc.
Panasonic Automotive Systems of America
Panasonic Automotive Systems of America
Paulstra C.R.C.
Perkin-Elmer, Inc.
Peterbilt Motors Co.
Philips Technologies
Pi Innovo, LLC
Polaris Industries
Pollak Corp.
Ponderosa Associates
PPG Industries
Prestolite Electric Inc.
Pro-Dex
Purolator Products Co.
Quality Industries
Quantum
Raufoss Automotive Components Canada
Reliance Machine Products Inc.
Ricardo, Inc.
Robert Bosch Co.
Robertshaw Tennessee
Schaeffler Group
Schukra of NA
SCHUNK Intec Inc.
Scientific and Research Institute for Standardization and Unification (NIISU)
Siemens Automotive Corp.
Sigma International
Simula Automotive Safety Devices, Inc.
SKF (formerly Chicago Rawhide)
SL America
Solutia Inc.
South Central College
Southwest Research Institute
Sowilo Networks
Spartan Chassis Systems
Square D Co.
SSI Technologies Inc.
Stant Manufacturing Inc.
Stewart & Stevenson LLC
Swagelok Co.
Synerject LLC
Systems Research Laboratories Inc.
Takata Automotive Systems Laboratory
Taylor Made Industries
TEAM Industries
Technologies M4 Inc.
Teradyne Inc.
TESMA Engine Technologies
Texas Instruments Inc.
The Budd Co.
The Genie Co.
The Timken Co.
ThyssenKrupp Bilstein of America Inc.
TI Automotive
TM4 Inc.
Toyota Motor Corp.
Trelleborg Automotive
TRW Inc.
U. S. Military Branches
U.S. EPA
U.S. Steel Corp.
U.S. Tsabaki Automotive Division
UCI-Fram Group
Unicell Corp.
United Defense LP
UQM Technologies, Inc.
Valeo
Van-Rob Stampings
VDO
Visteon Electronics
Volkswagen de Mexico S.A. de C.V.
Volvo Truck North America Inc.
W.E.T. Automotive Systems Ltd.
Wabash Technologies
Warn Industries
Webasto Sunroofs, Inc.
Webb Wheel Products, Inc.
Westport Innovations
Wheel to Wheel Inc.
Woodward Governor Co.
Yamaha Motor Mfg. Corp. of America
Yazaki North America, Inc.
ZF Batavia
ZF Industries
ZF Lemforder

CATALOG KEY

You will see the following icons alongside the course descriptions. These icons indicate:

- delivery formats available for the course
- the course is part of an SAE certificate
- that it is an ACTAR approved course

Live, online – indicates the course is an instructor-led web seminar offered live and online via telephone and internet connection

Online, on demand – indicates the course is available online anytime the participant would like to access the course through the internet

Certificate – indicates the course is part of an SAE International curriculum-based, multi-course certificate. See a list of the multi-course certificates on page VII

ACTAR logo – indicates the course is an ACTAR approved course. For more information on ACTAR and ACTAR accredited courses, see page VI

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ELECTRONICS & ELECTRICAL CONTROL SYSTEMS

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SAE MULTI-COURSE CERTIFICATE PROGRAMS

Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate.

Intended to provide a guide towards deeper knowledge in a specific area, SAE's multi-course certificates outline required courses that offer foundational knowledge of the subject. Some certificate programs also feature additional electives designed to broaden your exposure to more specific aspects of the technology studied. PLUS—completion of many of the multi-course certificate programs equates to graduate credits towards the SAE/Kettering University 20-credit *Certificate in Automotive Systems* and Kettering's 40-credit M.S in Mechanical Engineering. Visit training.sae.org/collegecredit for more information.

SAE offers these multi-course certificate programs:

- Transmission/Drivetrain
- General Management and Leadership
- Professional and Legal Issues
- Diesel Technology
- SI Engine
- Vehicle Dynamics
- Product Engineering Tools and Methods

Visit ***training.sae.org/credentialing/certificate*** for more information

ABOUT SAE INTERNATIONAL

STANDARDS DEVELOPMENT AND LIFELONG LEARNING.

SAE International is a global association committed to being the ultimate knowledge source for the mobility engineering professional. By uniting over 135,000 engineers and technical experts, we drive knowledge and expertise across a broad spectrum of industries. We act on two priorities: encouraging a lifetime of learning for mobility engineering professionals and setting the standards for industry engineering.

SAE International is the world's leader in mobility engineering knowledge. We are trusted by engineers and other professionals around the globe to provide a broad, multi-sector source for information and solutions. The SAE International Professional Development program offers access to over 300 live online and classroom, and online, on demand learning opportunities—learning opportunities that supply the right content to help solve your specific challenges.

SAE INTERNATIONAL CORPORATE LEARNING SOLUTIONS

This resource guide is designed specifically to help companies address their learning needs through a variety of SAE Professional Development options.

Options

For 8 - 100+ employees, SAE works with companies like yours to design and deliver customized training at your site.

Through SAE Corporate Learning Solutions you can:

- Select an existing SAE course for delivery at your site
- Subscribe to a single online, on demand course for one or many employees
- Purchase a corporate subscription to the entire library of over 50 online courses (more than 350 hours of content available)
- **Customize a learning experience to address your specific business needs**

Advantages

With as few as eight employees who have the same learning need, SAE Corporate Learning Solutions offers multiple advantages:

- **Variety** — Choose from a comprehensive course list of over 300 titles.
- **Personalization** — If you can't find the specific topic you need or if the course content does not exactly match your requirements, SAE can customize a training program. We can also integrate online learning for a "blended solution."
- **Quality** — SAE courses are conducted by leading academic and industry instructors. All courses and instructors undergo a review and approval from objective industry experts. This assures course content is relevant and accurate.
- **Convenience** — We schedule the instructor, supply the comprehensive course materials for each attendee, and coordinate other administrative details like instructor travel and accommodation or online connections.
- **Cost Effective** — The instructor comes to you! No staff travel expenses and no time away from the office, save time and money. Also, our extensive network and existing course list makes our pricing extremely competitive!
- **Timeliness** — SAE International is the world's leader in mobility engineering knowledge. Our programs are developed and refined to stay ahead of industry trends; and we offer only the most up-to-date and knowledgeable instructors.

What is included in a Corporate Learning Solutions Program?

- **Customization** — Most courses can be tailored to address your company's specific business or training objectives. Often this involves incorporating company data, generating case problems, or developing completely new content.
- **Administrative Coordination** — SAE staff contracts with the instructor, supplies all course materials, and provides attendance and post-course evaluation forms. All you do is provide the facility and audio-visual equipment!
- **Pre-training Communication with the Instructor** — SAE arranges communication with the instructor and relevant company representatives to review the learning objectives and ensure understanding of the scheduled training. This is another opportunity to gear the program to your specific needs.
- **Continuing Education Units** — SAE awards Certificates of Completion with IACET approved Continuing Education Units (CEUs) to all attendees. One CEU is granted for every 10 learning contact hours.

Contact SAE Corporate Learning:
1-724-772-8529 or corplearn@sae.org

What determines the Corporate Learning Solutions cost?

- The length of the program (number of days or hours of learning contact time)
- The learning materials. Some courses include textbooks or other learning aids
- The number of attendees
- Any customization required
- The instructor's travel expenses or connection fees

These variables are used to calculate a base fee, which is typically based on 10 attendees. The fee increases proportionally as more attendees are added. Companies are additionally responsible for instructor travel expenses or connection fees, transfer fees, and living expenses.

What amenities does your company provide?

- A suitable meeting room or classroom
- Audio-visual equipment and computers (if required)
- Refreshment breaks and meals (if desired)
- Information on local hotels and airports along with directions to your facility

Explore State Resources for Training Dollars

Often states and local economic development groups have grant dollars available for training. Contact your state's Department of Labor or other groups in your area to research funds available for your organization.

For example, Michigan residents can visit www.michiganworks.org and enter their zip code to find local offices and *Michigan Works*! contacts in the area.

ACCREDITATIONS

The IACET CEU

SAE International is recognized as an Authorized Provider by the International Association for Continuing Education and Training (IACET). All SAE Professional Development seminars, e-Seminars, web seminars, and engineering academies meet eligibility requirements for IACET Continuing Education Units (CEUs) according to the ANSI/IACET 1-2013 Standard. To receive CEUs, attendees are required to be engaged in the entire class and demonstrate mastery of the learning objectives by successfully completing a knowledge assessment.

Many organizations offer some form of continuing education credit, but only the IACET CEU is held to the strict, research-based IACET Criteria and Guidelines for Continuing Education and Training. Only IACET Authorized Providers, who undergo a strict application and site-review process, can award the IACET CEU. IACET Authorized Providers are required to re-apply and be reauthorized every five (5) years.

The Continuing Education Unit (CEU) was created by IACET as a measurement of continuing education. One (1) IACET CEU is equal to ten (10) contact hours of participation in an organized continuing education experience under responsible sponsorship, capable direction, and qualified instruction. Under IACET's care, the IACET CEU has evolved from a quantitative measure to a hallmark of quality training and instruction. For more information on IACET, visit www.iacet.org.

To obtain official transcripts, please contact SAE Customer Service at 1-877-606-7323 (U.S. and Canada only) or 1-724-776-4970 (outside U.S. and Canada)

ACTAR Approved SAE Courses

Some SAE courses have been approved by the Accreditation Commission for Traffic Accident Reconstruction (ACTAR) for Continuing Education Units (CEUs). In addition, the ACTAR CEUs are also listed with the course description.

ACTAR approved courses feature the ACTAR icon.

Upon completion of any of these courses, accredited reconstructionists should contact ACTAR, 1-800-809-3818, to request CEUs. As an ACTAR approved course, the fee for the CEUs for each course is $5.00.

SAE CERTIFICATION & CERTIFICATE PROGRAMS

SAE CREDENTIALING - ELEVATING KNOWLEDGE

Show the industry the depth of your organization's expertise. SAE offers focused topic-specific credentialing programs for engineers and other professionals in ground vehicle and aerospace. Shine a light on their knowledge and expertise through SAE Credentialing.

Your team can earn an **SAE Certification** by passing industry-created and vetted exams. Get more information at *training.sae.org/credentialing*

How does it work?

- **Complete** established eligibility requirements (typically educational background and work experience)
- **Pass** an industry-developed, vetted, and proctored exam that tests mastery of an industry-defined body of knowledge
- **Earn** your industry recognized credential endorsing your experience and knowledge of the technology, and establishing a solid foundation on which to build a successful career.

Certifications must be maintained over 3-year period of time by fulfilling established maintenance requirements.

Or, expand their knowledge and build your organization's reputation as an expert through industry-advised Certificate of Competency programs.

How does it work?

- **Complete** a course in a focused content area
- **Pass** an industry-vetted exam that verifies your understanding of the material
- **Earn** a Certificate of Competency or Certificate of Mastery

SAE Certification or Certificate of Competency – how does it benefit the ENGINEER?

- Validates their mastery of industry-driven training and learning objectives or confirms mastery of an industry-generated body of knowledge
- Imparts international recognition of experience and skills
- Provides a portable credential that is recognized across industry
- Demonstrates their commitment to continued growth and improvement

What is the value to the ORGANIZATION?

- Recognizes the capabilities of your people and enhances your company's credibility with the industry as a supplier OR OE through an independent assessment
- Contributes to the hiring and promotion process – quickly illustrates the capabilities and experience of potential new hires or those you'd like to advance
- Encourages employee commitment to growth and opportunity
- Supports the promotion of professional competence

SAE currently offers the following Credentialing Programs:

Vehicle Electrification (VE) Program: offering a Certificate of Competency, Certified Vehicle Electrification Professional (CVEP) and Certified Vehicle Electrification Engineer/Scientist (CVESS), Vehicle Electrification (VE) Certification is designed to validate a mastery of knowledge essential to VE safety and all major VE systems.

Design Review Based on Failure Modes (DRBFM) Program: offering a Certificate of Competency, DRBFM Professional Certification and DRBFM Expert Certification. The DRBFM program focuses on competency and application of philosophy, preparation, change point FMEA, design review, and actions results and feedback.

SAE CERTIFICATION & CERTIFICATE PROGRAMS

SAE INTERNATIONAL ALSO OFFERS CURRICULUM-BASED, MULTI-COURSE CERTIFICATES IN SPECIFIC TECHNICAL AREAS.

Intended to provide a guide towards deeper knowledge in a specific area, SAE's multi-course certificates outline required courses that offer foundational knowledge of the subject. Some certificate programs also feature additional electives designed to broaden your exposure to more specific aspects of the technology studied.

In addition to the Continuing Education Units (CEUs) awarded, successful completion heightens your expertise within the field and earns you an SAE credential recognizing your achievement.

PLUS—completion of many of the multi-course certificate programs equates to graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering's 40-credit M.S in Mechanical Engineering. Visit **training.sae.org/collegecredit** for more information.

 **Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate.**

NEW! Accident Reconstruction Certificate Program

Professionals become more proficient in the practice of vehicle crash/accident reconstruction by successfully completing this certificate program from SAE. Required courses guide one through crash reconstruction methods, vehicle dynamics, and event data recorder (EDR) technology then completion of three elective courses suit the individual's specific technical interest area.

The following are required courses:

- **Vehicle Crash Reconstruction Methods** (I.D.# C1417)
- **Vehicle Dynamics for Passenger Cars and Light Trucks** (classroom I.D.# 99020 or online on demand I.D.# PD130702ON) OR **Applied Vehicle Dynamics** (I.D.# C0414)
- **Applying Automotive EDR Data to Traffic Crash Reconstruction** (I.D.# C1210) OR **Accessing and Interpreting Heavy Vehicle Event Data Recorders** (I.D.# C1022)

Choose three electives:

- **Advanced Vehicle Dynamics for Passenger Cars and Light Trucks** (I.D.# C0415)
- **Chassis and Suspension Component Design for Passenger Cars and Light Trucks** (I.D.# 95025)
- **Hydraulic Brake Systems for Passenger Cars and Light Trucks** (I.D.# C0509)
- **High-Performance Brake Systems** (I.D.# C0718)
- **Introduction to Brake Control Systems: ABS, TCS, and ESC** (classroom I.D.# C0315 or online on demand I.D.# PD130501ON)
- **Tire and Wheel Safety Issues** (I.D.# C0102)
- **The Tire as a Vehicle Component** (I.D.# C0101)
- **Injuries, Anatomy, Biomechanics & Federal Regulation** (I.D.# 85049)
- **Commercial Vehicle Braking Systems** (classroom I.D.# C0233 or online on demand I.D.# PD130611ON)
- **Introduction to Heavy Truck Tire, Steering, and Suspension Dynamics** (I.D.# C1209)
- **Fundamentals of Automotive All-Wheel Drive Systems** (I.D.# C0305)
- **Fundamentals of Heavy Truck Dynamics** (I.D.# C0837)
- **Applying Automotive EDR Data to Traffic Crash Reconstruction** (if not taken as a required course – I.D.# C1210)
- **Accessing and Interpreting Heavy Vehicle Event Data Recorders** (if not take as a required course – I.D.# C1022)

Diesel Technology Certificate Program

This certificate equips engineers with a solid understanding of diesel engines, emissions and aftertreatment strategies, and related components including fuel injection and air management. The program requires completion of courses that address these areas and offers further depth through a menu of electives.

The required courses are:

- **Diesel Engine Technology** (classroom: I.D.# 93014 or online, on demand: I.D.# PD130812ON)
- **Common Rail Diesel Fuel Injection** (I.D.# C0920)
- **Turbocharging Internal Combustion Engines** (I.D.# C0314)

Choose one elective:

- **Diesel Engine Noise Control Web Seminar or Web Seminar RePlay** (I.D.# WB1041; PD331041ON)
- **Exhaust Flow Performance and Pressure Drop of Exhaust Components and Systems** (I.D.# C0235)
- **Exhaust Gas Recirculation (EGR) for Diesel Engines** (I.D.# C1214)
- **Selective Catalytic Reduction for Diesel Engines** (I.D.# C0913)
- **Variable Valve Actuation Design and Performance Impact on Advanced Powertrains** (I.D.# C1332)

Completion of the ***Diesel Engine Technology Engineering Academy*** can be used as a substitute for ***Diesel Engine Technology*** and one elective.

SAE CERTIFICATION & CERTIFICATE PROGRAMS

General Management and Leadership Certificate Program

This program focuses on four core management and leadership competencies: *management capability, team leadership, project management, and finance* providing a basis for growth into a leadership or management role.
All of the following courses are required:

- **Managing Engineering & Technical Professionals** (I.D.# C0608)
- **Engineering Project Management** (I.D.# 99003)
- **Principles of Cost and Finance for Engineers** (I.D.# C0828)
- **Leading High Performance Teams** (I.D.# C0410)

Attending the ***Engineering Management Academy*** serves as a substitute for ***Managing Engineering and Technical Professionals,*** and ***Leading High Performance Teams*** required courses.

Product Engineering Tools and Methods Certificate Program

This program focuses on the study, development, management and implementation of product engineering principles, methodologies and techniques. When used properly, these tools and methods become powerful productivity enhancers reducing product development time and cost through improved communication, documentation, problem-solving, and quality.

All of the following courses are required:

- **Design of Experiments (DOE) for Engineers Web Seminar** (I.D.# WB0932) OR classroom seminar - **Design of Experiments for Engineers (DOE)** (I.D.# C0406)
- **Finite Element Analysis (FEA) for Design Engineers Web Seminar** (I.D.# WB1241)
- **Fundamentals of Geometric Dimensioning & Tolerancing (GD&T) Web Seminar or Web Seminar RePlay** (live, online: I.D.# WB0933; online, on demand I.D.# PD PD330933ON) or classroom seminar - **Geometric Dimensioning & Tolerancing** (I.D.# C0133)
- **Tolerance Stack-up Fundamentals Web Seminar or Web Seminar RePlay -** (live, online: I.D.# C0842; online, on demand I.D.# PD PD330842ON) OR classroom seminar - **Tolerance Stack- Up Analysis** (I.D.# C0022)
- **Root Cause Problem Solving: Methods and Tools Web Seminar or Web Seminar RePlay** (live, online: I.D.# WB0931; online on demand I.D.# PD PD330931ON)

Choose one elective:

- **Accelerated Test Methods for Ground and Aerospace Vehicle Development** (classroom: I.D.# C0316 or online, on demand: I.D.# PD130524ON)
- **All three advanced web seminar/web seminar rePlay titles in the Geometric Dimensioning & Tolerancing Series** (I.D.#s WB1319, WB1320, & WB1321)
- **Design for Manufacturing & Assembly (DFM/DFA)** (I.D.# 92047)
- **Design Review Workshop** (I.D.# C1306)
- **Finite Element Analysis for Design Engineers - Hands-on FEA Workshop** (I.D.# 93006)
- **Introduction to Design Review Based on Failure Modes (DRBFM) Web Seminar or Web Seminar RePlay** (live, online I.D.# WB1047; online, on demand I.D.# PD331047ON)
- **Introduction to Failure Mode and Effects Analysis for Product and Process** (I.D.# C1201)
- **Robust Design** (I.D.# C1201)
- **Statistical Tolerance Design** (I.D.# 88033)
- **Weibull-Log Normal Analysis Workshop** (I.D.# 86034)

Professional and Legal Issues Certificate Program

This program focuses on legal and risk management issues critical for engineers to master to facilitate the successful design and deployment of products from a safety and reliability perspective.

All of the following courses are required:

- **Patent Law for Engineers** (I.D.# 88007)
- **Product Liability and The Engineer** (I.D.# 82001)
- **The Role of the Expert Witness in Product Liability Litigation** (I.D.# 92054)
- **Program and Risk Management** (I.D.# C0409)

SI Engine Certificate Program

This certificate is designed to familiarize engineers with key spark ignition engine components and technologies and how they function as a system. By completing the certificate, engineers can acquire fairly deep engine expertise and, at the same time, earn an SAE credential.

All of the following courses are required:

- **Basics of Internal Combustion Engines** (classroom: I.D.# C0103 or online, on demand: I.D.# PD130944ON)
- **Internal Combustion Systems: HCCI, DoD, VCT/VVT, DI and VCR** (I.D.# C0613)
- **Turbocharging Internal Combustion Engines** (I.D.# C0314)
- **Powertrain Selection for Fuel Economy and Acceleration Performance** (I.D.# C0243)

Choose one elective:

- **Gasoline Direction Injection (GDI)** (I.D.# C1009)
- **Combustion and Emissions for Engineers** (I.D.# 97011)
- **Automotive Heat Transfer** (I.D.# C1230)
- **Introduction to Commercial and Off-Road Vehicle Cooling Airflow Systems** (classroom: I.D. #C0738 ; live online: I.D.# WB1240; or online on demand: I.D.# PD331240ON)
- **Exhaust Flow Performance and Pressure Drop of Exhaust Components and Systems** (I.D.# C0235)
- **Piston Ring Design/Materials** (I.D.# 86009)
- **Compact Heat Exchangers for Automotive Applications** (I.D.# 97002)
- **Fundamentals of Automotive Fuel Delivery Systems** (I.D.# C0203)
- **Variable Valve Actuation Design and Performance Impact on Advanced Powertrains** (I.D.# C1332)

SAE CERTIFICATION & CERTIFICATE PROGRAMS

Transmission/Drivetrain Certificate Program

This program familiarizes engineers with key drivetrain components and how those components function as a system. By completing the certificate, engineers can increase their expertise within the drivetrain body of knowledge and, at the same time, earn the SAE Certificate of Achievement

All of the following courses are required:

- **A Familiarization of Drivetrain Components** (classroom: I.D.# 98024 or online, on demand: I.D.# PD130555ON)
- **Fundamentals of Automotive All-Wheel Drive Systems** (classroom: I.D.# C0305 or online, on demand: I.D.# PD130556ON)
- **Fundamentals of Modern Vehicle Transmissions** (classroom: I.D.# 99018 or online, on demand: I.D.# PD130419ON)
- **Introduction to Gears** (I.D.# C0822)
- **High-Performance Differentials, Axles, & Drivelines** (I.D.# C1113)
- **Powertrain Selection for Fuel Economy & Acceleration Performance** (I.D. # C0243)

Vehicle Dynamics Certificate Program

Designed to equip engineers with key vehicle dynamics and handling theory and application from a systems perspective, the objective of this program is for engineers to understand the interaction and performance balance between the major vehicle subsystems. The program design requires completion of fundamental and advanced-level vehicle dynamics theory and application courses with three elective courses that best suit an individual's interest areas or engineering emphasis.

All of the following courses are required:

- **Vehicle Dynamics for Passenger Cars and Light Trucks** (classroom: I.D.# 99020 or online, on demand: I.D.# PD130702ON)
- **Fundamentals of Heavy Truck Dynamics** (I.D.#C0837)
- **Advanced Vehicle Dynamics for Passenger Cars and Light Trucks** (I.D.#C0415)

Choose three from these electives:

- **Applied Vehicle Dynamics** (I.D.# C0414)
- **Fundamentals of Steering Systems** (I.D.# C0716)
- **Introduction to Brake Control Systems: ABS, TCS, and ESC -** (classroom: I.D.# C0315 or online, on demand: I.D.# PD130510ON)
- **The Tire as a Vehicle Component** (I.D.# C0101)
- **Tire and Wheel Safety Issues** (I.D.# C0102)
- **Chassis & Suspension Component Design for Passenger Cars & Light Trucks** (I.D.# 95025)
- **Commercial Vehicle Braking Systems** (I.D.# C0233)
- **Heavy Vehicle Ride Comfort Engineering** (I.D.# C0948)
- **Hydraulic Brake Systems for Passenger Cars and Light Trucks** (I.D.# C0509)
- **High-Performance Brake Systems** (I.D.# C0718)
- **Fundamentals of Heavy Truck Dynamics** (I.D.# C0837)
- **Vehicle Dynamic Basics for Off-highway Trucks** (I.D.# C1239)

Get more information on the curriculum-based, multi-course certificates at training.sae.org/credentialing/certificate/

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CHASSIS AND VEHICLE DYNAMICS

Includes vehicle and truck dynamics, ride and handling, tires, suspension, and braking systems

BRAKES AND BRAKING SYSTEMS

Commercial Vehicle Braking Systems e-Seminar

I.D.# PD130611ON
Access Period: 1 Year
Duration: 18 Hours

Increased public pressure to improve truck safety and new government braking regulations for commercial vehicles have intensified the need to better understand the factors influencing heavy vehicle braking performance. In this e-Seminar, Instructor Leonard Buckman focuses on understanding medium-duty hydraulic brake systems and heavy-duty air brake systems and how both systems' performance can be predicted, maintained and optimized. He explains the function and application of the major brake system components and helps you to discover how brakes, tires and roadways interact as a system. Federal braking regulations for both hydraulic and air brake vehicles are also covered.

Based on the popular classroom seminar, this more than 18 hour course offers an overview, seventeen modules and course exercises accompanied by this handbook. The text, *Commercial Vehicle Braking Systems: Air Brakes, ABS and Beyond, written by the instructor is included as a reference.*

Learning Objectives

By attending this seminar, you will be able to:

- Design safe and efficient braking systems
- Test and measure braking performance
- Maintain and troubleshoot braking systems
- Comply with state and federal regulations on brakes
- Analyze commercial vehicle brake systems as they affect accident investigation

Who Should Attend:

This e-Seminar is geared toward engineers and technicians who are involved in the design, development and testing of heavy vehicle brakes. Fleet personnel involved with safety and brake system specification and maintenance, driver-trainers, and truck accident investigators will also find this course of value.

This course has been approved by the Accreditation Commission for Traffic Accident Reconstruction (ACTAR) for 2.2 Continuing Education Units (CEUs). Upon completion of this e-seminar, accredited reconstructionists should contact ACTAR, 800-809-3818, to request CEUs. As an ACTAR approved course, the fee for CEUs is reduced to $5.00.

Major Topics Include:

- Overview
- Brake Actuation Systems
- Major Air System Components
- Trailer Air Actuation Systems and Components
- Foundation Brakes
- Braking Performance Fundamentals
- Maintenance
- Brake Force Distribution
- Vehicle Dynamics and Tires
- Thermal Considerations
- Tractor-Trailer Brake System Compatibility
- Antilock Brake Systems (ABS)
- Electronic Communication
- Automatic Traction Control (ATC)
- Electronically Controlled Braking Systems (ECBS)
- Electronic Stability Control (ESC) and Roll Protection (RSC)
- Brake Testing
- Brake Regulations

What You Will Receive:

- 365 Day access through MyLearn.sae.org
- Links to streaming video modules
- Course Handbook (downloadable .pdf's, subject to DRM)
- The book, Commercial Vehicle Braking Systems:

Air Brakes, ABS and Beyond, by Leonard C. Buckman Handbook (downloadable .pdf)
- Online Pre-test & Post-test (self-test, immediate results)
- CEUs/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Leonard C. Buckman
	1.8CEUs

Introduction to Brake Control Systems e-Seminar

I.D.# PD130501ON
Access Period: 1 Year
Duration: 9.5 Hours

In this e-seminar, James Walker, Jr. delves into brake control technology. Starting with the fundamentals of the tire-road interface, this course introduces participants to brake control system mechanization, system sensor needs, and the basic control strategies employed by anti-lock braking systems (ABS), traction control systems (TCS), electronic stability control systems (ESC), and their derivatives.

Limiting factors and compromises that must be made in the design and development of brake control systems are covered through a brief review of hydraulic brake system functionality, the friction circle concept, and the fundamentals of longitudinal and lateral vehicle dynamics. Brake control system integration with other vehicle on-board technologies are also discussed.

Based on the popular classroom seminar, the nine and a half hour course is divided into 13 modules accompanied by a handbook. Walker revisits key concepts in a summary at the end of the course to reinforce learning and retention.

Learning Objectives

By participating in this e-Seminar, you will be able to:

- Define basic tire-road interface characteristics and performance limits
- Analyze brake system design parameters and their vehicle performance effects
- Evaluate the compromises between stability, steerability, and stopping distance
- Discern the discrete mechanical components of the ABS subsystem
- Compare ABS sensor technologies and packaging strategies
- Specify fundamental ABS performance attributes
- Develop basic DRP operating requirements
- Explain the additional mechanization needs of TCS and ESC
- Contrast the additional sensors required for TCS and ESC
- Reconcile TCS performance expectations vs. method of implementation
- Interpret ESC metrics and ultimate limitations
- Identify special conditions and considerations which can impact performance
- Discuss opportunities for advanced brake control system integration

Who Should Attend:

This course was developed for engineers involved in all disciplines related to the design or development of vehicle braking systems, vehicle dynamics, powertrain systems, or chassis/suspension systems. A basic knowledge of college algebra, college physics, and a familiarity with vehicle foundation brake system functionality is required.

Individuals new to the field of brake control systems will benefit most from the material; this course is not intended for individuals with significant background in, or experience with, brake control systems. In addition, please note that because of proprietary considerations this class does not provide details of algorithm design, algorithm performance, or algorithm application.

This course has been approved by the Accreditation Commission for Traffic Accident Reconstruction (ACTAR) for 10 Continuing Education Units (CEUs). Upon completion of this e-seminar, accredited reconstructionists should contact ACTAR, 800-809-3818, to request CEUs. As an ACTAR approved course, the fee for CEUs is reduced to $5.00.

Major Topics Include:

- Tire-Road Interface Characteristics
- Hydraulic Brake System Overview
- Stability, Steerability, Stopping Distance
- Mechanization of ABS
- ABS Sensor Overview
- ABS Performance
- DRP Performance
- Mechanization of TCS and ESC
- TCS and ESC Sensor Requirements
- TCS Performance
- ESC Performance
- Special Conditions and Considerations
- Advanced Integration

What You Will Receive:

- 365 Day access through MyLearn.sae.org
- Links to streaming video modules
- Course Handbook (downloadable .pdf's, subject to DRM)
- Online Pre-test & Post-test (self-test, immediate results)

- CEUs/Certificate of Achievement (with satisfactory post-test score)

Instructor:	James E. Walker
	1.0 CEUs

Vehicle Braking Performance: Braking Confidence and Pedal Feel Fast Track

I.D.# PD230912ON
Access Period: 3 Months
Duration: 51 Minutes

Braking confidence and pedal feel are important braking performance attributes that should be optimized to achieve customer satisfaction with a vehicle's braking system. The relationship between the input force and travel provided by the driver to achieve the desired vehicle deceleration is as core to the vehicle personality or DNA as ride, handling, or driveability.This Fast Track will cover the main concepts and methods needed for tuning brake systems to desired pedal force and travel characteristics.

In this one-hour, ten minute online short course, instructor Tom Hall will teach how braking confidence is defined in both objective and subjective terms, the relationships between input force and vehicle force will be developed. In addition, the relationships between input travel and vehicle deceleration will be developed. Effects of primary brake system subcomponents will be evaluated. Effects on component variability including frictional properties of brake pads will be studied.

Learning Objectives:

By participating in this Fast Track short course, you will be able to:

- Explain the general mechanism by which pedal force is converted to stopping force and vehicle deceleration by the brake system
- Determine the amount of stopping force and deceleration that will occur for a given pedal force and pedal travel
- Explain the general parametric relationships between pedal force, travel and vehicle deceleration, and how to adjust key parameters to achieve pedal force, pedal travel and vehicle deceleration targets
- Explain how external factors such as elevation and temperature affect braking performance
- Identify the challenges related to braking design and braking confidence optimization for emerging technologies such as regenerative braking capabilities of hybrid and electric vehicles

Who Should Attend:

The Vehicle Braking Performance: Braking Confidence and Pedal Feel Fast Track would be of value to anyone involved in the validation of a braking system, either in the development of the validation plan or the execution of the validation plan. This course would also be of value to those involved in vehicle marketing -- a detailed understanding of the metric's generation and contributing effects will insure that promotion and comparison is done in a qualified manner.

Major Topics Include:

- Introduction to Braking Confidence
- Input Force to Vehicle Deceleration Relationship
- Input Travel to Vehicle Deceleration Relationship
- Parametric Analysis
- Environmental Effects
- Emerging Trends Affecting Braking Confidence

What You Will Receive:

- Three months of online access to the 51 minute presentation
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation

Instructor:	Thomas J. Hall

Vehicle Braking Performance: Stopping Distance Fast Track

I.D.# PD230826ON
Access Period: 3 Months
Duration: 1 Hours

Stopping Distance is one of the most common metrics of a vehicle's braking performance and one of the most critical attributes of accident prevention and minimization. The measurements are used within the development of the vehicle and are a critical aspect of accident prevention, accident reconstruction, and overall occupant and pedestrian safety management. While the results of this metric are published in a variety of sources, the factors that differentiate vehicle performance, vehicle dynamics, and calculation of the braking performance required to achieve desired performance are not widely available.

In this one-hour online short course, instructor Tom Hall reviews the methods used to measure and report stopping distance. He also analyzes the associated formulations to determine the braking forces created by a wheel brake and necessary to achieve a desired distance. Vehicle and driver contributions to the overall stopping event are examined.

CHASSIS AND VEHICLE DYNAMICS

Learning Objectives

By participating in this Fast Track short course, you will be able to:

- Calculate the stopping distance of a vehicle based on known vehicle parameters
- Determine the stopping distance of a vehicle under different road surface conditions
- Compare the performance of tires on various road surfaces and slip conditions
- Relate the published stopping distance to the ability to avoid (stop short) of a road obstacle
- Formulate the brake force required to achieve a desired stopping distance
- Calculate the brake force created by a wheel brake
- Normalize actual test data to commonly reported standard values
- Determine the contribution of ABS to stopping performance
- Compute ABS efficiency by common methods

Who Should Attend:

The Vehicle Braking Performance: Stopping Distance Fast Track would be of value to anyone involved in the validation of a braking system, either in the development of the validation plan or the execution of the validation plan. Those involved in accident reconstruction and accident prevention would benefit from an understanding of the techniques, principles, contributing factors and limitations of stopping performance to improved vehicle and road system design. This course would also be of value to those involved in vehicle marketing -- a detailed understanding of the metric's generation and contributing effects will insure that promotion and comparison is done in a qualified manner.

Major Topics Include:

- Common Procedures Used to Assess Stopping Distance
- Performance Metrics Compared to Target Avoidance
- Determination and Generation of Forces Necessary to Stop a Vehicle
- Contributions and Limitations of Anti-Lock Brake Systems

What You Will Receive

- Three months of online access to the 60 minute presentation
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation

Instructor:	Thomas J. Hall

NEW! SAE ACCIDENT RECONSTRUCTION CERTIFICATE PROGRAM

Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate program.

Become more proficient in the practice of vehicle crash/accident reconstruction by successfully completing this certificate program from SAE. Required courses guide you through crash reconstruction methods, vehicle dynamics, and event data recorder (EDR) technology. Then select three electives that suit your individual technical interest area. Completing the SAE Accident Reconstruction Certificate Program grants you eight credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems or Kettering's 40-credit M.S. in Mechanical Engineering. Visit training.sae.org/college-credit for more information. View the list of required and elective courses and more information on enrolling in this SAE certificate program--training.sae.org/certificate/accident_recon

VEHICLE DYNAMICS

Vehicle Dynamics for Passenger Cars and Light Trucks e-Seminar

I.D.# PD130702ON
Access Period: 1 Year
Duration: 15 Hours

This e-Seminar presents an introduction to vehicle dynamics from a vehicle system perspective. The theory and applications are associated with the interaction and performance balance between the powertrain, brakes, steering, suspensions and wheel and tire vehicle subsystems. The role that vehicle dynamics can and should play in effective automotive chassis development and the information and technology flow from vehicle system to subsystem to piece- part is integrated into the presentation.

Dr. Richard Lundstrom develops and solves governing equations of motion for both steady and transient conditions. He presents manual and computer techniques for analysis and evaluation. Vehicle system dynamic performance in the areas of drive-off, braking, directional control and rollover is emphasized. The dynamics of the powertrain, brakes, steering, suspension and wheel and tire subsystems and their interactions are examined along with the important role of structure and structural parameters related to vehicle dynamics. Physical experiments applicable to vehicle dynamics are also introduced.

Learning Objectives

CHASSIS AND VEHICLE DYNAMICS

By participating in this e-Seminar, you will be able to:

- Summarize how vehicle dynamics is related to the voice of the customer
- Identify important vehicle system parameters useful for effective application of vehicle dynamics to chassis development
- List and explain parameters that effect vehicle performance relative to drive-off, braking, directional control and rollover
- Identify physical measurements needed to effectively apply vehicle dynamics to passenger cars and light trucks
- Define the value of vehicle dynamics simulation in the development and evaluation of vehicles
- Explain the balance required between ride, directional control and rollover and the essential process for this balance to be obtained for marketplace vehicles

Who Should Attend:

This e-Seminar is intended for automotive engineers and quality professionals who work in product design, testing, quality, process or development.

This course has been approved by the Accreditation Commission for Traffic Accident Reconstruction (ACTAR) for 18 Continuing Education Units (CEUs). Upon completion of this e-seminar, accredited reconstructionists should contact ACTAR, 800-809-3818, to request CEUs. As an ACTAR approved course, the fee for CEUs is reduced to $5.00.

Major Topics Include:

- Vehicle Dynamics: Introduction
- Drive-Off Dynamics: Introduction and Vehicle Resistances
- Drive-Off Dynamics: Vehicle Characteristics and Powertrain Matching
- Drive-Off Dynamics: Tire Patch Forces and Performance Prediction
- Braking Dynamics: Introduction and Balance Characteristics
- Braking Dynamics: Tire/Wheel Limits, Efficiency, and Performance
- Ride Dynamics: Introduction
- Ride Dynamics: Quarter Vehicle Dynamic Model
- Ride Dynamics: Parameter Estimation
- Ride Dynamics: Wheel Motion and Secondary Ride
- Ride Dynamics: Summary
- "Low Speed" Steering Dynamics: Introduction and Steering Geometry
- "Low Speed" Steering Dynamics: Turning Circle
- "High Speed" Steering Dynamics: Introduction
- "High Speed" Steering Dynamics: Tire Forces and Characteristics
- "High Speed" Steering Dynamics: Cornering Compliance and Body Roll
- "High Speed" Steering Dynamics: Understeer Gradient - Rigid Body Contributions
- "High Speed" Steering Dynamics: Understeer Gradient - K & C Contributions
- "High Speed" Steering Dynamics: Transient Cornering Response

What You Will Receive

- 365 days of single-user access (from date of purchase) to the 15 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's) including the SAE Papers:
  - 970091
  - SP-355
  - 760713
  - 760710
- The Bosch Automotive Handbook** (bound, hardback)
- The book, The Automotive Chassis: Engineering Principles by Reimpell, Stoll and Betzler (eBook, downloadable through My Library)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 1.5 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Richard Raye Lundstrom

SAE VEHICLE DYNAMICS CERTIFICATE PROGRAM

Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate program.

Designed to equip you with key vehicle dynamics and handling theory and application from a systems perspective, the objective of this program is for you to understand the interaction and performance balance between the major vehicle subsystems. The program design requires completion of fundamental and advanced-level vehicle dynamics theory and application courses with three elective courses that best suit your specific interest areas or engineering emphasis. View the list of required and elective courses and more information on enrolling in this SAE certificate program--training.sae.org/certificate/vehicle_dynamics

ELECTRICAL/ELECTRONICS AND ELECTRONIC SYSTEMS

Includes electronics, vehicle electrification, modeling and simulation, data sensors, automotive lighting, and control systems.

ELECTRONICS & ELECTRICAL CONTROL SYSTEMS

Controller Area Network (CAN) for Vehicle Applications e-Seminar

I.D.# PD130557ON
Access Period: 1 Year
Duration: 10.5 Hours

The Controller Area Network has become the standard of choice for most automotive manufacturers. Approved for use as an ISO and EPA diagnostic network, its usage continues to grow. This e-seminar covers the theory and use of the CAN protocol, and its applications in the automotive industry.

Instructor Mark Zachos presents details on how the CAN protocol and other standards (J2284, J2411, J1939, ISO 11898, etc.) complement each other. Validation engineers, test engineers, embedded programmers, and those who are currently or will be working with applications using CAN will benefit from the content on CAN application layers; the latest J1939, J2284, J2411, and IDB standards, regulations, and implementation requirements; and details of device hardware and software interfaces. Also presented is a demonstration using system development tools.

Learning Objectives

By participating in this e-Seminar, you will be able to:

- Apply CAN protocol
- Demonstrate how CAN is used in various automotive applications
- Use CAN-related standards and specifications

Who Should Attend:

This e-Seminar is geared toward validation engineers, test engineers, embedded programmers, and those who are currently working (or will be in the future) with applications using CAN. You should have at least an undergraduate engineering degree.

Major Topics Include:

- Introduction
- Network Overview
- CAN Protocol
- CAN Controllers
- CAN Physical Layers
- Overview of J2284, J2411, IDB, J1939, Diagnostics on CAN
- SAE J1939
- Gryphon Demonstration
- Working Examples of J1939

What You Will Receive:

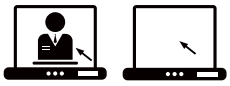
- 365 days of single-user access (from date of purchase) to the 10.5 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- The SAE standards, J1939 Recommended Practice for a Serial Control and Communications Vehicle Network and J1939/71 Recommended Practice for Vehicle Application Layer (.pdf, downloadable)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 1.1 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Mark P. Zachos
	1.1 CEUs

ELECTRICAL/ELECTRONICS AND ELECTRONIC SYSTEMS

Hybrid and Electric Vehicles (HEVs): Current Production, Future Strategies Web Seminar RePlay

I.D.# PD330906ON
Access Period: 30 Days
Duration: 2 Hours



Hybrids, and to a lesser extent, electric vehicles, have been on the road since 1997. Although just two hybrids were on the market in 2001, there are more than a dozen today, and the market is ramping up quickly, driven by fuel prices and constraints, environmental regulations, and customer demand. The commercial vehicle market is also rapidly embracing hybrid technology. This two-hour webi seminar will highlight the passenger, light-duty, and heavy-duty hybrid and electric vehicles that are currently in production, offered for sale, or planned for near-term production. Asian, European, and North American manufacturers of hybrid and electric vehicles will be reviewed. Tier 1 suppliers of major hybrid and electric vehicle components will be covered as well.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- List the hybrid and electric vehicles that have been commercialized from 1997 to present
- Identify passenger, light-duty, and heavy-duty hybrid-electric vehicles that are on the market
- Explain the major resource and regulatory drivers of hybrid and electric vehicle development
- Recognize basic layouts of light, medium, and heavy-duty hybrid vehicle powertrains
- Compare advantages and disadvantages of different hybrid architectures
- Summarize upcoming HEV and EV production plans

Who Should Attend:

This course will benefit executive, manager, marketing, or other passenger car and light duty industry professionals who need a comprehensive overview of past, current, and future hybrid and electric vehicle production. Those unfamiliar with the evolution of hybrid and electric vehicle development, yet whose job will be impacted by hybrid and electric vehicles in the future, will benefit also.

Major Topics Include:

- Hybrid and electric vehicle production, 1997-present
- Current Asian hybrid vehicle production
- Current US hybrid vehicle production
- Advantages and disadvantages of series hybrids
- Upcoming commercialization of series hybrids
- Market and regulatory drivers of HEV/EV production
- Fuel constraints
- US regulatory drivers
- "Green state" regulatory drivers
- EU regulatory drivers
- Asia's regulatory drivers
- Planned Asian hybrid and electric vehicle production
- Planned European hybrid and electric vehicle production
- Planned US hybrid and electric vehicle production
- Commercial hybrid and electric vehicle production
- Asian commercial hybrids
- European commercial hybrids
- North American commercial hybrids
- Tier 1 suppliers and partnerships
- Internal-combustion engines (ICE)
- Energy storage systems
- Motors and power electronics

What You Will Receive:

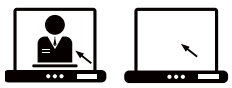
- Thirty days of online single-user access (from date of purchase) to the one session, approximately two hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .2 CEUs* (with satisfactory assessment score)

Instructor:	Jack Lelan Rosebro
	0.2 CEUs

VEHICLE ELECTRIFICATION

Plug-in Hybrids: Opportunities and Challenges Web Seminar RePlay

I.D.# PD330905ON
Access Period: 30 Days
Duration: 2 Hours



The path to commercialization of plug-in hybrids is likely to require complex interactions between OEMs, battery manufacturers, electric utilities, and government, yet the plug-in hybrid is a still-developing technology. How do plug-in hybrids (PHEVs) differ from conventional hybrids? What are the advantages and challenges for vehicle manufacturers, public utilities, energy and environmental concerns, and end-users? What is the current state of plug-in hybrid development?

Those unfamiliar with PHEV or vehicle-to-grid (V2G)

technology, yet whose job will be impacted by plug-in hybrid vehicles in the future, will benefit from this two-hour web seminar.

Learning Objectives

By participating in this web seminar replay, you will be able to:

- Describe the relevant differences between plug-in hybrid (PHEV) and conventional hybrid vehicles
- Identify fundamental charge-discharge strategies
- Explain the performance demands placed on PHEV energy storage systems and development trends in energy storage
- Recognize the enablers and barriers to mass commercialization of PHEVs
- Summarize infrastructure requirements as well as supply-side and demand-side incentives
- Explain the potential energy and emission benefits of PHEV and V2G synergies

Who Should Attend:

This course will benefit automotive and commercial vehicle industry professionals who want to understand the rapidly-changing development of plug-in hybrids, as well as proposed legislation that may affect that development, and surrounding infrastructure that will play a supporting role in PHEV commercialization.

Major Topics Include:

- Plug-in hybrid (PHEV) architectures
  - Gasoline-electric plug-in hybrids
  - Diesel-electric plug-in hybrids
  - Fuel cell plug-in hybrids
- Plug-in hybrid (PHEV) charge-discharge strategies
  - Series plug-in hybrids
  - Parallel plug-in hybrids
  - Series-parallel plug-in hybrids
  - Charge-sustaining (CD) strategies
  - Charge-depleting (CD) strategies
  - Blended charge-discharge strategies
- Plug-in hybrid (PHEV) energy storage systems
  - State of energy storage chemistries today
  - Influence of all-electric range
  - Influence of charge-discharge strategies
- State of plug-in hybrid development today
  - Conversion of existing hybrid vehicles
  - Passenger and light-duty vehicles
  - Heavy-duty vehicles
- Interaction between plug-in hybrids and the electrical grid
  - Charging considerations
  - Infrastructure considerations
  - PHEVs and grid demand
- Vehicle-to-grid (V2G)
  - How V2G works
  - State of V2G development today
  - What's needed to enable large-scale commercialization V2G
- Government incentives toward development of PHEVs
  - Supply-side incentives
  - Demand-side incentives

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the one session, approximately two hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .2 CEUs* (with satisfactory assessment score)

Instructor:	Jack Lelan Rosebro
	0.2 CEUs

MANAGEMENT AND LEADERSHIP

Includes effective leadership, strategic thinking, team building, management, and effective decision making.

Root Cause Problem Solving: Methods and Tools Web Seminar RePlay

I.D.# PD330931ON
Access Period: 30 Days
Duration: 8 Hours

Tough times require searching for things that we can change and making them better. But so often problems are solved with 'band-aids' and not root cause solutions. This approach is getting too expensive and at best only helps companies tread water. To combat these issues and adopt a fresh approach, teams can use the methods and tools of Root Cause Problem Solving to first view problems as opportunities for improvement, identify root causes and implement solutions to prevent recurrence. Benefits include improved quality and customer satisfaction, reduced operation costs, and greater employee knowledge of work processes.

This proven 8-step approach to problem solving will help improve operational and financial performance by identifying causes and implementing solutions to significant or recurring problems. This approach to problem solving is used by many major automotive manufacturers.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Describe the 8-Step Problem Solving Methodology
- Define the difference between Symptom and Root Cause
- Use tools and techniques to solve problems
- Evaluate effectiveness of problems solving efforts
- Describe the role of problem solving in continuous improvement
- Write an action plan to apply problem solving to a specific concern

Who Should Attend:

This course is applicable to those directly working in or responsible for performance improvement of any definable, repetitive process, e.g. manufacturing, design, logistics, purchasing, sales, or distribution, including:

- Manufacturing managers, supervisors and team leaders
- Manufacturing engineers
- Design engineers
- Quality engineers and technicians
- Technical managers
- Project team leaders
- Problem solving and quality improvement facilitators
- Anyone whose role includes problem solving; therefore all supervisors and lead personnel

Major Topics Include:

Session 1

- Overview
  - Following a process approach
  - What is a problem?
  - Inhibitors to effective problem solving
  - 8-step problem solving process overview
- Step 1: See the Problem as an Opportunity
  - Framing the problem solving effort
  - Identifying team members
  - Team roles
- Step 2: Describe the Problem
  - Symptoms vs. Causes
  - Methods for describing the problem
  - Using and charting data
  - Problem Is/Is-Not analysis

Session 2

- Step 3: Implement Containment
  - Protect the Customer
  - Process Control Plan
- Step 4: Recognize Potential Root Causes
  - Identifying possible causes
  - Process Maps
  - Cause-Effect diagrams
  - 5-Why tool

Session 3

- Step 5: Design Solution
  - Solutions that don't work
  - Process Controls and Error Proofing
  - Standardized Work
- Step 6: Implement Permanent Corrective Actions
  - Plan the work
  - Complete system changes
  - Verify effectiveness

Session 4

- Step 7: Prevent Recurrence
  - Was the problem eliminated?
  - Layered audits
  - Leverage learnings with FMEA
- Step 8: Recognize Efforts
  - Team debrief and lessons learned
  - Evaluate and celebrate success
- Summary
  - Sufficiency checklist for effective problem solving
  - Continuous Improvement

What You Will Receive:

- Thirty days of online single-user access to the four session recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .8 CEUs* (with satisfactory assessment score)

Instructor:	Murray J. Sittsamer
	0.8 CEUs

MANAGING PRODUCT DEVELOPMENT/QUALITY ASSURANCE

Includes product development, compliance, risk management, problem solving, and quality.

Fundamentals of Systems Acquisition Management

I.D.# PD43DAU01
Access Period: 1 Year
Duration: 26 Hours

This online course provides a broad overview of the DoD systems acquisition process, covering all phases of acquisition. The content of this course is based on and is presented from the DoD perspective and serves as the foundation for understanding the regulations and language used in the federal acquisition system. This course introduces the Joint Capabilities Integration and Development System; the planning, programming, budgeting, and execution process; DoD 5000-series policy documents; and current issues in systems acquisition management. Designed for individuals who have little or no experience in DoD acquisition management, this course familiarizes the participant with the terminology and processes used by government agencies and contracting organizations.

Learning Objectives:

By participating in this online course, you will be able to:

- Identify the fundamental precepts and basics of Defense Systems Acquisition Management
- Identify the diverse, interrelated, and changing nature in the different disciplines of Defense Systems Acquisition Management
- Identify the regulations and governing structures of Defense Systems Acquisition Management

Who Should Attend:

SAE is pleased to offer this course to government contractors and other individuals requiring an understanding of the regulations and language used in the federal acquisition process. Additionally, individuals interested in pursuing acquisition careers with the federal government will benefit from this certified DAU Equivalency course. Successful completion also meets the ACQ101 course requirement for DAWIA Level I Certification.

Major Topics Include:

ACQ 101 consists of 24 lessons that are divided into three sections:

1. Acquisition Policy and Planning
   - Lesson 1 - Defense Acquisition Workforce Improvement Act (DAWIA)
   - Lesson 2 - Systems Acquisition Management: An Introduction
   - Lesson 3 - Systems Acquisition Management: Introduction to the Life Cycle
   - Lesson 4 - Systems Acquisition Management: Organizations and Acquisition Categories
   - Lesson 5 - Team Building
   - Lesson 6 - The Joint Capabilities Integration and Development System (JCIDS)
   - Lesson 7 - Work Breakdown Structure

2. Financial and Contract Management
   - Lesson 8 - Financial Management: Cost Estimation
   - Lesson 9 - Financial Management: Resource Allocation Process
   - Lesson 10 - Financial Management: Program/ Budget Execution
   - Lesson 11 - Contract Management: Planning for Solicitation
   - Lesson 12 - Contract Management: Solicitation, Evaluation, and Award
   - Lesson 13 - Contract Management: Post-Award
   - Lesson 14 - Earned Value Management

3. Technical Management
   - Lesson 15 - The Systems Engineering Process Environment
   - Lesson 16 - The Systems Engineering Process
   - Lesson 17 - Science and Technology in the Acquisition Process
   - Lesson 18 - Test and Evaluation Overview
   - Lesson 19 - Acquisition Logistics: Fundamentals
   - Lesson 20 - Acquisition Logistics: Supportability Planning

- Lesson 21 - Software Acquisition: Fundamentals
- Lesson 22 - Software Acquisition: Development and Management
- Lesson 23 - Production, Quality, and Manufacturing Management
- Lesson 24 - Facilities Engineering

What You Will Receive:

- 365 days of access (from date of purchase) to the 26 hour course
- Online coursework
- Downloadable resource documents for each lesson
- Periodic knowledge checks
- Online testing (immediate results and automatically submitted to SAE)
- 2.6 CEUs*/Certificate of Achievement withcredit granted for DAU Equivalency (with successful completion)

Instructor:	Defense Acquisition University
	2.6 CEUs

Global 8D - Ford Online Course

I.D.# PD111012ON
Access Period: 4 Months
Duration: 12 Hours

Global 8D (G8D) is a disciplined process developed by Ford Motor Company to help product development and manufacturing engineers identify and solve problems. Solving problems results in efficient, as well as effective, resolution to 'root causes' of customer satisfaction issues, and helps reduce warranty costs.

With this 12-hour online course, you will learn the methods and tools used to complete each step in the Ford Global 8D find-and-fix problem-solving process, including steps to define the problem, verify the root cause and escape point, and prevent occurrence. The course is designed to provide you with the analytical and procedural information you need to understand, describe, and participate in the G8D problem-solving process as a team member. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

Learning Objectives

By participating in this online course, you will be able to:

- Describe each step in the G8D process
- Identify the types of problems best resolved using the G8D problem-solving method
- Participate as an effective G8D team member
- Apply Global 8D problem-solving methods as a G8D team member
- Use G8D process support tools and the G8D web application

Who Should Attend:

This course is geared toward quality, manufacturing, and product development engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

Major Topics Include:

- Global 8D Overview
- Prepare for Global 8D and Establish the Team
- Describe the Problem and Find the Root Cause
- Choose and Implement a Permanent Corrective Action (PCA)
- Complete the Global 8D

What You Will Receive:

- Four months of online access to the 12-hour course
- Proof of Participation

Instructor:	Ford Quality Office, Ford Learning & Development

Introduction to Advanced Product Quality Planning (APQP) Fast Track

I.D.# PD230908ON
Access Period: 3 Months
Duration: 1 Hours

To become a preferred supplier in the automotive industry, organizations must demonstrate high-level engineering and organizational capabilities that will meet customers' needs today and tomorrow. Because the outcome of a product development project may determine whether or not an organization procures a purchase order or contract from a global automotive customer, the Introduction to Advanced Product Quality Planning Fast Track addresses an overview of the best practices / methodologies for planning and managing the successful launch of a new product.

The benefits of a successful new product launch are recognized by both global automotive customers and suppliers. There are thousands of great inspirations and great ideas each year, but the difficult task that so many organizations struggle with is how to take those ideas and develop them into a viable product design, and then manufacture the designed product, and then distribute and sell the product. An understanding of the Advanced Product Quality Planning (APQP) process, the management of the process, and the implementation of the process is critical to the product development multi-disciplinary team which includes top management, the project manager, product engineering, process

engineering, design and development, manufacturing, quality, and purchasing personnel.

Learning Objectives

By participating in this Fast Track short course, you will be able to:

- Explain what APQP is, what the purpose of APQP is, and what the goals are of an effective APQP process
- Identify the impacts and benefits that an effective APQP process has on both the customer and the supplier
- Describe how an APQP process is effectively integrated into the supplier's business management system
- Compile a 'Master Plan' for new product introduction and outline the inputs and outputs of the various phases of an effective APQP process
- Summarize the benefits of an effective APQP process and illustrate how APQP leads to continual improvement for both the customer and supplier

Who Should Attend:

Participants in the Introduction to Advanced Product Quality Planning (APQP) Fast Track will gain a 'common-sense' perspective for successful new product launches and what needs to be done to comply with automotive customer specific requirements. You will also understand how to apply the concepts of 'front-end' planning (via the APQP process) that will result in continual improvement of products and services for both the customer and the supplying organization. This course is relevant to individuals with limited or general knowledge of the APQP process and some experience with introducing new products or new manufacturing processes.

Major Topics Include:

- What is APQP?
- What is the purpose of APQP?
- Understanding how APQP integrates into the automotive supply chain
- APQP - A master plan for new product development
- Summary of APQP benefits

What You Will Receive:

- Three months of online single-user access (from date of purchase) to the 60 minute presentation
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Instructor:	Larry E. Bissell

Introduction to Weibull Engineering Fast Track

I.D.# PD230946ON
Access Period: 3 Months
Duration: 1.17 Hours

The Weibull engineering technique is the starting point for solving most issues related to product reliability, maintainability, supportability, quality, safety, test planning, and cost control. Weibull Analysis is popular worldwide as the best method for predicting modeling variability and failure of designs, products, and systems. In this introductory short course, instructor Wes Fulton will provide a solid overview of Weibull Engineering capabilities. This 80 minute Fast Track should be considered a prerequisite for participation in a Weibull project or for attending additional SAE training that covers advanced Weibull applications.

Learning Objectives:

By participating in this Fast Track short course, you will be able to:

- Evaluate whether available data will be appropriate for Weibull Engineering
- Use both failures and non-failures for the best solution
- Generate a Weibull plot and interpret the results
- Evaluate the correctness of a Weibull solution
- Distinguish between an infant mortality issue and a wear-out issue
- Forecast events under different maintenance strategies
- Determine pass/fail criteria in designing a test program
- Convert Weibull results into meaningful cost-based information

Who Should Attend:

The Introduction to Weibull Engineering Fast Track is designed for the engineer - from automotive, aerospace, electrical, biomedical, and nuclear. This course does not require any pre-requisite, as the content will unfold from the basics, up to the more advanced features of this valuable analysis tool. The knowledge gained in this course can serve as a prerequisite to more advanced Weibull projects.

Major Topics Include:

- Introduction and Background
- Basic Weibull Plotting and Interpretation
- Case Studies of Successful Weibull Applications
- Overview of Weibull Extensions
- Course Summary

MANAGING PRODUCT DEVELOPMENT/QUALITY ASSURANCE

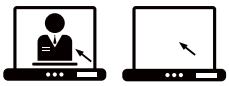
What You Will Receive:

- Three months of online single-user access (from date of purchase) to the 80 minute presentation
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Instructor:	James W. Fulton

Patent Litigation in the U.S.: What You Need to Know Web Seminar RePlay

I.D.# PD330940ON
Access Period: 30 days
Duration: 4 Hours



In today's economic environment, patents have become an increasingly important asset for both individuals and corporations. Licensing revenue has become a significant source of value in the global intellectual property economy. This course will tell you what you need to know about U.S. patent litigation and will provide in-depth insights into the practical realities of patent disputes in the U.S.

Learning Objectives

By participating in this web seminar replay, you will be able to:

- Obtain an overview of U.S. patent litigation
- Explain the basic legal principles for liability and damages in patent cases
- Gain insights into how patent disputes are resolved
- Predict the fees and expenses associated with bringing and/or defending a patent case in the U.S.
- Anticipate the scope of discovery in, and/or business disruption arising from, a U.S. patent case
- Peek into the future of potential patent law reform

Who Should Attend:

This course is geared toward executives, in-house counsel, in-house patent agents, and senior managers across industries, such as automotive and aerospace. Participants may be both U.S. and non-U.S. -- anyone who needs help in understanding what to expect and what the realities are should they become involved in U.S. patent litigation.

Major Topics Include:

Session 1

- Overview of Patent Litigation
  - Issues the patent-owner has to prove
  - Issue the accused infringer has to prove
- What is the Scope of Discovery?
  - Documents, including e-documents
  - Depositions
  - Third parties (e.g. customers, suppliers)
  - Confidentiality of discovery materials
- Who Decides Liability and Damages?
  - Jury
  - Judge
  - Mediator/Arbitrator

Session 2

- How Long Does it Take from Filing to Trial?
  - District Courts
  - ITC
- How Much Does it Cost?
  - Fees and expenses
  - Contingency fees
  - Recovery of fees and expenses
- What Changes are on the Horizon?
  - Supreme Court
  - Patent law reform

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the two session, approximately four hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to YOUR content questions
- .4 CEUs* (with satisfactory assessment score)

Instructor:	Russell Evan Levine
	0.4 CEUs

CALISO ONLINE COURSES

Good Laboratory Practices (GLP) Training –CALISO Online Course

8 Hours
I.D.# GLP

GLP refers to a Quality Systems of management controls for laboratories and research organizations to ensure the consistency and reliability and reproducibility of results. The original regulatory enforcement was first published by FDA and then a few years later by EPA. It is also outlined in the Organization for Economic Co-operation and Development (OECD) Principles of GLP in 1992 and has since been added to many national regulations. Your company, and all who partake in the daily activities of running a laboratory or a research and testing center, will benefit from this course. This 8-hour GLP (.8 CEU) overview is particularly adapted for training all levels of an organization on the requirements of this standard.

Learning Objectives

By participating in this online course, you will be able to:

- Understand the high specific requirements and intent of this GLP regulation
- Understand the GLP requirements and 21CFR58
- Understand requirement for Good Laboratory Practices
- Understand how the requirements should be implemented within your organization

Major topics include:

- Scope
- Definitions
- Inspection of a testing facility
- Personnel
- Testing facility management
- Quality assurance unit
- General
- Animal care facilities

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently get a comprehensive training of GOOD LABORATORY PRACTICES (GLP)
- Want to improve your CV and career opportunities with qualifications in quality assurance

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

ISO 9001 Overview – CALISO Online Course

4 Hours
I.D.# ISO 9001OVERVIEW

ISO 9001 is a quality management standard developed by the International Organization for Standardization (ISO). The ISO 9001 standard is generic and can be used for any organization, whether it provides physical products or services. The requirements must be carefully interpreted to make sense within a particular organization. Developing automotive products is not like producing food products or offering consulting services; yet the ISO 9001 standard, because it is business and management oriented, can be applied to any activity. It is the most widely used quality management standard in the world. This four-hour ISO 9001 overview is particularly adapted for training top management on the high level requirements.

Learning Objectives

By participating in this online course, you will be able to:

- Understand the high level requirements and intent of this international standard
- Understand the process approach to managing an organization
- Understand how the requirements can be interpreted should be implemented within an organization

Major topics include:

- General Requirements of ISO 9001
- Management Responsibility
- Resource Management
- Product Realization (summary)
- Measurement, Analysis and Improvement

This SAE/CALISO course is for you if you:

- • Want to quickly and efficiently get a comprehensive overview of ISO 9001:2008
- • Want to improve your CV and career opportunities with qualifications in ISO 9001
- • Want to upgrade your expertise from auditing ISO 9001:2000 to ISO 9001:2008
- • Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2002

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining

70% or above on the final average of the ongoing quizzes.

	0.4 CEUs

ISO 9001:2008 Training – CALISO Online Course

8 Hours
I.D.# ISO 9001TRAINING

ISO 9001 is a quality management standard developed by the International Organization for Standardization (ISO). Your company and all who partake in the daily activities of running the business will benefit from taking ISO 9001 training. This eight-hour ISO 9001 (.8 CEU) overview is particularly adapted for training all levels of an organization on the requirements of this standard.

Learning Objectives

By participating in this online course, you will be able to:

- Understand the high specific requirements and intent of this international standard
- Understand the process approach to managing an organization
- Understand how the requirements can be interpreted should be implemented within an organization

Major topics include:

- General Requirements of ISO 9001
- ISO 9001 Vocabulary
- Management Responsibility
- Resource Management
- Product Realization
- Measurement, Analysis and Improvement

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently get a comprehensive training of ISO 9001:2008
- Want to improve your CV and career opportunities with qualifications in quality assurance
- Want to upgrade your expertise from ISO 9001:2000 to ISO 9001:2008

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

ISO 9001:2008 Auditor Training – CALISO Online Course

8 Hours
I.D.# ISO 9001AUDITOR

ISO 9001 is a quality management standard developed by the International Organization for Standardization (ISO). Your company and all who partake in the daily activities of running the business will benefit from taking ISO 9001 training. The eighthour (.8 CEU) ISO 9001 Auditor course provides training on the standard itself and on how to lead or conduct internal audits and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

Learning Objectives

By participating in this online course, you will be able to:

- Master the auditing techniques per ISO 19011, which are used for quality, environmental, and safety management system audits
- Learn how to prepare and conduct an audit
- Be exposed to real auditing case studies covering many industries

Major topics include:

- General Requirements of ISO 19011
- Auditing techniques
- QMS Auditing Case Studies

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to lead an ISO 9001:2008 audit
- Want to quickly and efficiently be trained on ISO 9001 (the standard), and ISO 9000 (the vocabulary for the standard)
- Want to be a lead auditor to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in quality assurance and leading 1st part audits
- Want to upgrade your expertise from auditing ISO 9001:2000 to ISO 9001:2008
- Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2002

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

MANAGING PRODUCT DEVELOPMENT/QUALITY ASSURANCE

ISO 9001:2008 Lead Auditor – CALISO Online Course

22 Hours
I.D.# ISO 9001LEADAUDITOR

As described in the previous ISO 9001 Overview description, ISO 9001 is a quality management standard developed by the International Organization for Standardization (ISO). Your company and all who partake in planning, leading and conducting the audit activities of running the business will benefit from taking ISO 14001 Auditor training. The 22-hour (2.2 CEU) ISO 9001 Auditor course provides training on the standard itself and on how to lead or conduct internal audits and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

Learning Objectives

By participating in this online course, you will be able to:

- Understand every requirement of this international standard
- Understand the process approach to managing an organization
- Understand how the requirements can be interpreted and implemented in various industries
- Master the auditing techniques per ISO 19011, which are used for quality, environmental, and safety management system audits
- Learn how to prepare and lead an audit
- Be exposed to real auditing case studies covering many industries

Major topics include:

- General Requirements of ISO 9001
- Management Responsibility
- Resource Management
- Product Realization
- Measurement, Analysis and Improvement
- General Requirements of ISO 19011
- Auditing techniques
- QMS Auditing Case Studies

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to conduct an ISO 9001:2008 audit
- Want to quickly and efficiently be trained on ISO 9001 (the standard), and ISO 9000 (the vocabulary for the standard)
- Want to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in quality assurance and leading 1st part audits
- Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2002

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes

2.2 CEUs

ISO 9001 Business Strategy – CALISO Online Course

I.D.#BSI

This is the ideal course for the CEO, Executive, other senior management team member, or corporate development department (strategy) staff who must design the vision for the company and chart the course and strategy for the management team to follow. This course was designed by expert partner-level management consultants with an average 15-years of experience with the top tier global strategic management consulting firms as consultants to Fortune 500 companies and financial institutions.

Major topics include:

- Vision, what does it do and how important is it?
- Selecting market segments where the company will compete
- Understanding market segments and capturing with tactical strategy and brand
- Figuring out the capabilities the company needs to have to win
- Enabling the needed set of capabilities at your company
- Performance metrics and aligning the firm to successfully execute the strategy

This SAE/CALISO course is for you if you:

- Are an employee or manager and want to quickly and efficiently become familiar with business strategy for implementation
- Want to understand Business Strategy in order to knowledgably assess and contract Business Strategy services from a management consulting firm
- Want to improve your CV and career opportunities with Business Strategy knowledge and qualifications
- Are interested in learning world-class best practice methodology which will help increase your value to your company and help you think strategically
- Need to develop a competitive strategy for your company
- If the vision and strategy for your company is unclear or possibly in need of further enhancement

- Are uncertain that you have the correct organization design, processes, technology, and performance metrics needed to successfully execute the company's business strategy
- Are restructuring or implementing quality programs but, so far, have not seen desired results
- Noticed that legacy processes, policies, and organization structures at your company don't change although they seem inadequate, out of date, or inconsistent with the business strategy

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	1.2 CEUs

ISO 14001:2004 Training – CALISO Online Course

8 Hours
I.D.#ISO14001

ISO 14001 is an environmental management standard (EMS) developed by the International Organization for Standardization (ISO). The ISO 14001 standard is generic and can be used for any organization, whether it provides physical products or services. The requirements must be carefully interpreted to make sense within a particular organization. Developing automotive products and the environmental impact of this activity is not like producing food products or offering consulting services; yet the ISO 14001 standard, because it is business and management oriented can be applied to any activity. It is the most widely used EMS standard in the world.

Your company and all who partake in the daily activities of running the business will benefit from taking ISO 14001 training. This eight-hour ISO 14001 (.8 CEU) overview is particularly adapted for all members of the organization.

Learning Objectives

By participating in this online course, you will be able to:

- Understand the high specific requirements and intent of this international standard
- Understand the process approach to managing an organization
- Understand how the requirements can be interpreted and should be implemented within an organization

Major topics include:

- General Requirements of ISO 14001
- ISO 14001 Vocabulary
- Environmental Policy
- Planning
- Implementation and Operation
- Checking
- Management Review

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently get a comprehensive training of ISO 14001:2004
- Want to improve your CV and career opportunities with qualifications in EMS
- Do NOT have time to allocate two full days to take an environmental management class
- Want to train more of your staff on auditing economically and without having to immobilize them in a class for a full day

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

ISO 14001:2004 Auditor Training – CALISO Online Course

8 Hours
I.D.#ISO14001AUDITOR

ISO 14001 is an environmental management standard (EMS) developed by the International Organization for Standardization (ISO). The ISO 14001 standard is generic and can be used for any organization, whether it provides physical products or services. The requirements must be carefully interpreted to make sense within a particular organization. Developing automotive products and the environmental impact of this activity is not like producing food products or offering consulting services; yet the ISO 14001 standard, because it is business and management oriented can be applied to any activity. It is the most widely used EMS standard in the world. Your company and all who partake in the daily activities of running the business will benefit from taking ISO 14001 training. This eight-hour (.8 CEU) ISO 14001 Auditor course provides training on the standards and how to conduct internal audiets and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

Learning Objectives:

By participating in this online course, you will be able to:

- Master the auditing techniques per ISO 19011,

which are used for quality, environmental, and safety management system audits
- Learn how to prepare and conduct an audit
- Be exposed to real auditing case studies covering many industries

Major topics include:

- General Requirements of ISO 19011
- Auditing Techniques
- EMS Auditing Case Studies

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to lead an ISO 14001:2004 audit
- Want to quickly and efficiently be trained on ISO 14001 (the standard) and ISO 14000 (the vocabulary for the standard)
- Want to be a lead auditor to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in EMS and leading first part and second party audits
- Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2002
- Do NOT have time to allocate two full days to take an ISO 14001 auditor class
- Want to train more of your staff on auditing economically and without having to immobilize them in a class for a full day

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

ISO 14001:2004 Lead Auditor – CALISO Online Course

22 Hours
I.D.#ISO14001LEADAUDITOR

As described in the previous ISO 14001 course description, ISO 14001 is an environmental management standard (EMS) developed by the International Organization for Standardization (ISO). Your company and all who partake in planning, leading and conducting the EMS audit activities of your business and managing its environmental program will benefit from taking ISO 14001 training. The 22-hour (2.2 CEU) ISO 14001 Lead Auditor course is the most comprehensive training on the subject. It provides training on the standard itself but also on how to lead or conduct internal audits and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

Learning Objectives:

By participating in this online course, you will be able to:

- Master the auditing techniques per ISO 19011, which are used for quality, environmental, and safety management system audits
- Learn how to prepare and conduct an audit
- Be exposed to real auditing case studies covering many industries

Major topics include:

- General Requirements of ISO 14001
- ISO 14001 Vocabulary
- Environmental Policy
- Planning
- Implementation and Operation
- Checking
- Management Review
- General Requirements of ISO 19011
- Auditing Techniques
- EMS Auditing Case Studies

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to lead an ISO 14001:2004 audit
- Want to quickly and efficiently be trained on ISO 14001 (the standard), and ISO 14000 (the vocabulary for the standard)
- Want to be a lead auditor to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in EMS and leading first part and second party audits
- Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2002

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	2.2 CEUs

ISO /TS 16949:2009 Training – CALISO Online Course

8 Hours
I.D.# ISO 16949

The ISO/TS16949 is an ISO technical specification for the automotive industry aiming to the development of a

quality management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the supply chain. The requirements must be carefully interpreted to make sense within a particular organization.

Your company and all who partake in the daily activities of running the business will benefit from taking ISO/TS 16949 training. This eight-hour ISO/TS 16949 (.8 CEU) overview is particularly adapted for training all levels of an organization on the requirements of this standard.

Learning Objectives:

By participating in this online course, you will be able to:

- Understand the high specific requirements and intent of this international standard
- Understand the process approach to managing an organization
- Understand requirement for automotive supply chain management
- Understand how the requirements can be interpreted and should be implemented within an organization

Major topics include:

- General Requirements of ISO 16949
- ISO 16949 Vocabulary
- Management Responsibility
- Resource Management
- Product Realization
- Measurement, Analysis and Improvement

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently get a comprehensive training of ISO 16949:2009
- Want to improve your CV and career opportunities with qualifications in quality assurance
- Want to upgrade your expertise from QS 9000 to ISO 16949:2009

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

ISO /TS 16949:2009 Auditor Training – CALISO Online Course

8 Hours
I.D.# ISO16949AUDITOR

The ISO/TS16949 is an ISO technical specification for the automotive industry aiming to the development of a quality management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the supply chain. The requirements must be carefully interpreted to make sense within a particular organization.

Your company and all who partake in the QMS and supplier audit activities will benefit from taking ISO/TS 16949 training. The eight-hour (.8 CEU) ISO/TS 16949 Auditor course is the most comprehensive training on the subject. It provides training on the standard itself but also on how to lead or conduct internal audits and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

Learning Objectives:

By participating in this online course, you will be able to:

- Master the auditing techniques per ISO 19011, which are used for quality, environmental, and safety management system audits
- Learn how to prepare and conduct an audit
- Be exposed to real auditing case studies covering many industries

Major topics include:

- General Requirements of ISO 19011
- Auditing techniques
- QMS Automotive Auditing Case Studies

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to lead an ISO/TS 16949:2009 audit
- Want to quickly and efficiently be trained on ISO/TS 16949 (the standard), and ISO 9000 (the vocabulary for the standard)
- Want to be a lead auditor to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in quality assurance and leading 1st part audits
- Want to upgrade your expertise from auditing QS 9000 to ISO/TS 16949:2009
- Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2002

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

ISO /TS 16949:2009 Lead Auditor Training – CALISO Online Course

22 Hours
I.D.# TS16949LEADAUDITOR

The ISO/TS16949 is an ISO technical specification which forms the requirements or application of ISO 9001 for automotive production and relevant service part organizations. It is essentially ISO 9001 with additional automotive specific requirements and is require by most major automotive manufacturers. Once your company implements processes and procedures that comply with the requirements listed in ISO/TS 16949, you can be audited by a third party organization called a Registrar, which will certify your organization to this standard.

This lead auditor course provides management representatives, QA managers or supervisors and others not only the information needed to conduct an audit for ISO/TS 16949, but also to organize, implement and lead it. All audit teams need a leader, and the body of knowledge of this course covers all of the lead auditing aspects.

Learning Objectives:

By participating in this online course, you will be able to:

- Discuss the specific requirements and intent of the TS 16949 specification
- Describe how the requirements should be interpreted and implemented within an organization
- Apply what you learn to conduct internal audits and supplier audits for your company
- Upgrade your expertise from auditing QS9000 to ISO/TS 16949
- Upgrade your expertise from auditing with ISO 19011:2002 to ISO 19011:2011

Major topics include:

- Statistical Process Control (SPC)
- APQP/CP: Advanced Product Quality Planning and Control Plans
- PPAP: Product Part Approval Process
- FMEA: Failure Mode and Effects Analysis
- MSA: Measurement Systems Analysis

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to lead an ISO/TS 16949:2009 audit
- Want to quickly and efficiently be trained on the TS 16949 specification
- Want to be a lead auditor to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in quality assurance and leading 1st part audits
- Want to upgrade your expertise from auditing with ISO 19011:2002 to ISO 19011:2011

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	2.2 CEUs

ISO 19011:2011 Auditor Training – CALISO Online Course

4 Hours
I.D.#ISO 19

ISO 19011 is a guideline developed by the International Organization for Standardization (ISO). The ISO 19011 standard is generic and can be used for auditing any type of management standard: quality, environmental, heath and safety and others. Your company and all who partake in the daily activities of running the business will benefit from taking ISO 19011 training for its auditing activities. The four-hour (.4 CEU) ISO 19011 course is the most comprehensive training on the subject. It provides training on the standard itself but also on how to lead or conduct internal audits and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

Learning Objectives:

By participating in this online course, you will be able to:

- Master the auditing techniques per ISO 19011, which are used for quality, environmental, and safety management system audits
- Learn how to prepare and conduct an audit
- Be exposed to real auditing case studies covering many industries

Major topics include:

- General Requirements of ISO 19011
- Auditing techniques
- Auditing Case Studies

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently learn how to audit management systems
- Want to be a lead auditor to conduct internal audits and supplier audits for your company
- Want to improve your CV and career opportunities with qualifications in quality assurance and leading 1st part audits
- Want to upgrade your expertise from auditing with

ISO 10011-1 to ISO 19011:2002

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

0.4 CEUs

Sarbanes-Oxley (SO X) Training – CALISO Online Course

4 Hours
I.D.#SOX

This is the ideal course for employees or managers who want to get a comprehensive training on Sarbanes-Oxley (SOX) compliance requirements, practical applications, and how ISO 9001 business management methodologies can be used, applied and combined to implement Sarbanes-Oxley. This is the ideal course for individuals who you want improve their résumé and career opportunities in SOX, by adding this course to the education or training section of your CV.

Learning Objectives:

By participating in this online course, you will be able to:

- Understand origin and intent of Sarbanes-Oxley
- Understand how Sarbanes-Oxley can be interpreted and practically implemented in various industries and sizes of companies
- Learn to recognize warning signs of potential or committed Sarbanes-Oxley non compliances
- Implement suitable systems, checks and balances to detect suspicious financial activities and non compliances
- Be aware of the legal, criminal and financial penalties of Sarbanes-Oxley non compliance
- What to do when Sarbanes-Oxley non compliance is discovered

Major topics include:

- Sarbanes-Oxley, what is it?
- Sarbanes-Oxley (SOX) Certification Requirements
- Sarbanes-Oxley Section 302 - a big concern; Section 906 - the biggest concern
- What's a CEO to do? How to most easily implement SOX without the CEO having to do everything?
- Minimal levels of SOX compliance, Risk Analysis
- How to avoid defrauding of the auditors by the business
- Whistle blower program
- What to do if something is already wrong (non-compliance)?
- Top steps to Sarbanes-Oxley compliance

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently become familiar with Sarbanes-Oxley to understand, implement Sarbanes-Oxley compliance as an employee or a manager
- Want to understand Sarbanes-Oxley compliance in order to knowledgably assess and contract Sarbanes-Oxley services
- Want to improve your CV and career opportunities with Sarbanes-Oxley knowledge and qualifications
- Want to protect your company from financial fraud and related legal, criminal and financial liability

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

0.4 CEUs

Six Sigma Overview – CALISO Online Course

8 Hours
I.D.#SIGMA

Six-Sigma is a systematic way to improve a product, process and/ or service. This is the ideal course for employees or managers who want to get a basic training on Six-Sigma concepts, methodology and techniques.

Six-Sigma methodology can be used for any size organization, whether it provides physical products (i.e. hardware or software) or services. Developing and maintaining profitable products and services require continuous improvement in numerous key areas such as quality, performance and efficiency. Six-Sigma techniques can help any company achieve these goals.

This is the ideal course for individuals who you want improve their résumé and career opportunities in Six-Sigma, by adding this industry- wide recognized course to the education or training section of your CV.

The course covers Six-Sigma process improvement techniques; it is a stepping stone for Six Sigma Green and Black-belt certifications.

Learning Objectives:

By participating in this online course, you will be able to:

- Understand Six-Sigma concepts

MANAGING PRODUCT DEVELOPMENT/QUALITY ASSURANCE

- Understand how Six-Sigma techniques can be interpreted and implemented in various industries and situations
- Learn and apply key Six-Sigma metrics and analysis
- Be exposed to real case studies that can be applied to many similar circumstances

Major topics include:

- Six-Sigma, what is it?
- Six-Sigma, why use it?
- International quality standards and Six-Sigma
- Six-Sigma Core Concepts, How to use Six-Sigma
- Six-Sigma application example and Case Study "JFS"
- Another Case Study "BBB"
- Top steps to Six-Sigma
- Sigma Table, Spread Sheet Tips

This SAE/CALISO course is for you if you:

- Want to quickly and efficiently become familiar with Six-Sigma to understand and launch Six-Sigma projects as an employee or a manager
- Want to improve your CV and career opportunities with Six-Sigma knowledge and qualifications
- Want to systematically improve the profitability and customer satisfaction of your product or service by improving numerous key areas such as quality, performance and efficiency

This is an internet-delivered course featuring graphical presentation screens with text-based instruction, videos, and on-going quizzes to reinforce learning and retention and gauge your understanding of a topic before you move forward. An online training certificate will be issued upon successful completion of the course and obtaining 70% or above on the final average of the ongoing quizzes.

	0.8 CEUs

CATALOG KEY

You will see the following icons alongside the course descriptions. These icons indicate:

- delivery formats available for the course
- the course is part of an SAE certificate
- that it is an ACTAR approved course

Live, online – indicates the course is an instructor-led web seminar offered live and online via telephone and internet connection

Online, on demand – indicates the course is available online anytime the participant would like to access the course through the internet

Certificate – indicates the course is part of an SAE International curriculum-based, multi-course certificate. See a list of the multi-course certificates on page VII

ACTAR logo – indicates the course is an ACTAR approved course. For more information on ACTAR and ACTAR accredited courses, see page VI

MATERIALS AND MANUFACTURING

Includes manufacturing, parts and components, and assembly; as well as materials including plastics, alloys, and metals.

MATERIALS

Laminated Glass: Design Considerations for Vehicle Door Systems Fast Track

I.D.# PD130810ON
Access Period: 3 Months
Duration: 40 Minutes

The benefits of laminated glass for automobiles are being recognized at both the manufacturer and consumer levels, resulting in an increasing number of vehicles adopting this technology. This evolution in glass technology creates both opportunities and challenges, which must be understood by today's automotive designers and engineers for successful implementation. Because laminated glass has different structural properties than tempered glass, this 40 minute presentation will provide an overview of best practices for integration of the product into vehicle door systems based upon extensive testing and field experience.

The growing demand for the benefits provided by laminated glass means that members of the automotive industry must understand the product and how to incorporate it into vehicles. The information in this short course is intended to provide sufficient information to understand both the benefits and challenges associated with the adoption of laminated glass in vehicles.

Learning Objectives

By participating in this Fast Track short course, you will be able to:

- Identify the factors which led to the evolution of vehicle glazing
- Explain the benefits associated with the adoption of laminated glass in automobiles
- Describe the challenges associated with the adoption of laminated glass in automobiles
- Manage activitiy related to design validation, purchasing and marketing of laminated door glass
- Assess door systems relative to industry best practices for laminated glass
- Evaluate door systems for potential of glazing failure due to static and dynamic stresses

Who Should Attend:

This course was developed for engineers and those in the automobile supply chain involved in all disciplines related to the design or development of glass. The course is designed to give a technology overview that is relevant to those who simply want an introduction to laminated glass, while providing sufficient technical detail on best practices to benefit seasoned glazing engineers.

Major topics include:

- Overview of Laminated Glazing
- Laminated Glazing Selection Criteria
- Automotive Glass Strength Characterization
- Static Stresses and Door Design Considerations
- Dynamic Stresses from Door Slam
- Laminated Glass Performance and Analysis Techniques
- Summary of Laminated Glazing Benefits

What You Will Receive:

- Three months of online single-user access (from date of purchase) to the 40 minute presentation
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Instructors:	Peter Dishart and Dewitt W. Lampman
	0.4 CEUs

METALLURGY

Principles of Metallurgy

I.D.# PD261322ON
Access Period: 90 days
Duration: 4 Hours

This online course teaches the basic microscopic structures present inside of metals, how these structures and metal composition influence metal strength, and how these structures can be modified using common manufacturing processes to obtain specific mechanical properties. Several examples are presented to demonstrate how common alloying and manufacturing methods are used to modify the microscopic structures and properties of metals. It includes twelve modules that are five to 25 minutes in length, followed by a quiz.

Learning Objectives

By participating in this online course, you will be able to:

- Explain the relationship between a metal's properties and its composition, microscopic structure, and the manufacturing processes used to fabricate the metal
- Describe three types of microscopic structures present in metals
- Explain how cold working, alloying, and heat treating are used to strengthen a metal
- Explain the microstructure and property changes that occur in cold worked metals during annealing, in steels during through hardening, and during precipitation strengthening heat treatments
- Relate the heat treatment time and temperature to the microscopic structures and properties of through hardened steels, cold-worked metals, and precipitation strengthened alloys

Who Should Attend:

This course is targeted towards design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds.

Major topics include:

- Composition
- Microscopic structures
- Crystal defects
- Diffusion
- Cold Working
- Annealing
- Solid Solution strengthening
- Precipitation Strengthening Heat Treatment
- Steel and Steel Heat Treating

What You Will Receive:

- Three months (from date of purchase) of online access to the four hour presentation
- Course handbook (downloadable, .pdf's)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Corrosion of Metals

I.D.# PD261328ON
Access Period: 90 days
Duration: 5 Hours

This online course teaches about corrosion of metals. The physics of corrosion is explored as a background for the discussion of seven common types of corrosion (uniform, galvanic, crevice, pitting, intergranular, stress corrosion cracking, and dealloying). Students will learn why and how corrosion occurs and methods for controlling corrosion. It includes eleven modules followed by a quiz.

Learning Objectives

By participating in this online course, you will be able to:

- List the four parts of a corrosion cell
- Explain the anode and cathode reactions that occur in a corrosion cell
- Describe the seven common types of corrosion that occur in metals
- List at least one significant metallurgical or mechanical design factor that influences corrosion rate for each of type of corrosion
- Distinguish between different types of corrosion by appearance
- Explain the mechanism for the different types of corrosion
- Identify at least one method for controlling the corrosion rate for each of the seven types of corrosion

Who Should Attend:

This course is targeted to design engineers, manufacturing engineers, and quality engineers. It is suggested that, as a prerequisite, you either take our Principles of Metallurgy online course or have basic knowledge of the following topics: grains, grain boundaries, crystal lattice, substitutional solid solution, diffusion, phases, precipitation, precipitation hardening, microstructure, tensile testing.

Major topics include:

- Introduction to electrochemical corrosion

- Aqueous corrosion
- Uniform corrosion
- Galvanic corrosion
- Crevice corrosion
- Pitting corrosion
- Intergranular corrosion
- Stress corrosion cracking
- Dealloying
- Course review

What You Will Receive:

- Three months of online access (from date of purchase) to the five hour presentation
- Course handbook (downloadable, .pdf's)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Corrosion of Metals: Chemistry of Corrosion

I.D.# PD261334ON
Access Period: 90 days
Duration: 1 Hours

This online course covers the fundamental mechanisms involved in the aqueous (water based chemicals) corrosion of metals. The factors that influence the inherent corrosion behavior of a metal and the factors that influence metal corrosion rate will be discussed. The course takes one hour to complete.

Learning Objectives

By participating in this online course, you will be able to:

- Describe the three possible behaviors of a metal in an aqueous (water based) solution
- List the four requirements of an corrosion cell
- Describe the anode and cathode reactions that occur in a corrosion cell
- Describe the three forms of anode and cathode electrical contact
- Explain the relationship between corrosion rate, corrosion current, and corrosion current density.
- Explain the difference between noble and active behavior
- Explain the effects of an external voltage and contact with another metal on the corrosion rate of a metal
- Explain five factors that influence corrosion rate
- Describe four factors that influence the corrosion performance of a metal component

Who Should Attend:

This course is targeted to design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds. It is suggested that, as a prerequisite, you should be familiar with chemistry concepts such as ions, electrons, and chemical reactions.

Major topics include:

- Parts of an electrochemical corrosion cell
- Corrosion reactions
- Factors that influence the corrosion behavior of a metal
- Factors that influence the corrosion rate of a metal

What You Will Receive:

- Three months (from date of purchase) of online access to the one hour presentation
- Course handbook (.pdf, dowloadable)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Corrosion of Metals: Galvanic Corrosion

I.D.# PD261336ON
Access Period: 90 days
Duration: 60 Minutes

This online course teaches why and how galvanic corrosion occurs and methods for controlling galvanic corrosion. The course content can be completed in one hour.

Learning Objectives:

By participating in this online course, you will be able to:

- Describe the three essential components of a galvanic cell
- Explain the driving force for galvanic corrosion
- Describe four factors that influence galvanic corrosion rate
- Select compatible metals from a galvanic series
- Describe four methods to control galvanic corrosion

Who Should Attend:

This course is targeted to design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds. It is suggested that, as a prerequisite, you have knowledge of the concepts covered in our Corrosion of Metals: Chemistry of Corrosion online course.

Major topics include:

- Galvanic corrosion cell components
- Factors that influence galvanic corrosion rate
- Galvanic series and its use
- Methods to control galvanic corrosion

What You Will Receive:

- Three months (from date of purchase) of online access to the one hour presentation
- Course handbook (.pdf, dowloadable)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Corrosion of Metals: Uniform Corrosion

I.D.# PD261335ON
Access Period: 90 days
Duration: 60 Minutes

This online course teaches about uniform corrosion of metals. Participants will learn why and how uniform corrosion occurs and methods for controlling it. References of textbooks and handbooks for more information are also provided. The course content can be completed in one hour.

Learning Objectives:

By participating in this online course, you will be able to:

- Describe the appearance of uniform corrosion
- Explain the uniform corrosion mechanism
- Explain two metallurgical factors that influence uniform corrosion
- Describe four methods to control uniform corrosion
- Calculate design dimensions for components made of metals with known uniform corrosion rates

Who Should Attend:

This course is targeted to design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds. It is suggested that, as a prerequisite, you have knowledge of the concepts covered in our Corrosion of Metals: Chemistry of Corrosion online course.

Major topics include:

- Uniform corrosion mechanism
- Why uniform corrosion occurs
- Appearance of uniform corrosion
- Methods for controlling uniform corrosion

What You Will Receive:

- Three months (from date of purchase) of online access to the one hour presentation
- Course handbook (.pdf, dowloadable)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Hardness Testing

I.D.# PD261331ON
Access Period: 90 days
Duration: 30 Minutes

This online course focuses on Rockwell and Brinell hardness testing and Vickers and Knoop microhardness testing. Participants will learn about how the tests are performed, test sample requirements, test parameter selection, and testing requirements. The course can be completed in 30 minutes.

Learning Objectives

By participating in this online course, you will be able to:

- Explain how Brinell and Rockwell hardness tests are performed
- Explain how Vickers and Knoop microhardness tests are performed
- Explain the sample and testing requirements for Brinell and Rockwell hardness and Knoop and Vickers microhardness tests
- Describe the effects of test load and indenter size on indentation depth and size

Who Should Attend:

This online course is targeted to design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds. It is suggested that, as a prerequisite, you have knowledge of the concepts covered in our Corrosion of Metals: Chemistry of Corrosion online course.

Major topics include:

- Rockwell hardness testing
- Brinell hardness testing
- Knoop and Vickers microhardness sample preparation and testing

What You Will Receive:

- Three months (from date of purchase) of online access to the thirty minute presentation
- Course handbook (.pdf, dowloadable)

- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Metallurgy of Precipitation Strengthening

I.D.# PD261329ON
Access Period: 90 days
Duration: 2 Hours

This online course teaches about the microscopic changes that take place in a precipitation strengthened alloy and their effects on the properties of the alloy. The effects of the different heat treating steps (solution treatment, quench, and aging) and heat treating process parameters (solution treatment temperature and time, quench rate, and aging temperature and time) on the alloy microstructure and the effects on alloy strength are discussed. The course is divided into five modules followed by a quiz.

Learning Objectives

By participating in this online course, you will be able to:

- Describe the process steps for precipitation strengthening an alloy
- List alloys that are precipitation strengthened
- Explain why precipitation strengthens an alloy
- Describe the microstructure and property changes that occur during the precipitation strengthening heat treatment process steps
- List the critical process parameters for solution treatment, quenching, and aging
- Relate the critical process parameters to alloy microstructure and the properties of precipitation strengthened alloys
- List the tests used to evaluate whether a precipitation strengthened alloy has been properly heat treated

Who Should Attend:

This course is targeted to design, manufacturing, and quality engineers. It is suggested that, as a prerequisite, you have knowledge of the concepts covered in our Principles of Metallurgy online course.

Major topics include:

- Introduction
- Phase diagrams
- Precipitation strengthening heat treatment
- Heat treatment details
- Quality control and course review

What You Will Receive:

- Three months of online access (from date of purchase) to the two hour presentation
- Course handbook (downloadable, .pdf's)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Metallurgy of Steel Case Hardening

I.D.# PD261333ON
Access Period: 90 days
Duration: 60 Minutes

This online course discusses common steel case hardening processes and how they are used to modify the surface layers of steels to obtain specific mechanical properties. Participants will learn about the process parameters and how they affect case composition, depth, microstructure, and properties. The course takes one hour to complete.

Learning Objectives

By participating in this online course, you will be able to:

- Describe the thermal cycles and significant process variables for six common case hardening processes
- Explain the case microstructures that result from the six common case hardening processes
- Describe the effects of case hardening process parameters on case depth, microstructure, and hardness of case hardened steel
- Explain two ways to measure case depth of carburized steel
- List common problems encountered with case hardening processes and how to prevent these problems

Who Should Attend:

This course is targeted to design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds. It is suggested that, as a prerequisite, you have knowledge of the concepts covered in our Principles of Metallurgy and Metallurgy of Steel: Principles or knowledge of the concepts covered in those courses.

Major topics include:

- Carburizing
- Carbonitriding
- Nitriding
- Nitrocarburizing
- Flame hardening

- Induction hardening

What You Will Receive:

- Three months (from date of purchase) of online access to the one hour presentation
- Course handbook (.pdf, dowloadable)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Metallurgy of Steel Heat Treating

I.D.# PD261327ON
Access Period: 90 days
Duration: 5 Hours

This online course teaches about common heat treating processes and how they are used to modify the microstructure of steels to obtain specific mechanical properties. You will learn about the metallurgy of steel, the effects of heat treating temperature and cooling rate on microstructure properties, and the effects of the interaction between heat treating process parameters and steel composition on steel microstructure and strength. It includes eleven modules followed by a quiz.

Learning Objectives

By participating in this online course, you will be able to:

- Describe the common metallurgical phases and microstructures found in steels
- Explain how the iron-carbon phase diagram and time-temperature-transformation diagrams are used to predict the phases present in a steel, based on a heat treating thermal cycle
- Describe the thermal cycles and significant process variables for annealing, normalizing, through hardening, tempering, case hardening, and surface hardening processes
- Relate the interactions between heat treating temperature, heat treating time, cooling rate, and composition on a steel's microstructure and properties
- Explain the effects of heating temperature and time on steel microstructure and properties and the effects of cooling rate on steel microstructure and properties
- Explain the difference between maximum hardness and hardenability
- Describe two factors that influence steel hardenability
- Explain common problems encountered with through hardening, case hardening, and surface hardening processes and how to prevent these problems
- Describe the effects of case hardening process parameters on case depth, microstructure, and hardness of case hardened steel
- Explain two ways to measure case depth

Who Should Attend:

This course is targeted to design engineers, manufacturing engineers, quality engineers, and sourcing specialists. It is suggested that, as a prerequisite, you either take our Principles of Metallurgy online course or have basic knowledge of the following topics: solid solution, substitution, interstitial, diffusion, effects of process temperature and time on diffusion and metallurgical changes, metallurgical phase, grain, grain boundary, precipitates and precipitation, tensile testing, and hardness testing.

Major topics include:

- Introduction
- Metallurgy of Steel
- Steel Phase Diagram
- Phase Transformations in Steel
- Annealing and Normalizing
- Through Hardening
- Case Hardening

What You Will Receive:

- Three months (from date of purchase) of online access to the five hour presentation
- Course handbook (downloadable, .pdf's)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Metallurgy of Steel Through Hardening

I.D.# PD261330ON
Access Period: 90 days
Duration: 60 Minutes

This online course teaches about the metallurgy of the following steel through hardening processes: quench and temper, martempering, and austempering. Participants will learn about the effects of heat treating temperature and cooling rate on steel microstructure and properties, and the effects of the interaction between heat treating process parameters and steel composition on through hardened steel microstructure and strength. This course takes one hour to complete.

Learning Objectives

By participating in this online course, you will be able to:

- Describe the heat treatment processes used for through hardening
- List the significant process variables for through hardening
- Describe the effects on steel microstructure and properties of the significant through hardening and tempering process variables
- Explain the difference between maximum hardness and hardenability
- Read a hardenability curve
- Relate hardenability to through hardened steel microstructure and hardness
- Explain three common problems encountered with quenching and how to prevent these problems

Who Should Attend:

This course is targeted to design, manufacturing, and quality engineers, and sales people and purchasing agents with technical backgrounds. It is suggested that, as a prerequisite, you have knowledge of the concepts covered in our Principles of Metallurgy online course.

Major topics include:

- Quench and temper
- Steel hardenability
- Common problems associated with quenching (distortion, cracking, retained austenite)
- Martempering
- Austempering

What You Will Receive:

- Three months (from date of purchase) of online access to the one hour presentation
- Course handbook (downloadable, .pdf's)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Metallurgy of Steel: Principles

I.D.# PD261326ON
Access Period: 90 days
Duration: 3 Hours

This online course teaches the phases and microstructures that form in steels, their effects on steel properties, the microstructure changes that occur when steel is heated and cooled, the effects of carbon content and cooling rate on the microstructures that form. Also, how to read the iron-carbon phase diagram will be discussed. All this information is applicable to understanding the effects of steel heat treating processes and heat treating process parameters on the microstructure and properties of heat treated plain carbon, low-alloy, and tools steels. The course is divided into six modules followed by a quiz.

Learning Objectives

By participating in this online course, you will be able to:

- Explain the designation systems used for steel alloys
- Identify the alloying elements and carbon content in carbon and low-alloy steels based on their alloy designations
- Describe the common metallurgical phases and microstructures found in steels
- Identify six phase fields on an iron-carbon phase diagram
- Explain the effects of the different microstructures that form in steel on steel strength and hardness
- Explain the metallurgical changes that occur inside steel during heat and cooling
- Explain how the iron-carbon phase diagram and time-temperature-transformation diagrams are used to predict the phases present in a steel based on a heat treating thermal cycle
- Relate the interactions between heat treating temperature, heat treating time, cooling rate, and steel composition on a steel's microstructure and properties

Who Should Attend:

This online course is targeted to design, manufacturing, and quality engineers, and sourcing specialists. It is suggested that, as a prerequisite, you have basic knowledge of solid solution, substitutions, interstitials, diffusion, effects of process temperature and time on diffusion and metallurgical changes, metallurgical phases, grains, grain boundaries, dislocations or the concepts covered in our Principles of Metallurgy online course.

Major topics include:

- Steel types and designations
- Metallurgical phases that form in steel and their effects on properties
- Steel phase diagram
- Metallurgical changes in carbon steel during cooling
- Metallurgical changes in carbon steel during heating
- Course Review

What You Will Receive:

- Three months (from date of purchase) of online access to the two hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, dowloadable)
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

Tensile Testing

I.D.# PD261308ON
Access Period: 90 Days
Duration: 25 Minutes

This online course teaches about tensile testing of metals with a focus on how the testing is performed and tensile properties are measured. It includes one module followed by a quiz.

Learning Objectives

By participating in this online course, you will be able to:

- Explain how tensile tests are performed
- Describe the types of samples that can be tested
- Explain how the test data is analyzed to determine elastic modulus, yield strength, tensile strength, and elongation
- List common tensile test standards that describe tensile specimen preparation, test procedure, and data analysis

Who Should Attend:

This course is targeted towards design, manufacturing, supplier quality and quality control engineers, sales people and purchasing agents with technical backgrounds.

Major topics include:

- How a tensile test is performed
- Tensile specimen shape
- Calculation of stress and strain
- Stress and strain curve
- How to determine elastic modulus, yield strength, tensile strength, and elongation from a stress-strain curve

What You Will Receive:

- Three months (from date of purchase) of online access to the 25-minute presentation
- Course handbook (downloadable, .pdf's)
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Author:	Industrial Metallurgists, LLC

SAE MULTI-COURSE CERTIFICATE PROGRAMS

Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate.

Intended to provide a guide towards deeper knowledge in a specific area, SAE's multi-course certificates outline required courses that offer foundational knowledge of the subject. Some certificate programs also feature additional electives designed to broaden your exposure to more specific aspects of the technology studied. PLUS—completion of many of the multi-course certificate programs equates to graduate credits towards the SAE/Kettering University 20-credit *Certificate in Automotive Systems* and Kettering's 40-credit M.S in Mechanical Engineering. Visit training.sae.org/college-credit for more information.

SAE offers these multi-course certificate programs:

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- Diesel Technology
- SI Engine
- Vehicle Dynamics
- Product Engineering Tools and Methods

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NOISE, VIBRATION AND HARSHNESS

Includes acoustics, engine noise control, sound package materials, vibration, and harshness.

Acoustic Fundamentals for Solving Noise and Vibration Problems Web Seminar & Web Seminar RePlay

Webniar I.D.# WB1309
RePlay I.D.# PD331309ON
Replay Access Period: 30 days
Duration: 6 Hours

This web seminar replay will provide an introduction to the characteristics of sound waves, human perception of sound, sound and vibration measurements, measurement facilities, and various noise sources and noise control principles. It will include an overview of sound pressure, power, intensity, decibels, and frequencies. Practical examples will be used to familiarize participants with the acoustic fundamentals for solving noise and vibration problems and the associated solution principles.

Learning Objectives

By participating in this web seminar replay, you will be able to:

- Discuss the differences of various acoustic terminologies that are important to solve noise and vibration problems
- Define a relationship between sound pressure, sound power, and sound intensity
- Associate decibel to both sound and vibration
- Prepare effective acoustic specifications encompassing all variables that affect noise and vibration
- Select correct instrumentation for noise and vibration measurements recognizing the challenges of measurements
- Define the source-path-receiver relationship
- Determine the steps of noise and vibration source identification process for a given application
- Employ different noise control options to address specific noise and vibration issues

Who Should Attend:

This fundamental web seminar will be especially valuable for technical staff, engineers, and managers with limited experience in noise and vibration. It is designed to be suitable for all areas of the mobility industry. An Associate degree in the field of science or technology is recommended; BS degree is preferred.

Major topics include:

Session 1

- Introduction
  - Waves
  - Pressure, power, intensity
  - Frequency
  - Human perception of sound
- Decibels
  - What is decibel
  - Addition and subtraction of decibels
  - Background noise
  - Linear averaging/spatial averaging
- Frequency
  - Frequency Analysis
  - Linear and logarithmic frequency
  - Filters

Session 2

- Human Perception of Sound
  - Equal Loudness contours
  - Frequency weighting of sound
  - Loudness, loudness level, articulation index
- Instrumentation and Facilities
  - Transducers
  - Spectrum analyzers
  - Anechoic/hemi-anechoic room
  - Reverberation room
  - Sound power measurements
  - Source-path-receiver relationship

Session 3

- Various Noise Sources

  - Product noise
  - Community Noise
  - Industrial noise
  - Vehicle noise
  - Aircraft noise
- Noise Control Principles
  - Sound package materials
  - Absorber, barrier, damper, isolator
  - Mufflers, resonators
  - Active and passive noise control

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the three session, approximately six hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- .6 CEUs* (with satisfactory assessment score)

Instructor:	Pranab Saha
	0.6 CEUs

Diesel Engine Noise Control Web Seminar and Web Seminar RePlay

Webniar I.D.# WB1041
RePlay I.D.# PD331041ON
Replay Access Period: 30 days
Duration: 4 Hours

This web seminar provides an in-depth overview of diesel engine noise including combustion and mechanical noise sources. In addition, the instructor will discuss a system approach to automotive integration including combining sub-systems and components to achieve overall vehicle noise and vibration goals.

Learning Objectives

By participating in this web seminar replay, you will be able to:

- Identify and analyze commonly occurring diesel engine noise sources
- Understand how analytical and experimental techniques can be used to solve diesel noise issues
- Prescribe appropriate noise control analysis and solutions for specific diesel engine NVH issues

Who Should Attend:

This course is ideal for those want to understand the root causes of many diesel engine noise issues, and how to use this understanding to better diagnose and control diesel engine-related noises.

Those intending to take this web seminar should have at least a bachelor's degree in engineering, or equivalent, and be familiar with basic engineering mechanics and vibrations.

Major topics include:

Session 1

- The Basics of Diesel Engine Noise
- Combustion Noise Forcing Functions
- Combustion Mode Switching
- Mechanical Forcing Functions in Diesels
- Separating Combustion and Mechanical Noise Sources
- Strategies for Reducing Forcing Functions

Session 2

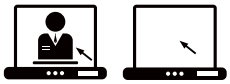
- Surface Radiated Noise
- Exterior Covers: Radiated Sound and Simulation Modeling
- Gear Train Noise Issues and Countermeasures
- Drive-By Noise Contribution
- Diesel Engine Design Considerations for Low Noise
- Application Noise Issues

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the two session, approximately four hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .4 CEUs* (with satisfactory assessment score)

Instructor:	Thomas Reinhart
	0.6 CEUs

Vehicle Sound Package Materials Web Seminar RePlay



Webnair I.D.# WB1204
RePlay I.D.# PD331204ON
RePlay Access Period: 30 days
Duration: 8 Hours

This four-session course provides a detailed understanding of the source – path-receiver relationship for developing appropriate sound package treatments in vehicles, including automobiles, commercial vehicles, and other transportation devices. The web seminar provides a detailed overview of absorption, attenuation (barrier), and damping materials and how to evaluate their performances on material, component, and vehicle level applications. A significant part of this course is the case studies that demonstrate how properly designed sound package materials successfully address vehicle noise issues.

NOISE, VIBRATION AND HARSHNESS

Learning Objectives

By participating in this web seminar replay, you will be able to:

- Identify various descriptors that are used in acoustics while working with sound package materials
- Identify three fundamentally different sound package materials that are used in the industry
- Explain how these materials work and how to improve their performance
- Describe how various measurements are made and why they are necessary on a material level, component level, and vehicle level
- Prescribe appropriate sound package materials for specific NVH issues
- Construct proper protocols for combining different sound package materials for different components so that the final vehicle meets the required acoustic target

Who Should Attend:

This course will be especially valuable for those new to the vehicle sound package area and those interested in how absorbers, barriers, and dampers work, how they are different from each other, how they interact with each other in an application, and what one needs to be aware of while making measurements so the results are meaningful. The web seminar is also designed for OEM or supplier engineers and those in roles involved with design, evaluation, trouble-shooting, procuring, releasing, supplying, and/or manufacturing noise control materials and parts for passenger cars and light trucks, heavy trucks, off-highway vehicles, farm machinery, and other transportation systems including aircraft, watercraft and rail transit. An undergraduate degree and familiarity with basic acoustics and vibration, or acoustical materials would be beneficial.

Major topics include:

Session 1

- Vehicle Noise Sources and Solutions
  - The noise system – sources
  - Ranking noise paths
  - Source-path-receiver relationship
  - The noise control system using sound package materials
  - Calculating Onboard Energy Storage Needs
- Sound Package Material – Absorber
  - Application
  - Primary function
  - Effect of various parameters

Session 2

- Sound Package Material – Absorber (cont'd)
  - How it works
  - How to improve performance
  - Case studies
  - Measurements

Session 3

- Sound Package Material – Barrier
  - Application
  - Primary function
  - How it works
  - How to improve performance
  - Case studies
  - Measurements

Session 4

- Sound Package Material – Damper
  - Application
  - Primary function
  - How it works
  - How to improve performance
  - Case studies
  - Measurements
- Component and Vehicle Level Noise Measurements
  - Why
  - How
  - The need for standards and targets for NVH studies

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the four session, approximately eight hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .8 CEUs* (with satisfactory assessment score)

Instructor:	Pranab Saha
	0.8 CEUs

POWER AND PROPULSION

Includes vehicle powertrain and its various components, internal combustion systems and their emissions control, hybrid and electric vehicles, and fuels.

POWERTRAIN AND DRIVETRAINS

A Familiarization of Drivetrain Components e-Seminar

I.D.# PD130555ON
Access Period: 1 Year
Duration: 5.25 Hours

An efficient, durable, and quiet running drivetrain is as essential to customer satisfaction as styling and interior creature comforts. In this e-Seminar, you will be exposed to various methods that can be used to accomplish this goal. Designed to help you visualize both individual components and the entire drivetrain system - without reference to complicated equations - this e-seminar focuses on the terms, functions, nomenclature, operating characteristics and effect on vehicle performance for each of the drivetrain components. Instructor Joseph Palazzolo provides an introduction to the various components of the drivetrain, including the clutch or torque converter, manual or automatic transmission, driveshaft, axle, wheel ends, and brakes.

The course presentation also provides insight into: the structure and function of each component; vehicle performance; and related noise, vibration and harshness issues. You will be equipped to evaluate the space requirements, mounting needs, clearances required, and effect on vehicle performance for each component.

Based on the popular classroom seminar, the five and a quarter hour course is divided into seven modules accompanied by a handbook.

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Discuss both practical and technical aspects of smoothing clutch operation by incorporating cushion and torsional dampers
- Compare different types of transmission synchronizers, automatic transmission torque converters, hydraulic clutch operation and epicyclic gear trains
- Describe the interaction of gear ratios and vehicle performance as related to engine horsepower and torque curves
- Explain phasing and mounting of propeller shafts as related to torsional excitation and secondary couple loads
- Review different types of differentials
- Compare common misconceptions of limited slip devices to their actual performance
- Recognize four-wheel drive systems and the need for an inter-axle differential
- Appraise electronic control of torque through braking and clutching devices
- Evaluate the total drivetrain package as a system

Who Should Attend:

This e-Seminar was intended for engineers now working with passenger car, sport utility, truck, bus, industrial, and off-highway vehicles who have had minimal prior experience with the total drivetrain. An engineering undergraduate degree in any discipline would be beneficial.

Major topics include:

- Clutches
  - Explain the function of a manual transmission clutch system
  - Identify all the components of the clutch system and their function
  - Calculate clutch torque capacity and explain the significance of each parameter
  - Explain the difference between pull and push type clutch actuation systems
  - Identify the different clutch pedal travel positions
  - Troubleshoot common clutch problems and potential solutions
- Transmission
  - Explain the functionality of torque multiplication and its relationship to speed

    - Identify the components that compromise manual and automatic transmissions
    - Explain the need and function for energy absorbing devices like synchronizers and clutches
    - Graphically illustrate the underlying fundamentals of gearing and multi-speed transmission powerflow
    - Describe the basic function of fluid couplings
- Propshaft
    - Define the primary function of prophafts
    - Explain lead-lag phenomenon of single cardan joints and phasing to correct
    - Explain the difference between static and dynamic balance
    - Interpret the concept to constant velocity joints
- Axle
    - Distinguish the different drive gear types
    - Define the need for differentials and their function in the a vehicle
    - Explain the inherent pros and cons of open differentials versus limited slip
    - Identify the axle wheel end types along with common complaints and concerns
- Transfer Case
    - List the different types of All-Wheel Drive Systems
    - Compare and contrast the different modes of operation and their use
    - Identify typical transfer case design parameters
- Wheel Ends
    - Explain the difference between live and dead spindle
    - Name the requirements for wheel end bearing packages
- Brakes
    - Explain the basic brake system function
    - Identify the different types of line routing methods and why
    - Define the basic function of the master cylinder, brake booster, calipers, and wheel cylinders
    - Compare and contrast disc versus drum brake systems
    - Articulate the basic function and concept of anti-lock brake systems

What You Will Receive:

- 365 days of single-user access (from date of purchase) to the 5 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 0.6 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Joe Palazzolo
	0.6 CEUs

Fundamentals of Automotive All-Wheel Drive Systems e-Seminar

I.D.# PD130556ON
Access Period: 1 Year
Duration: 4.5 Hours

This e-seminar provides an introduction to the fundamental concepts and evolution of passenger car and light truck 4x4/all- wheel drive (AWD) systems including the nomenclature used to describe these systems. Basic power transfer unit and transfer case design parameters, component application to system function, the future of AWD systems, and emerging technologies that may enable future systems are covered.

Based on the popular classroom seminar, the four and a half hour course is divided into eight modules accompanied by a handbook. It is an excellent follow-up to SAE's A Familiarization of Drivetrain Components e-Seminar (which is designed for those who have limited experience with the total drivetrain).

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Identify front wheel drive and rear wheel drive vehicle architectures
- Identify part time, full time, and on demand all-wheel drive systems
- Explain the benefits of all-wheel drive over two-wheel drive
- Quantify all wheel drive traction and mobility benefits
- Describe auxiliary axle disconnect systems
- Explain basic vehicle dynamics performance and the effect of AWD on performance
- Identify couplers vs. biasing devices and their basic function
- Describe the differences between mechanical and electrical implementation in AWD systems
- Describe basic control strategies and logic
- Discuss advanced propulsion concepts and systems

Who Should Attend:

This e-Seminar was designed for engineers (working with passenger cars, light trucks, and SUVs) who need

to master AWD components and their functions and effects. Engineers new to the 4WD/AWD field, as well as managers, marketing personnel, purchasing professionals and others interested in all-wheel drive fundamentals, will benefit from this e-seminar.

Major topics include:

- All-Wheel Drive Systems Overview
  - Explain the differences between understeer, oversteer, and neutral steer vehicle dynamics behavior
  - Compare and contrast front-wheel drive based versus rear-wheel drive based powertrain architectures
  - Discuss the history of all-wheel drive systems
  - Identify the need for differentials in a vehicle
  - Calculate percent grade and understand it's importance
- Part-Time Systems
  - Explain the powerflow of a transfer case in all part-time modes
  - Articulate the need and benefit of auxiliary axle disconnects
  - Describe the history and evolution of disconnect systems
- Full-Time Systems
  - Explain the powerflow of a full-time transfer case
  - Explain the powerflow of an on-demand transfer case
  - Identify the difference between a transfer case and power transfer unit
- Transfer Case Design
  - Identify typical transfer case design parameters
  - Recognize the operation of chain drive systems
  - Explain the need for lubrication pumps
  - Identify the components and function of manual versus electric shift systems
  - Assess the powerflow of low range
  - Compare the differences between a "simple" and "complex" power transfer unit
- Couplers
  - Name the difference between a coupler and torque biasing device
  - Explain the operating differences between active and passive systems
  - Articulate the function difference between speed sensing and torque sensing devices
  - Discuss the many different actuation types and methods in use today
  - Explain the influence on vehicle dynamics behavior of different devices and implementations
  - Compare and contrast the performance of different devices in many different vehicle situations
- Vehicle NVH
  - List the elements that cause noise, vibration, and harshness
  - Analyze system ratio and its affect on overall design considerations
  - Predict chassis interaction to all-wheel drive system implementation
- Emerging Technologies
  - Explain the basic function of a twin coupling approach
  - List performance benefits achievable with independent wheel control
  - Discuss the history and current status of torque vectoring systems
  - Identify some current implementation methods of electrified all-wheel drive
- All-Wheel Drive Interactions/New Developments
  - Explain torque split ratio and its influence on vehicle behavior
  - Describe the tire friction circle and its relationship to lateral and longitudinal acceleration
  - Discuss the history and function of ER and MR fluids

What You Will Receive:

- 365 days of single-user access (from date of purchase) to the 4.5 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 0.5 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Joe Palazzolo
	0.5 CEUs

Fundamentals of Modern Vehicle Transmissions e-Seminar

I.D.# PD130419ON
Access Period: 1 Year
Duration: 14 Hours

In this e-seminar, Dr. William Mark McVea details the transmission's primary functions - to provide drivability characteristics to the vehicle and adaptive connectivity between the engine and the remainder of the fixed function driveline. The discussion then focuses on the latest transmission systems designed to achieve the

most efficient engine operation. Current designs, the components and sub-systems used, their functional modes, how they operate, and the inter-relationships are examined. Automatic control, hydro-mechanic design theory and implementation, mechatronics, toroidal transmission functions, and the future of the automatic transmission are discussed. Continuously Variable Transmission (CVT) systems, which represent a fundamental shift in the way power is transmitted from the primary source to the remainder of the driveline, is covered in depth.

Based on the popular classroom seminar, the 14 hour course is divided into nine modules, accompanied by a handbook.

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Explain the competing technologies in current use to provide mechanical power transmission within the technical confines of modern vehicle designs
- Discuss the fundamental operational principles of modern vehicle based transmission systems
- Describe in detail the differing characteristics and technical aspects of stepped versus stepless mechanical power transmission systems, their value, practical use, and applicability to stated performance parameters
- Theorize on the practical application of any of the major common designs to a specific application, or performance objective
- Predict and analytically determine the most appropriate system to satisfy a stated operational need
- Review proposed new technology and decide on proof of concept based on the technical merits and technological extensions employed or proposed

Who Should Attend:

This e-Seminar is for those who wish to become familiar with the operational theories or functional principles of modern vehicle transmission systems. As the material covered is targeted at a number of design and engineering disciplines, you should have a minimum of two years of design experience in the automotive powertrain field, or preferably a B.S. in engineering or related field.

Major topics include:

- Transmission Technology Development
  - Discuss the historical development of transmission technology
  - Clearly articulate the use and time period associated with each component in common transmission designs
  - Explain the functional improvements as transmission technology progressed
- Transmission Speed Ratios and Operation
  - Perform a standard assessment of powertrain requirements
  - Complete a basic analysis of powertrain ratio requirements and performance assessment
  - Correctly compare and contrast the benefits of any of the common transmission technologies
  - Apply the concepts of stepped transmission ratios and ratio selection techniques to any vehicle/prime mover performance requirements
- Manual Transmission Power Flow and Components
  - Correctly identify the major manual stepped transmission components
  - Adequately describe each of their functions
  - Deduce power flow through a manual / geared automotive transmission
  - Explain the phenomenon of shift synchronization and list the common problems that occur in common driving
- Torque Converter
  - Accurately describe the difference between a hydrostatic coupling and a torque converter and why a torque converter is a better application to modern vehicle automatic transmission systems
  - Explain the fluid dynamic properties of energy transfer within a torque converter
  - Explain the principle of torque multiplication through the torque converter
  - Determine the need for use of a one-way clutch under the stator in a torque converter
  - Perform a torque converter match to application based on wheel geometry and performance data synthetic coefficient
  - Compare and contrast application and design considerations of all modern hydraulic charge pumps
- Automatic Transmission Power Flow and Components
  - Knowledgeably discuss the power flow through an epicyclical gear train
  - Explain each component in an epicyclical geartrain
  - Calculate the individual ratios associated with each epicyclical configuration
  - Correlate each holding element with the configuration it supports, as well as how it affects the power-flow through the geartrain
  - Read the holding element chart for any epicyclical geartrain and define that geartrain's power flow
- Holding Members and Hydraulic Control
  - Explain the operation and use of clutch packs

and bands in modern transmission systems
    - Correctly calculate the torque holding capacity of a well defined clutch pack or band break
    - Explain the operational principle of spool valves as used in modern transmission control bodies
    - Describe the fluid flow and pressure relationships within a simple hydro-mechanical automatic transmission valve body
    - Outline the step-wise series of events in a simple `one-two' shift in a modern automatic transmission control system
- Continuously Variable Transmission
    - Explain the basic premise of continuously variable transmissions
    - Describe the performance benefits of CVT's over stepped transmission systems
    - List the common CVT layouts and the function of their basic components
    - Calculate the net reduction in accelerative times for a vehicle using a CVT as compared to any stepped transmission design
- Continuously Variable Transmission Technology
    - Describe in laymen's terms the theory of operation of one of multiple types of CVT technologies
    - Explain the concept of `push-belt' technology as it applies to CVT designs
    - Compare and contrast the use of push-belt versus pull-belt technologies
    - Summarize the major components within modern production ready push-belt CVT designs
    - List and describe the required components of one of a number of common push-belt style CVT design
- Technology Review
    - Confidently discuss and understand the results of a literature search regarding CVT technologies
    - Analyze the net benefits of the theoretical application of CVT technology to a current stepped transmission equipped vehicle
    - Comprehend the operation of new conceptual designs providing continuously variable power transmission
    - Clarify the convergence of CVT with Dual-Clutch transmission technologies

What You Will Receive:

- 365 days of access (from date of purchase) to the 14 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 1.5 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Dr. William M. McVea PE
	1.5 CEUs

Introduction to Powertrain Calibration Engineering Web Seminar & Web Seminar RePlay

Webniar I.D.# WB1346
RePlay I.D.# PD331346ON
RePlay Access Period: 30 days
Duration: 5 Hours

Driven by the need for lower emissions, better fuel economy and improved drive quality, optimized powertrain calibrations are required for the many different vehicle configurations on today's roadways. While powertrain components such as the internal combustion engine, transmission, and hybrid electric powertrain are somewhat familiar to the automotive industry, the control theory, calibrations and system interactions between these components are a relatively unfamiliar aspect.

This web seminar will introduce participants to the concepts behind optimized powertrain calibrations and how they impact fuel consumption, exhaust emissions, and vehicle performance. Participants will also gain exposure to the role that the calibration plays in the system level interactions of the various powertrain components.

Each participant will be asked to view the recording from the one-hour SAE Vehicle/Powertrain Calibration Engineering: What Is It and Why Is It For You? Telephone/Webcast as a course requirement.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Describe the role of calibration in powertrain and vehicle performance
- Identify the fundamental requirements that drive powertrain calibration development
- List the major international regulatory agencies
- Identify the driving factors for complexity of powertrain systems
- Identify the powertrain system interactions that are influenced by calibration
- Recognize tools used in the development of powertrain calibrations
- Diagram the high level calibration process flow

POWER AND PROPULSION

Who Should Attend:

This course is intended for anyone who would like a better understanding of powertrain calibration and how it influences vehicle performance and drivability. Engineering students with an automotive interest through automotive professionals will gain insight into the calibration process and its system impact. It will also be beneficial to those involved in the specification, design, development, testing and planning of vehicles and powertrains. Product planners and program managers will find the overview aspects helpful.

Prerequisites

Material presented will be practical in nature with basic mathematics used to describe quantitative measures. A background in mechanical or electrical engineering will assist in gaining maximum benefit from the material presented. Experience or training in engine or transmission engineering is helpful, but not essential.

Major topics include:

Session 1
Requirements, Boundary Conditions and Complexity

- Fundamental requirements driving powertrain calibration
  - Regulations
  - Vehicle Requirements
  - Environmental requirements
- Overview of the factors driving complexity in powertrain calibration systems
  - Global requirements
  - Fuels
  - Product hardware

Calibration Functional Objectives

- Overview of some basic powertrain calibration tasks including base engine, transmission, OBD, aftertreatment, vehicle driveability
- Base Engine Calibrations
  - Steady state models (air charge, exh backpressure, knock thresholds)
  - Single point optimizations (spark, AFR, VVT, EGR, FUP, etc..)
  - Simple transients
- In-vehicle validation of dyno cals
  - Steady state correlation
  - Transient conditions
  - Knock behavior and fuel sensitivity
- Vehicle-specific Calibrations
  - Pedal progression
  - Drive/shift quality
  - Emissions
  - Performance
- Location-Specific Calibrations
  - Customer expectation of “normal” behavior in all climates
  - Hot weather (component protection)
  - Cold Weather (Emissions, startability, drive quality)
- Altitude (Emissions, startability, drive quality, performance)

Session 2

- Systems – How they interact
  - What is a powertrain system?
  - Powertrain subsystem calibration and interactions (engine, aftertreatment, transmission, hybrid, control)
  - Overview of some basic powertrain components and their effects on the overall system
  - Communication between systems and components
  - The calibration engineer’s role in the overall development process as the bridge between hardware and controls
- Calibration Tasks
  - Testing environments for calibration engineers including simulations, engine test cells, powertrain test cells, chassis dynamometer test cells and test track/field testing
  - Tools of the trade - industry standard tools and specialized tools that calibration engineers use
  - Using test data to create a calibration including modeling, optimization and table generation

What You Will Receive:

- Thirty days of online single-user access to the two session, approximately four hour, recorded presentation
- Course workbook (downloadable, .pdf’s)
- Online learning assessment
- .4 CEUs* (with satisfactory assessment score)

Instructors:	Julian Blair, Gregory Banish, Chi Binh La and Talus Park
	0.4 CEUs

Powertrain Controls (PTC) - Ford Online Course

I.D.# PD111013ON
Access Period: 3 Months
Duration: 6 Hours

POWER AND PROPULSION

The Ford Powertrain Controls (PTC) online course introduces the critical role the powertrain controls system plays in providing excellent vehicle performance, fuel economy, driveability, and emissions. The course describes the powertrain controls system components, including sensors and actuators. The information is presented from a functional, interface diagram, and p-diagram perspective, to enable reliable and robust powertrain operation. In addition, the course emphasizes powertrain controls interactions with internal and external interfaces.

This 6-hour online course is intended to stimulate systems interaction thinking by emphasizing powertrain controls interactions with internal and external interfaces and to help you understand powertrain control systems, prevent late design changes, reduce warranty costs, and improve customer satisfaction. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

Learning Objectives:

By participating in this online course, you will be able to:

- Identify the powertrain controls system and its components
- Describe powertrain controls hardware and software
- Explain powertrain controls system fundamentals, functions, and interactions
- Describe interfacing activities with other organizations
- Explain the impact of powertrain controls changes to interfacing activities
- Describe powertrain controls system modes of operation
- Identify customer and government attributes affected by powertrain controls system performance
- Identify requirements and metrics for powertrain controls systems
- Optimize driveability, performance, fuel economy, emissions, and diagnostics
- Evaluate p-diagrams and boundary diagrams to identify potential adverse powertrain controls system interactions with surrounding systems
- Describe and access powertrain controls documentation and lessons learned

Who Should Attend:

This course is geared toward powertrain, product development, quality, and manufacturing engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

Major topics include:

- Powertrain Controls Overview
- Powertrain Controls Hardware
- Powertrain Controls Software/Calibration and Diagnostics
- Powertrain Controls Reliability and Robustness
- Powertrain Controls Interfaces
- Sensors and Actuators
- Powertrain Controls Modes of Operation

What You Will Receive:

- three months (from date of purchase) of online access to the 6-hour presentation
- glossary of terms (pdf)
- reference guide (pdf)

Author:	Ford Quality Office, Ford Learning & Development

Powertrain As-Installed Driveline Subsystems (PAIDS) - Ford Online Course

I.D.# PD111014ON
Access Period: 3 Months
Duration: 8 Hours

Powertrain as-installed subsystems have a common fundamental function to perform in harmony, enabling the engine to power the vehicle and/or accessories. There is a need to avoid issues such as idle roughness and to realize these are system interaction issues. For example, modal alignment affects idle roughness, and improving idle roughness can affect fuel economy.

This 8-hour Ford online course describes the function and major interfaces of powertrain as-installed driveline subsystems. It also discusses Design Verification System (DVS) metrics/performance requirements for each subsystem and how each subsystem affects other subsystems. The course is aimed at increasing powertrain engineers' awareness of the system-level interactions and tradeoffs related to their design and release actions and their ability to make informed decisions. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

Learning Objectives:

By participating in this online course, you will be able to:

- Describe the four generic configurations of vehicle drivelines
- Explain the fundamental functions of each driveline and the additional functions that power all four

wheels
- Describe the hardware that delivers the driveline functions
- Describe the design, hardware, and types of drive axles
- Describe the primary functions of the drive axle subsystem
- Explain important interfaces of the drive axle, including attribute interfaces
- Describe driveshaft and halfshaft hardware, design, and primary functions
- Explain important driveshaft and halfshaft hardware interfaces and attribute interfaces
- Describe the design of the transfer case, power transfer unit (PTU), coupling, and rear drive unit (RDU)
- Identify the hardware, types of design, primary functions, and important interfaces of the transfer case, PTU, coupling, and RDU
- Identify important Design Verification System (DVS) metrics and performance requirements for the drive axle susbsystem, driveshafts and halfshafts, and the transfer case, PTU, coupling, and RDU
- Analyze design scenarios to identify the most practical resolution action

Who Should Attend:

This course is geared toward quality, manufacturing, and product development engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

Major topics include:

- Introduction to Driveline
- Drive Axles
- Driveshafts/Halfshafts
- Transfer Case/PTU/Coupling/RDU

What You Will Receive:

- three months (from date of purchase) of online access to the 8-hour presentation
- glossary of terms (pdf)
- reference guide (pdf)

Author:	Ford Quality Office, Ford Learning & Development

Powertrain As-Installed Stationary Subsystems (PAISS) - Ford Online Course

I.D.# PD111015ON
Access Period: 4 Months
Duration: 12 Hours

Powertrain as-installed subsystems have a common fundamental function to perform in harmony, enabling the engine to power the vehicle and/or accessories. There is a need to avoid issues such as idle roughness and to realize these are system interaction issues. For example, modal alignment affects idle roughness, and improving idle roughness can affect fuel economy.

This 12-hour Ford online course discusses hardware design, function, and major interfaces of powertrain as-installed stationary subsystems. It also discusses Design Verification System (DVS) metrics/performance requirements for each subsystem and how each subsystem affects other subsystems. The course is aimed at increasing powertrain engineers' awareness of the system-level interactions and tradeoffs related to their design and release actions and their ability to make informed decisions. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

Learning Objectives:

By participating in this online course, you will be able to:

- Describe the design, hardware, and primary functions of the accelerator controls subsystem
- Identify the types of accelerator controls
- Explain important accelerator controls hardware and attribute interfaces
- Describe the air induction subsystem design, hardware, and primary functions
- Explain important interfaces of the air-induction subsystem, including hardware and attribute interfaces
- Describe the design, hardware, and primary functions of the engine and transmission cooling subsystem
- Explain important interfaces of the engine and transmission cooling subsystem, including hardware and attribute interfaces
- Describe exhaust subsystem design, hardware and primary functions
- Explain important interfaces of the exhaust subsystem, including hardware and attribute interfaces
- Describe fuel system design, hardware, and primary functions
- Explain important fuel system hardware and attribute interfaces
- Describe the types and design of powerplant mounts
- Identify the hardware, primary functions, and attribute interfaces of the powerplant mounts subsystem
- Identify important Design Verification System (DVS) metrics and performance requirements for

the accelerator controls, air induction, engine and transmission, exhaust, fuel, and powerplant mount subsystems
- Analyze design scenarios to identify the most practical resolution action

Who Should Attend:

This course is geared toward quality, manufacturing, and product development engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

Major topics include:

- Accelerator Controls
- Air Induction
- Engine and Transmission Cooling
- Exhaust
- Fuel
- Powerplant Mounts

What You Will Receive:

- four months (from date of purchase) of online access to the 12-hour presentation
- glossary of terms (pdf)
- reference guide (pdf)

Author:	Ford Quality Office, Ford Learning & Development

Powertrain Driveability - Ford Online Course

I.D.# PD111016ON
Access Period: 3 Months
Duration: 3 Hours

All Powertrain Product Development engineers must know how their area of subsystem responsibility could affect vehicle Driveability. This 3-hour Ford online course will provide knowledge of Driveability fundamentals. With this knowledge, you can better determine actions to improve the customer's perception of Driveability. Although the focus of this course (including all examples and animations) is on vehicles with gasoline engines and automatic transmissions, it should be noted that vehicles with other powertrains (e.g., diesel engine, manual transmission, front-wheel drive) share the same customer attributes and general characteristics of Driveability. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

Learning Objectives:

By participating in this online course, you will be able to:

- Listen to the Voice of the Customer (VOC)
- Describe how the customer defines good driveability, how customer driveability concerns are researched, and how customer wants cascade to vehicle performance characteristics
- Discuss the vehicle reaction that causes customer driveability concerns and the vehicle systems and interfaces that are involved
- Appreciate driveability from an engineering perspective
- List subsystems that affect driveability
- Highlight the impact of future technologies
- Explain how driveability is measured and how these measurements are correlated back to customer concerns

Who Should Attend:

This course is geared toward quality, manufacturing, and product development engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

Major topics include:

- The Customer's Perspective
- Systems and Interfaces that Impact Driveability
- Evaluating a Vehicle's Driveability Performance

What You Will Receive:

- three months (from date of purchase) of online access to the 3-hour presentation
- glossary of terms (pdf)
- reference guide (pdf)

Author:	Ford Quality Office, Ford Learning & Development

Powertrain Performance Feel - Ford Online Course

I.D.# PD111017ON
Access Period: 3 Months
Duration: 3.5 Hours

In addition to NVH, Driveability, and Shift Quality, Performance Feel is among the four Powertrain attributes that directly influence customer satisfaction. It is defined in terms of the availability of power to the end customer and is the customer perception of performance that includes the effects of vehicle acceleration, accelerator control characteristics, shift character, and sound quality.

This 3.5-hour Ford online course is intended to increase the awareness of vehicle Performance Feel issues, target setting process, and the interactions and controls that affect Performance Feel. Improvement in Performance Feel is identified as high priority. Powertrain engineers

can improve Performance Feel by taking action in their own subsystem and/or cascading to other engineers how their systems affect it. While certain Ford proprietary information has been removed from the course, it contains essentially the same content that engineers from Ford and select suppliers have benefitted from taking.

Learning Objectives:

By participating in this online course, you will be able to:

- Define Performance Feel and describe the elements of the Performance Feel attribute from the customer's perspective
- Identify the vehicle systems and subsystems and the interfaces that affect Performance Feel
- Outline the analytical and test-based metrics, tools, and methodologies used to measure and enhance Performance Feel

Who Should Attend:

This course is geared toward powertrain, product development, quality, and manufacturing engineers. It is recommended that you have an engineering degree and experience in the automotive engineering field.

Major Topics Include:

- Performance Feel from the Customer's Perspective
- Performance Feel from an Engineering Perspective
- Metrics and Targets of Performance Feel
- Performance Feel Design Considerations

What You Will Receive:

- three months (from date of purchase) of online access to the 3.5-hour presentation
- glossary of terms (pdf)
- reference guide (pdf)

Author:	Ford Quality Office, Ford Learning & Development

ENVIRONMENT AND EMISSIONS CONTROL

Catalytic NOx Control Technologies for Diesel & GDI Engines Web Seminar & Web Seminar RePlay

Webniar I.D.# WB1237
Replay I.D.# PD331237ON
Replay Access Period: 30 days
Duration: 6 Hours

Lean burn engines (diesel and GDI) boast higher fuel economy and cleaner emissions than conventionally tuned engines while producing equivalent power. They employ higher combustion chamber compression ratios, significant air intake swirl and precise lean-metered direct fuel injection. The downfall of lean-burn technology, however, is increased exhaust NOx emissions (due to higher heat and cylinder pressure) and a somewhat narrower RPM power-band (due to slower burn rates of lean mixtures). Removal of NOx from exhausts is a critical need for emission standards and ambient ozone requirements.

This three session web seminar will examine the various catalytic processes for lean burn applications, including Selective Catalytic NOx Reduction (SCR), NOx Trap Technologies (i.e. LNT, NSR), and the combination of SCR, NOx Trap and Hydrocarbon NOx Reduction (LNC). It will focus in on SCR NOx fundamentals, equipping participants with the basic concepts for NOx control and important design parameters for SCR NOx catalyst. The course will examine the system design for SCR in diesel applications including passenger cars and heavy duty trucks, including SCR catalysts, SCR integration with diesel particulate filter, key sensor development catalyst durability issues and urea control.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Define NOx catalysis and identify key acronyms
- Describe in-use issues
- Cite key elements in NOx catalyst design for diesel applications
- Define SCR design for passenger cars and heavy duty applications
- Identify available sensors for SCR catalyst performance monitoring
- Determine where lean NOx traps may be appropriate versus SCR NOx control

Who Should Attend:

This web seminar will be especially valuable for mechanical, metallurgical and chemical engineers, materials scientists, and chemists involved in the design, operation and calibration of a NOx emission control system for both mobile and stationary source applications, such as automobiles, trucks, buses, ships, locomotives, stationary engines, small engines, etc. It will also help the newly hired engineer assigned to an emission control team, the seasoned veteran who just transferred to the emission control group, sales people responsible for emission controls, plant managers concerned about meeting new regulations with catalytic controls, and regulators now involved in transmission technologies.

Participants should have a basic familiarity with automotive emissions for gasoline engines, diesel engines or off-road applications. The Fundamentals of Catalytic Converter Integration for Emission Control Web Seminar RePlay, is a recommended prerequisite for those with less than three years of experience with catalytic converters.

Major Topics Include:

Session 1
Lean NOx Catalysis

- NOx reduction catalytic approaches
- Lean NOx reduction fundamentals
- Hydrocarbon NOx reduction (LNC)
- NOx traps technologies (LNT, NSR or NAC)
- SCR Cataytic NOx reduction (ammonia based)
- Combination SCR/NOx traps

Session 2
SCR NOx Catalyst

- SCR NOx catalytic approaches (Vanadia and Zeolite)
- Performance characteristics of SCR NOx catalysts (Vanadia and Zeolite)
- Comparison of commercial issues with lean NOx traps and SCR

Session 3
SCR Catalyst Design Mobile Applications

- Passenger cars
- Heavy duty systems
- Auxiliary equipment design
- Sensor performance
- Catalyst durability

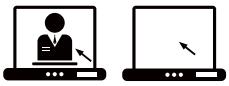
What You Will Receive:

- Thirty days of online access (from date of purchase) to the approximately six hour recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .6 CEUs* (with satisfactory assessment score)

Instructor:	Ronald Heck
	0.6 CEUs

Fundamentals of Catalytic Converter Integration for Emission Control Web Seminar RePlay

I.D.# PD331142ON
Access Period: 30 days
Duration: 8 Hours



This four session course will explore the main elements of the catalytic converter: the catalyst, the honeycomb, and the housing. Session One will cover catalyst fundamentals to equip participants with the basic concepts, important design parameters and main elements of the catalyst, the washcoat and the unitary support. The second session will add discussion on catalyst durability and the effects of in-use on the maintenance of catalyst performance. The third and fourth sessions will explore the ceramic honeycomb as an integral part of emissions control device.

Catalytic emission controls is a key design element of all commercial engines today, whether for autos, trucks, small engines or lawnmowers. Stringent emissions legislation and the advent of low-sulfur fuels have led to new developments to meet the 120,000 vehicle mile durability for passenger cars and 300,000 vehicle mile durability for trucks and buses. Catalytic converter design has become a high priority issue with the new more stringent regulations worldwide.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Define catalysis and identify catalyst acronyms
- Describe in-use issues
- Question catalyst suppliers
- Interpret basic test procedures for catalyst evaluation and cite key elements in catalyst design
- Define honeycomb substrate, the key properties of honeycomb structure, and the performance parameters in terms of cell dimensions
- Validate performance parameters with measured performance
- Describe test methods relevant to in-use conditions

Who Should Attend:

This course will be especially valuable for engineers and others involved in the design, operation and calibration of an emission control system for both mobile and stationary source applications. This includes automobiles, trucks, buses, ships, locomotives, stationary engines, small engines, etc. Participants will be equipped to be conversant in catalysis, the key elements, acronyms, preparation on honeycomb supports, key accelerating aging tests, key performance tests, key issues with in-use, important design parameters and the questions to ask

of catalyst suppliers to assist in meeting future emission regulations for all powerplants.

This course is designed for mechanical, metallurgical and chemical engineers, materials scientists, and chemists involved in heterogeneous catalysis, who are interested in handling, assembling, and failure analysis of catalytic converters. Participants should have a basic familiarity with automotive emissions for gasoline engines, diesel engines or off-road applications will prove valuable for participants.

This course is designed to cover the entire breath of education and experience backgrounds. For instance, it would help the newly hired engineer working in catalytic emissions controls as well as the seasoned veteran who just transferred to the emission control group.

Major Topics Include:

Session 1
Catalysis

- Brief historical background
- Fundamentals of catalysis
- Definition of catalyst and the characteristics of catalysis
- Catalytic reactions
- Catalyst preparation, characterization, and durability
- Reaction controlling mechanisms
- Calculating Onboard Energy Storage Needs

Session 2
Catalyst Durability

- Aging protocols
- Sintering concept and in-use examples
- Masking concept and in-use examples
- Poisoning concept and in-use examples
- Attrition concept and in-use examples
- Consequences of durability on performance
- Charging Systems for Electric Vehicles

Session 3
Honeycomb Substrates

- Ceramic substrates
- Metallic substrates
- Geometric properties
- Performance parameters
- Physical properties
- Effect of high surface area washcoat

Session 4
Honeycomb In-Use Durability

- Canning loads and mechanical stresses
- Temperature gradients in transverse direction
- Thermal stresses in washcoated honeycombs
- Allowable stress for lifetime durability

What You Will Receive:

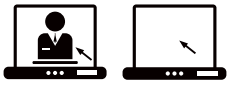
- Thirty days of online single-user access (from date of purchase) to the four session, approximately eight hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .8 CEUs* (with satisfactory assessment score)

Instructors:	Ronald Heck and Suresh T. Gulati
	0.8 CEUs

HYBRID AND ELECTRIC VEHICLES

Introduction to Hybrid Powertrains Web Seminar & Web Seminar RePlay

Webniar I.D.# C0903
RePlay I.D.# PD330903ON
RePlay Access Period: 30 days
Duration: 2 Hours



Although hybrid powertrains have been on the market for little more than a decade, hybridization has quickly become one of the most successful alternative powertrains available today. Some OEMs estimate that up to 80% of their light-duty vehicles will require some level of hybridization to meet upcoming CAFE regulations in the United States. Additional market drivers, such as California's greenhouse gas legislation (now adopted or in process in 20 US states and two Canadian provinces) and a possible global agreement on greenhouse gas production at the end of 2009 may help to accelerate the process.

Basic information on hybrids is scattered among information sources, and is often difficult to synthesize. In this two-hour web seminar, energy storage systems, inverters, motor-generators, and DC-DC converters are explained, as well as design considerations for both light-duty and heavy-duty vehicle powertrains and developing trends such as plug-in, flywheel and hydraulic hybrids.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Describe the efficiency improvements that hybrid vehicles achieve with respect to conventional

vehicles
- Identify common components of hybrid powertrains
- Recognize basic layouts utilized in light, medium, and heavy-duty hybrid vehicle powertrains
- Compare the advantages and disadvantages of different hybrid architectures
- Summarize hybrid powertrain applications that are on the market today
- Explain upcoming HEV developments

Who Should Attend:

This course is designed for the engineer, manager, or marketing professional who needs a quick overview of the design and manufacture of hybrid vehicle powertrains. Industry professionals who want a broad yet concise overview of the technological aspects of current and upcoming hybrid powertrains will benefit. Anyone who is unfamiliar with basic hybrid technology, yet whose job will be impacted by hybrid vehicles in the future, will benefit from this web seminar. A basic understanding of road vehicle construction and operation will be helpful.

Major Topics Include:

- Types of hybrids
  - Gasoline-electric hybrids (HEV)
  - Diesel-electric hybrids (HEV)
  - Hydraulic hybrids (HH)
- Hybrid-electric powertrain components
  - Energy storage systems
  - Motor controllers
  - Motor-generators
  - DC-DC converters
  - Safety interlocks and circuits
  - Ancillary systems
- Series hybrid architectures
  - Advantages and disadvantages of series hybrids
  - Upcoming commercialization of series hybrids
- Parallel hybrid architectures
  - Engine-assist systems
  - Through-the-road systems
- Series-parallel hybrid architectures
  - Power-split hybrids
  - GM "two-mode" hybrids
- Plug-in Hybrids
  - Advantages and disadvantages of PHEVs
  - Early PHEV conversions
  - Commercialization of PHEVs
  - Design considerations for PHEVs
- Hybrid vehicle trends and developments
  - Effects on IC engine development
  - Research and development trends

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the one session, approximately two hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .2 CEUs* (with satisfactory assessment score)

Instructors:	Jack Lelan Rosebro
	0.2 CEUs

ENGINES

Diesel Engine Technology e-Seminar

I.D.# PD130812ON
Access Period: 1 Year
Duration: 13 Hours

As diesel engines become more popular, a fundamental knowledge of diesel technology is critical for anyone involved in the diesel engine support industry. The SAE Diesel Engine Technology e-Seminar, featuring Instructor Magdi Khair, will explain the fundamental technology of diesel engines, starting with a short but thorough introduction of the diesel combustion cycle, and continuing with aspects of engine design, emission control design, and more. An overview of developing technologies for the future with a comprehensive section on exhaust aftertreatment is also included.

The nearly thirteen hour course is divided into an introduction and eight modules. The instructor makes reference to his book, Diesel Emissions and Their Control, co-authored with W. Addy Majewski and also available from SAE International.

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Summarize the technological advances in modern diesel engines
- Evaluate the sources of emissions from diesel engines and the influence of engine component design on curbing these emissions
- Explain diesel exhaust aftertreatment systems and their effectiveness in reducing emissions
- Recognize the importance of fuel injection parameters to performance and emission control

Who Should Attend:

If you are involved in diesel engine support industries such as catalytic converters, lube oils, gaskets, and turbochargers, and if you are not well versed with diesel

engines although they play a major role in your career's survival, this e-Seminar is for you.

Major Topics Include:

- The Case for the Diesel Engine
  - Define the compression ignition concept
  - Compare compression-ignited (CI) and spark ignited (SI) engines
  - Determine how nitric oxide emissions can be formed in CI and SI engines
  - Determine the reason for high thermal efficiency in CI engines
  - Examine some distinguishing features that contribute to the superiority of CI engines
  - Learn how CI engines contribute less to global warming by reducing carbon dioxide, a greenhouse gas, emission in the environment
  - Compare the thermal efficiency of various energy conversion machines
- The Diesel Combustion Process
  - Examine the four-stroke combustion process
  - Describe the pressure-volume diagram and apply it to diesel combustion
  - Describe the pressure-crankangle diagram and apply it to diesel combustion
  - Examine valve events and timing and define valve overlap
- Basic Types of Diesel Engines
  - List various types of diesel engines
  - Differentiate between direct- and indirect-injected diesel engines (DI & IDI)
  - Differentiate between various piston crown designs
  - Examine the importance of combustion bowl design on mixing fuel and air in preparation for high efficiency combustion
- The Diesel Fuel Injection System
  - List the major and auxiliary functions of the diesel fuel injection system
  - Categorize and list the various types of diesel fuel injection systems
  - Describe the function of the pump-line-nozzle injection system
  - Describe the function of the unit injector system
  - Describe the function of the common-rail system
  - Highlight the advantages of electronically-controlling fuel injection systems
- Air Management - Supercharging & Turbocharging
  - Determine the purpose of supercharging
  - Describe various methods of supercharging
  - List the various supercharger drives
  - Evaluate the performance of a centrifugal compressor through analyzing its performance map
  - Describe the basic operation of a turbocharger
  - List different types of turbochargers
  - Define turbocompounding, sequential turbocharging, and turbo-multistaging
- Emissions Formation in Diesel Engines
  - Differentiate between regulated and unregulated exhaust emissions
  - Explain the heat release diagram and give its relevance to emission formation
  - Describe in detail the phases of combusting a diesel fuel spray
  - Describe hydrocarbon, carbon monoxide, nitric oxides, particulate matter, and smoke formation in diesel combustion
- Steps Towards the Modern Diesel Engine
  - Review the design changes to the fuel injection system to control NOx emissions
  - Describe changes to the induction system for NOx reduction
  - Review combustion bowl design changes to achieve better mixing
  - Define the influence of intake port and intake manifold designs on emissions control
  - List design changes aimed at reducing lube oil contribution to particulate emissions
  - Describe the influence of high injection pressure on ignition delay and emission controls
  - List design changes aimed at reducing lube oil contribution to particulate emissions
  - Describe the influence of high injection pressure on ignition delay and emission controls
- Emerging Technologies
  - List technology options for future diesel engines
  - Explain how modern diesel fuel injection systems are helping diesel engines achieve better performance and cleaner exhaust
  - Describe the important design features of the modern diesel combustion system
  - Describe the role of the induction system in engine performance and exhaust emission control
  - Define the role of modern fuel composition on engine exhaust emissions
  - Detail the various diesel aftertreatment systems and list their advantages and disadvantages
  - Determine the importance of integrating engine and aftertreatment controls
  - List technologies and electrical accessories considered for future diesel engines and cite their advantages and disadvantages

What You Will Receive:

- 365 days of single-user access (from date of purchase) to the 13 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 1.3 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Magdi Khair
	1.3 CEUs

SAE DIESEL TECHNOLOGY CERTIFICATE PROGRAM

Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate program.

Designed to equip you with a solid understanding of diesel engines, emissions and aftertreatment strategies, and related components, the program requires completion of courses that address these areas and then facilitates further depth in aftertreatment technologies through a menu of electives. Complete the Diesel Technology Certificate and earn eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering's 40-credit M.S. in Mechanical Engineering. Visit training.sae.org/collegecredit for more information. View the list of required and elective courses and more information on enrolling in this SAE certificate program--training.sae.org/certificate/dieseltech.

Introduction to Commercial & Off-Road Vehicle Cooling Airflow Systems Web Seminar & Web Seminar RePlay

Webniar I.D.# WB1240
RePlay I.D.# PD331240ON
RePlay Access Period: 30 days
Duration: 12 Hours

Vehicle functional requirements, diesel emission regulations, and subsystem thermal limits all have a direct impact on the design of a powertrain cooling airflow system. Severe duty cycles, minimal ram air, fouling, and sometimes unconventional package layouts present unique challenges to the designer. This course introduces many airflow integration issues and vehicle-level trade-offs that effect system performance and drive the design.

The goal of this six-session web seminar is to introduce engineers and managers to the basic principles of diesel cooling airflow systems for commercial and off-road vehicles. Participants will learn about vehicle/product constraints, integration issues, cooling airflow, system resistance, fans, shrouds, radiators, coolers, estimating heat rejection, thermal recirculation, and overall system performance. Basic concepts will be reinforced with examples and a cooling performance calculation of a diesel cooling system.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Define vehicle requirements and many cooling airflow system integration issues
- Describe heat exchanger sizing considerations, design alternatives, and thermal effectiveness
- List fan/shroud aerodynamic design parameters, guidelines, and installation effects
- Apply the fan laws to evaluate alternative designs
- Calculate fan operating point and airflow using component pressure-loss coefficients
- Estimate engine heat rejection to coolant, including Exhaust Gas Recirculation (EGR)
- Calculate steady-state thermal performance of a diesel cooling airflow system

Who Should Attend:

OEM and supplier engineers and managers who are involved with vehicle cooling systems, or who interface with vehicle program management on these issues, will benefit from this seminar. Graduate-level students interested in cooling systems will also find it instructive.

Prerequisites

Participants should have an undergraduate engineering degree. Exposure to thermal product development is helpful, but not required.

Major Topics Include:

Session 1: Vehicle Perspective

- Overview Typical Cooling Airflow Systems
- Design Drivers
- A Classification of Vehicle Cooling Systems
- Industrial Air-cooled Heat Exchanger Assemblies
- Impact of System & Sub-system Requirements
- Thermal Recirculation
- Design Challenges

Session 2: Key Concepts – System Heat Transfer Equation and Pressure Losses

- 1st Law of Aerodynamics
- Radiator Heat Transfer Equation
- Definition of Standard Air
- Airflow Terminology and Standard Cubic Feet per Minute (SCFM)
- Bernoulli's Equation and Ram Pressure
- Pressure Loss Coefficient
- Vehicle Air Flow Restrictions – Flow Energy Losses
- Construct a System Pressure Loss Curve

Session 3: Fan Airflow

- Fan Classification and Specific Speed
- Fan Characteristic Curve and System Matching
- Air Performance Test Chambers (AMCA)
- Axial Fan Systems, Pusher and Puller
- Exercise the Fan Laws to Evaluate Design Alternatives
- Shroud Design Considerations
- Vehicle Installation Effects – Fan Position, Tip Clearance, Radiator Proximity

Session 4: Fan and Ram Airflow Map

- Ram Airflow
- Flow Energy Balance Equation
- Fan Operation with Ram
- Ram Total-Pressure Recovery
- Calculate System Loss Curve, Fan Operating Point and Cooling Airflow

Session 5: Compact Heat Exchangers

- Thermal Classification of Heat Exchangers
- Compact Heat Exchangers in Vehicle Applications
- Radiator Effectiveness and Louvered Fins
- Charge Air Coolers, Performance Calculation Against Requirements
- Air-Side Fouling Study and Heat Exchanger Design Considerations
- Thermal Accumulation Calculation

Session 6: Estimating Powertrain Heat Rejection

- SAE Dynamometer Gross Power Test Procedures
- Dynamometer Data on Engine Heat Rejection
- Brake Mean Effective Pressure (BMEP), A Power Density
- Specific Heat Rejection (SHR) Characteristic Curve
- EGR Heat Rejection to Coolant
- Evaluation of Diesel Cooling System
- Tools and Methods for System Development

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the six session, approximately twelve hour, recorded presentation
- Course workbook (downloadable, .pdf's) including the following SAE Papers:
  - 2002-01-0256, Cooling Inlet Aerodynamic Performance and System Resistance
  - 850281, An Automotive Front-End Design Approach for Improved Aerodynamics and Cooling
  - 900001, Heavy Truck Cooling Systems and
  - 740691, Designing the Engine Cooling Fan
- Online learning assessment
- Instructor follow up to your content questions
- 1.2 CEUs* (with satisfactory assessment score)

Instructor:	Jack Williams
	1.2 CEUs

Practical Race Car Data Acquisition: RPM and Speed Analysis Fast Track

I.D.# PD230834ON
Access Period: 3 Months
Duration: 81 Minutes

Two of the most important and commonly used components in racing data acquisition today are engine RPM and speed analysis. These two channels of data give race teams and engineers critical information that can be used every day to help quantify changes in both the driver and the race vehicle. This 80-minute, online short course focuses on race car data acquisition, highlighting cornering speeds, engine acceleration rates, gear selection, engine RPM curves, shift times, throttle on/off, engine acceleration, wheel spin, brake lock, cornering speed, ignition cutout and much more. Whether you are a weekend racer or a professional data acquisition engineer, you will find the components of this course fundamental to successful data analysis in the real world.

From hardware installation to software interpretation, this course will give you confidence and additional insight into these key pieces of data analysis.

Learning Objectives:

By participating in this Fast Track short course, you will be able to explain:

- Why data acquisition and analysis are so beneficial for all types and levels of racing and racers
- The most common set-ups for Engine RPM and Speed/MPH data acquisition
- The procedures for acquiring and analyzing Engine RPM and Speed data
- How to interpret the most common data logger outputs for both Engine RPM and Speed data
- Alternative analyses that may be necessary for certain racing applications

Who Should Attend:

The Practical Race Car Data Acquisition: RPM and Speed Analysis Fast Track is designed for the racer - from the professional road racer to the weekend racer - or the engineer who is incorporating data acquisition into their race team strategy and want to maximize the abilities of their system as quickly as possible. This course does not require any pre-requisite, as the content will unfold from the basics, up to the more advanced features of these important data acquisition sensors. The knowledge gained in this course can be applied the next day at any level of racing without any additional training or experience.

Major Topics Include:

- Introduction
- Set-up for Acquiring Engine RPM Data
- Acquiring and Analyzing Engine RPM Data
- Interpreting RPM Results
- Set-up for Acquiring Speed/MPH Data
- Interpreting Speed/MPH Results
- Alternative Analysis Strategies

What You Will Receive:

- Three months of online single-user access (from date of purchase) to the 80 minute presentation
- Integrated knowledge checks to reinforce key concepts
- Proof of Participation (Transcript)

Instructor:	Dave Scaler

Race Engine Calibration for Optimal Performance e-Seminar

I.D.# PD130701ON
Access Period: 1 Year
Duration: 7 Hours

The engine control module (ECM, or on-board computer) is the tool used to control the fuel injection rate, fuel injection timing, ignition timing, rate of exhaust gas recirculation (EGR), and other functions. The task of "programming" the ECM is much easier for a race engine than for a production engine because the calibration engineer does not need to be concerned about emissions: EGR, keeping the exhaust catalyst "happy", etc.

In this e-Seminar, Professor Ron Matthews provides a practical introduction to ECMs, including the uses for the various sensors. He discusses the specific methods used to incorporate the various sensor signals into the ECM's control systems for the fuel injection rate, fuel injection timing, and ignition timing. Background information includes an understanding of the desired air/fuel ratio and optimum ignition timing. While examples are tailored around the application of the ECM to Formula SAE race engines, this e-Seminar is useful for improving any engineer's understanding of the functions of the ECM for other types of race engines as well as production engines.

Based on the popular classroom seminar, this course offers four and a half hours of instruction divided into six modules; more than two hours of bonus material and software demonstrations; and a glossary of acronyms, accompanied by a handbook.

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Describe the functions of the crank position sensor, cam position sensor, intake air temperature sensor, manifold air pressure sensor, mass air flow sensor, exhaust "oxygen" or lambda sensor, throttle position sensor, engine coolant temperature sensor, and knock sensor
- Explain how the ECM controls the fuel injection rate, fuel injection timing, and ignition timing
- Interpret base look-up tables, multipliers, and adders
- Develop base look-up tables, multipliers, and adders

Who Should Attend:

This e-Seminar is intended for anyone interested in engine calibration/programming the on-board computer, especially for race engines. At a minimum, classification

as at least a junior in a curriculum leading to a BS degree in engineering or experience in engine development is necessary background for taking this course.

Major Topics Include:

- Basic Engine Theory
  - State the relationships between engine performance parameters, such as torque and specific fuel consumption, and the four fundamental efficiencies
  - Describe how changing a control parameter, such as the air/fuel ratio, affects performance via the effects of this control parameter on each of the fundamental efficiencies
  - Describe how changing an operating condition (engine speed and load) affects performance via the effects of this operating condition on each of the fundamental efficiencies
  - List the primary goals of calibrating both a race engine and a production engine
  - State why "correction factors" need to be used when reporting "wide open throttle" engine data, and explain how to calculate and use these correction factors
- ECM, Sensors, and Actuators
  - Explain why the on-board computer (often called the engine control module or ECM) needs the signals from the various sensors
  - Describe the functions of the crank position sensor, cam position sensor, intake air temperature sensor, manifold absolute pressure sensor, mass air flow sensor (if used), exhaust "oxygen" or lambda sensor, throttle position sensor, engine coolant temperature sensor, and knock sensor (if available on your engine)
- Air/Fuel Ratio Control
  - Describe how electronic fuel injection systems work, including the factors that affect the mass of fuel injected and the "pulse width" range that must be avoided
  - Interpret and explain the "base table" for pulse width (or the equivalence ratio base table for MAF systems)
  - Explain how the base pulse width table can be constructed from knowledge of the air trapped in each cylinder each cycle
  - Explain how operating conditions that are generally not encountered during experiments in the engine test cell are incorporated in the engine calibration via use of "multipliers"
  - Describe why certain multipliers are needed
  - Explain why some of the multipliers also require the calibration engineer to specify a "decay rate" and a "clamp"
  - Determine how to embed some of these multipliers in the base pulse width table
  - Explain the benefits of the MAF-based system in easing the burden on the calibration engineer
  - Discuss why "tip-in" and "tip-out" pose special control problems
  - Explain proper injection timing and injector targeting
  - Identify the benefits of adaptive learning
  - Explain why an ECM with individual cylinder trim is advantageous
- Ignition Timing
  - Discuss the operating regimes for Minimum advance for Best Torque (MBT) and Knock Limited Spark Advance (KLSA) ignition timing
  - Explain the factors that affect the burning rate and, thereby, MBT timing
  - Explain why the base ignition timing table is not linear in either engine speed or load
  - Describe how "adders" are used to obtain MBT timing for conditions outside of those encountered in the engine test cell
  - Explain the benefits of adaptive learning for spark timing control
- The Calibration Process
  - Explain why the calibration process must be an iterative procedure to obtain the proper ignition timing and fuel injection pulse width for every "cell" in the two base tables
  - Explain that generating the base pulse width table requires few experiments
  - Explain how to embed the "load" multiplier for pulse width
  - Generate the "start" multiplier, or the "crank" and "warmup" multipliers if your ECM has this option
  - Calculate the intake air temperature multiplier
  - Discuss how to experimentally generate the battery voltage multiplier using an injector test stand
  - Explain why the auto companies take thousands of data points to get MBT timing as accurate as possible in the base table, and why your race team will benefit from an equal effort
  - Discuss the issues or dangers (from the engine durability perspective) involved in generating MBT accurately
  - Discuss the problem that is encountered when trying to find MBT at low load and two techniques that can be used to overcome this problem
  - Explain how to safely identify the Knock Limited Spark Advance regime of engine operation
  - Recognize how to determine the values for

the ignition timing adders
- Conclusions
  - List things you should look for in an after-market ECM
  - Concisely review how to generate the base pulse width look-up table, the pulse width multipliers, the ignition timing look-up table, and the ignition timing adders
- Bonus Material: Generating Base Fuel Look-up Tables using WAVE Software
  - This demonstration from guest speaker Steve Rawnsley will expose you to:
  - Recognize a state-of-the-art engine modeling program
  - Understand how to use this program to ease the burden of generating the base pulse width look-up table
  - Investigate use of this program to estimate initial values for the base ignition timing look-up table
  - Investigate use of this program to estimate some of the pulse width multipliers
  - Investigate use of this program to estimate some of the ignition timing adders
- Bonus Material: WAVE Software Demonstration
- Bonus Material: Engine Control Units Demonstration
  - This segment featuring guest speaker Brian Lewis, will demonstrate how to:
  - Apply the lessons from the seminar and the engine modeling code to the base tables of an aftermarket ECM
  - Examine the pulse width multipliers and ignition timing adders that are available in this control system

What You Will Receive:

- 365 days of single-user access (from date of purchase) to the 4.5 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 0.70 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	Ronald D. Matthews
	0.7 CEUs

The Basics of Internal Combustion Engines e-Seminar

I.D.# PD130944ON
Access Period: 1 Year
Duration: 10 Hours

In this e-seminar, Dr. William Mark McVea covers the most relevant topics related to internal combustion engines - ranging from the chemistry of combustion to the kinematics of modern internal components. You will gain a practical, thorough approach to the basics of most common designs of internal combustion engines as they apply to the gaseous cycles, thermodynamics and heat transfer to the major components, and the design theories that embody these concepts.

The more than ten hour e-seminar is broken into ten modules including insights into two- and four-stroke cycles, principle operational differences of various fuels, timing and working relationships among internal components, limitations to current designs, and the evaluation of new designs.

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Discuss in detail the basic functioning and component interaction in a modern internal combustion engine, specifically; two and four-stroke cycles as they relate to reciprocating and rotary engine designs.
- Describe the general thermodynamic concepts governing the operation of an internal combustion engine and its various cycles
- Compare the principle operational differences of the various fuels used in internal combustion engines, their availability, and understand the applicability of each
- Discuss the function and operation of all major components and systems within a modern internal combustion engine
- Identify the operational principles behind the timing and working relationships among all internal components, and articulate the importance of this inter-relationship
- Recognize the limitations of the current designs and implementations of the modern internal combustion engine
- Perform a basic assessment and evaluation of new, cutting-edge designs and new powertrain initiatives as they apply to the mobility industry

Who Should Attend:

If you are a powertrain engineer, component supplier, vehicle platform powertrain development specialist, or involved in the application, design and discussion of

engines, this e-Seminar is for you. It is recommended that e-seminar viewers have an undergraduate engineering degree.

Major Topics Include:

- Fundamental Operating Procedures
  - Discuss and effectively differentiate between the basic differences and similarities of the two most common combustion cycle circuits
  - Correctly apply the various combustion/ ignition technologies
  - Describe the function, purpose and design issues regarding the hardware and components that support the energy conversion scheme from fast burn combustion, to linear motion, and finally to rotating power source
- Engine Technology Development
  - Apply the various operating cycles (i.e. 4-Stroke, 2-Stroke, etc.) correctly through selection of an engine technology appropriate for the intended application
  - Discuss the basic differences between spark ignition versus compression ignition technologies and correctly apply them to a given application
  - Explain the concept of 'fast burn' versus 'explosion' and define the difference between ignition and combustion
  - Describe the limitation of each of the operating cycle technologies and/or the combustion/ ignition systems
  - Explain in terms of specifications and appropriateness the fundamental differences and benefits between the stroked engine technology and the rotary eccentric cycle
- Fuel Delivery Systems
  - Apply combustion theory and the use of the stoichiometric ratio as it applies to internal combustion, hydrocarbon based engines
  - Demonstrate a working knowledge of the fundamental principles of fluid dynamics as they apply to liquid/air flow regimes within a closed channel
  - Discuss the economics of emissions as this concept applies to the concept of 'Air/Fuel Ratio'
  - Discuss the principles, properties and value of fluid flow through a venturi and how it provides the motive force to pull liquids into a flow stream, and then to cause mixing within that flow stream
  - Correctly identify components within a carbureted fuel/air management system, and define their function and/or contribution to fuel management functions
  - Provide the same knowledge discourse on fuel injection systems and components
  - Realize the causes of emission production, due to the effects of design, operation and components of an engine
- Valve Train
  - Describe all components associated with and adjacent to the valve systems within the modern internal combustion engine
  - Detail all of the relevant operational characteristics of the camshaft, which includes a technical description of its:
  - Function
  - Design
  - Benefits of various configurations
  - Use as an emission control device
- Component and Event Timing
  - Define the relationship between camshaft and crankshaft positions
  - Explain the relative position of camshaft lobes
  - Theoretically
  - Volumetrically
  - Practical
  - Describe Valve Actuation Timing and its design compromise
  - Low engine rotational speed
  - High engine rotational speed
- Fuels and Combustion
  - Knowledgeably discuss the chemical composition of hydrocarbon based fuels, specifically the:
  - Chemical constituents, chemical formula, the formulation process, the heat value and the expected potential energy of gasoline and diesel
  - Meaning and method of derivation of the 'Pump Number' rating for gasoline, and the difference between 'Pump Number' and 'Octane' as it is typically incorrectly applied
  - Value and use of 'Research Octane Number' and 'Motor Octane Number' as they apply to gasoline
  - Meaning and method of derivation of the 'Cetane' rating for diesel, its use as a measure of fuel heating value, and its application when selecting fuel grades as a function of environmental conditions (i.e. primarily temperature)
  - Main by-products of combustion of gasoline and diesel with standard air
  - Give a general description of the expected by-products of hydrocarbon based combustion
  - Describe the beneficial properties associated with the fluid dynamics of laminar flow regime and its effect on flame propagation rates
  - Define the concept of compression ratio

and its effect on combustion efficiency and potential energy release from the fuel
    - Discuss the relationship between compression ratio and typical combustion head configurations, design guidelines, and interrelated effects
- Ignition
    - Provide a comparison of spark ignition versus compression ignition
    - Give a general description of the spark ignition systems and components
    - Review the developmental history of ignition systems, their relative improvements and beneficial effect on emission reductions
    - Discuss authoritatively ignition theory, with specificity regarding the concepts of:
    - Normal ignition
    - Pre-ignition
    - Pre-detonation
    - Compare and contrast the benefits and detractors of the various heat ranges of spark plugs
    - Explain the need for and effect of ignition timing
- Emissions and Controls
    - Provide a brief narrative of the formation and levels of emissions produced within an internal combustion engine
    - Explain the functional aspect of all components related to the control of the amount of emissions produced, specifically the control systems used:
    - Passive
    - Active
    - Prior to formation
    - After treatment
    - Contribute to a discussion of the developmental examinations of:
    - Valve timing as an emission control system
    - Variable camshaft actuation
    - Variable valve actuation
    - Appreciate the functional meaning of thermodynamics as a means to quantify efficiency measures
- Thermodynamics
    - Understand the thermodynamic principles and definitions of some of the more practical commonly employed cycles:
    - Otto Cycle
    - Diesel Cycle
    - Mixed Cycle
    - Atkinson Cycle
    - Appreciate the applicability of the fundamentals of thermal management, as well as the use of these concepts as a means to predict performance
- Energy Conversion Kinematics and Mechanisms
    - Explain the various components of hardware of the bottom half of a motor
    - Define the movable parts of the cylinder:
    - Pistons
    - Connecting Rod
    - Crankshaft
    - Balancer
    - Define balancing theory

What You Will Receive:

- 365 days of single-user access (from date of purchase) to the 10 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 1.0 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructor:	William Mark McVea
	1.0 CEUs

SAE SI ENGINE CERTIFICATE PROGRAM

Watch for the certificate icon to indicate course titles that are part of an SAE multi-course certificate program.

Designed to familiarize you with key spark ignition engine components and technologies and how they function as a system, completing this certificate delivers a fairly deep level of engine expertise and, at the same time, an SAE credential. Complete the SI Engine Certificate and earn seven or eight graduate credits towards the SAE/Kettering University 20-credit Certificate in Automotive Systems and Kettering's 40-credit M.S. in Mechanical Engineering. Visit training.sae.org/college-credit. View the list of required and elective courses and additional information on enrolling in this SAE certificate program-- training.sae.org/certificate/siengine

Turbocharging for Fuel Economy and Emissions Web Seminar RePlay

I.D.# PD331018ON
Access Period: 30 days
Duration: 4 Hours

Turbocharging is already a key part of heavy duty diesel engine technology. However, the need to meet emissions regulations is rapidly driving the use of turbo diesel and turbo gasoline engines for passenger vehicles. Turbocharged diesel engines improve the fuel economy of baseline gasoline engine powered passenger vehicles by 30-50%. Turbocharging is critical for diesel engine performance and for emissions control through a well designed exhaust gas recirculation (EGR) system. In gasoline engines, turbocharging enables downsizing which improves fuel economy by 5-20%.

This course will explore turbocharging for gasoline and diesel (heavy and light duty) engines, including the fundamentals of turbocharging, design features, performance measures, and matching and selection criteria. It will discuss the interaction between turbocharging and engine systems and the impact on performance, fuel economy and emissions. Developments in turbocharging technology such as variable geometry mechanisms, two-stage and sequential (series & parallel) turbocharging, EGR including low pressure loop, high pressure loop and mixed mode systems and novel turbocharging systems will be described using figures and data.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Identify the basics of how a turbocharger works, how to measure the appropriateness of a turbocharger, and how to select and match a turbocharger to the needs of your powertrain
- Estimate the impact of turbocharging on performance and emissions
- Anticipate potential issues such as packaging, noise, driveability, reliability, and durability
- List the latest developments in turbocharging technology, their impact on engine performance and emissions, and the use of turbocharging world-wide

Who Should Attend:

This course will be beneficial to powertrain development engineers, component development engineers, engineering managers, product planners, service engineers, and those developing product strategy. Heavy duty diesel engine development engineers may find the course helpful by increasing their knowledge of turbocharging and EGR systems.

To get the most out of this course, you should have a familiarity with automotive engines. A Bachelor's degree in Engineering is desirable.

Major Topics Include:

Session 1: Introduction to Turbocharging

- Fundamentals, Functionality, and Basic Design Features of Turbochargers
- Impact of Turbochargers on Engine Performance, Emissions, and Fuel Economy
- Performance Maps, Selection Criteria, Comparison and Matching of Turbochargers to Engine and Powertrain Needs

Session 2: Advanced Issues and Technology

- Turbocharger Noise, Reliability, and Durability Considerations
- Advanced Technology Developments Including Variable Geometry, EGR Systems, and Multi-Stage Turbocharging
- Worldwide Growth in Application of Turbocharging

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the two session, approximately four hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .4 CEUs* (with satisfactory assessment score)

Instructors:	Syed M. Shahed and Arjun D. Tuteja
	0.4 CEUs

PRODUCT ENGINEERING TOOLS AND METHODS

Includes design, engineering practices, test methods, problem solving, and data analysis.

Accelerated Test Methods for Ground and Aerospace Vehicle Development e-Seminar

I.D.# PD130624ON
Access Period: 1 Year
Duration: 10 Hours

Engineers and managers involved with product development are constantly challenged to reduce time to market, minimize warranty costs, and increase product quality. With less and less time for testing, the need for effective accelerated test procedures has never been greater.

This course covers the benefits, limitations, processes, and applications of several proven accelerated test methods including accelerated reliability, step stress, FSLT (Full System Life Test), FMVT® (Failure Mode Verification Testing), HALT (Highly Accelerated Life Testing), and HASS (Highly Accelerated Stress Screening). It is designed for anyone involved in product design, life testing, reliability testing and validation for passenger cars, light trucks, heavy duty, off-highway or aerospace vehicles, including reliability engineers, validation engineers, design engineers and their managers. Users or purchasers of testing or engineering services will also find this course to be valuable.

Based on the popular classroom seminar, this course offers more than 10 hours of instruction divided into fourteen modules; a coordinated handbook; and an electronic copy of the instructor's book, Accelerated Testing and Validation, which includes numerous hands-on exercises and analytical spreadsheets.

Learning Objectives:

By participating in this e-Seminar, you will be able to:

- Choose the accelerated test method for a given application
- Analyze accelerated testing results
- Explain how to accelerate your current test methods
- Explain how to accelerate your validation program
- Adjust accelerated test programs for business situations
- Describe how product development cycles can be reduced from 18 to six months

Who Should Attend:

This e-Seminar is designed for anyone involved in product design, life testing, reliability testing and validation for passenger cars, light trucks, heavy duty, off-highway or aerospace vehicles, including reliability engineers, validation engineers, design engineers and their managers. Users or purchasers of testing or engineering services will also find this course to be valuable. There are no prerequisites for this course although a technical background is helpful.

Major Topics Include:

- Statistical Limitations and Innovation vs. Commodity
  - Identify the fundamentals of a statistical reliability test
  - Recognize the limits of statistical analysis and the effects of product types
- Product Availability and Supply Chain Effects
  - Identify the impact of product availability and the relationships within the supply chain
  - Recognize the effects of the transportation supply chain
- Terms and Definitions for Accelerated Testing
  - Summarize the definitions for goals, methods and limitations of test methods
  - Summarize the classification and differentiation of accelerated test methods
  - Summarize the definition of key terms
- Full Life System Testing
  - Restate the goal of a full system life test
  - Explain the basic methods of a full system life test
  - Discover how to reduce test time by cycling faster
  - Discover how to reduce test time by

eliminating non-damaging conditions
    - Discuss the limitations and assumptions inherent in this method
- Step Stress
    - Explain why achieving failure is successful
    - Demonstrate one life in a mandated test while finding failures
    - Examine the limitations and assumptions of the test method
- Accelerated Reliability
    - Distinguish the stress vs. life vs. probability relationship
    - Determine when to use the accelerated reliability technique
- Highly Accelerated Life Testing (HALT)
    - Understand why to test to multiple failures
    - Demonstrate when to test in the stress axis instead of the time axis
    - Predict the operational and destruct margins
    - Relate the importance of vibration
    - State the importance of vibration frequency range on strain
- Failure Mode Verification Testing (FMVT)
    - Identify stresses
    - Identify failure
    - Summarize the definition of failure
    - Discuss the service to destruct limit
    - Describe failure mode progression analysis
    - Perform Design Maturity Analysis
- Reliability, Warranty and Maturity
    - Recognize the interaction between statistical reliability estimates, warranty rates and failure modes
- Data Analysis Techniques
    - Analyze non-statistical data for maturity, potential for improvement
    - Accommodate uncertainty and large systems
- Overcoming Life Prediction Limitations in HALT and FMVT
    - Review the details of setting up an accelerated test for multiple stress sources with an eye towards life prediction
    - Determine a life estimate from an accelerated test to failure such as HALT and FMVT using several different methods
    - Understand when each method for life prediction can be used
- Program Acceleration
    - Recognize the importance of accelerating a whole program and not just an individual test
- Hybrid Test Methods
    - Combine two or more tests based on the strengths and weaknesses of the tests
- Synthesis
    - Synthesize a concise set of tests that traceably satisfy the hypothesis that must be true for the product to work, while meeting timing

What You Will Receive:

- 365 days of single-user access (from date of purchase) to the 10 hour course
- Links to streaming video modules
- Course Handbook (downloadable, .pdf's, subject to DRM)
- The book, Accelerated Testing and Validation by Alexander J. Porter (eBook, downloadable through My Library)
- Online Pre-test (self-test, immediate results)
- Online Post-test (submit to SAE)
- Instructor follow up to your content questions
- 1.0 CEUs*/Certificate of Achievement (with satisfactory post-test score)

Instructors:	Alexander J. Porter
	1.0 CEUs

Advanced GD&T Competencies: Composite Positioning Web Seminar RePlay

I.D.# PD331321ON
Access Period: 30 days
Duration: 1.5 Hours

While the basics of position are covered in a standard Geometric Dimensioning & Tolerancing (GD&T) course, and sometimes a lone example of composite position is given, those discussions often overlook the variations allowed that enable more accurate control based on part function. This advanced web seminar will clarify the proper use of “double-decker” position controls in GD&T. There are two distinct types: composite position (one symbol) and two single-segment position controls (two symbols). These are commonly used to locate patterns of features (bolt circles, etc.), but they are rarely taught in any depth. In this course, participants will learn the difference in showing one vs. two position symbols and the importance of the datum references in understanding each meaning, per the ASME Y14.5-2009 standard.

Many samples will be shown of the proper tolerancing of patterns of holes and pins that use each method. Examples and exercises will be provided to allow participants to practice several calculations. Learning these advanced techniques will permit better communication of part and assembly requirements between designers and manufacturers.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Explain composite positioning tolerancing

- Explain two single-segment tolerancing
- Apply the appropriate callout based on functional requirements
- Describe gages for each and calculate gage sizes

Who Should Attend:

This advanced-level course is intended for designers, product engineers, manufacturing engineers, manufacturing personnel, and quality/gaging inspectors with a basic knowledge of GD&T concepts. It is a companion to the Advanced GD&T Competencies: Profile of a Surface and Datum Usage webi seminars.

Prerequisites:

For those new to GD&T, the Fundamentals of Geometric Dimensioning & Tolerancing Web Seminar is a recommended prerequisite.

Major Topics Include:

- Brief review of position and bonus tolerance
- Explanation of composite tolerancing
- The need to control orientation vs. location
- Adding secondary and tertiary datums to the lower tolerance
- Two single-segment position tolerancing
- Functional gaging and CMM gaging perspectives

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the approximately one and one half hour recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .15 CEUs* (with satisfactory assessment score)

Instructor:	John-Paul A. Belanger
	0.15 CEUs

Advanced GD&T Competencies: Datum Usage Web Seminar RePlay

I.D.# PD331319ON
Access Period: 30 days
Duration: 1.5 Hours

While the basics of datums are covered in a standard Geometric Dimensioning & Tolerancing (GD&T) course, those discussions often overlook the variations that enable datums to be used in complex ways. This advanced course will detail the proper use of datums, showing their full potential to make your drawings as effective as possible. Most people who use GD&T are familiar with traditional datums derived from flat surfaces, and have adequate knowledge of the principle of establishing 3-2-1 contact points. In this web seminar, participants will learn to select, identify, simulate, and describe datums and datum features for special uses such as irregular shapes, flexible parts, and datum references that use the maximum material modifier. Also covered are several new modifiers and options given in the ASME Y14.5-2009 standard. Learning these advanced techniques will allow designers to better communicate certain requirements.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Explain the difference between a datum and a datum feature
- Select appropriate datums for irregularly shaped parts such as body or interior panels
- Properly simulate given datums
- Explain effects of a modified datum on a geometric tolerance
- Interpret new datum tools such as translation and custom degrees of freedom

Who Should Attend:

This advanced-level course is intended for designers, product engineers, manufacturing engineers, manufacturing personnel, and quality/gaging inspectors with a basic knowledge of GD&T concepts. It is a companion to the Advanced GD&T Competencies: Profile of a Surface and Composite Positioning web seminars.

Prerequisites:

For those new to GD&T, the Fundamentals of Geometric Dimensioning & Tolerancing Web Seminar is a recommended prerequisite.

Major Topics Include:

- Brief review of traditional datum usage
- Selecting datums: surface vs. feature of size
- Use of the MMB modifier (formerly MMC)
- Using a pattern as a single datum
- The new translation modifier
- Applying the "M" modifier to a surface
- Customized degrees of freedom
- Irregular feature of size datums
- Moveable datum targets

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the approximately one and one half hour recorded presentation

- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .15 CEUs* (with satisfactory assessment score)

Instructor:	John-Paul A. Belanger
	0.15 CEUs

Advanced GD&T Competencies: Profile of a Surface Web Seminar RePlay

I.D.# PD331320ON
Access Period: 30 days
Duration: 1.5 Hours

While the topic of profile is covered in a basic Geometric Dimensioning & Tolerancing (GD&T) course, those discussions often ignore the variations allowed with these symbols that enable them to be used in complex ways. This advanced web seminar will clarify the proper use of the profile tolerances in GD&T and uncover the nuances of these two symbols. Since profile of a surface is arguably the most powerful GD&T symbol, its full potential will be explored. It can be used to control size, form, orientation, and location and its relationship to datums can be varied. Learning these advanced techniques will allow designers to better communicate certain requirements. The examples given in this session will also illustrate several of the new options for profile that were introduced in the ASME Y14.5-2009 standard.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Explain when profile tolerances require a datum reference
- Determine which aspects of GD&T a given profile tolerance controls
- Interpret unilateral, bilateral, and nonuniform tolerances
- Describe how to properly measure profile tolerances

Who Should Attend:

This advanced-level course is intended for designers, product engineers, manufacturing engineers, manufacturing personnel, and quality/gaging inspectors with a basic knowledge of GD&T concepts. It is a companion to the Advanced GD&T Competencies: Datum Usage and Composite Positioning web seminars.

Prerequisites:

For those new to GD&T, the Fundamentals of Geometric Dimensioning & Tolerancing Web Seminar is a recommended prerequisite.

Major Topics Include:

- Review of profile of a surface and profile of a line
- Using profile without datums
- All around and all over
- Locating a profile zone with toleranced dimensions
- Using the MMB modifier with profile
- Composite profile
- The "U" modifier
- Nonuniform tolerancing

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the approximately one and one half hour recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .15 CEUs* (with satisfactory assessment score)

Instructor:	John-Paul A. Belanger
	0.15 CEUs

Design of Experiments (DOE) for Engineers Web Seminar RePlay

I.D.# PD330932ON
Access Period: 30 days
Duration: 12 Hours

Design of Experiments (DOE) is a methodology that can be effective for general problem-solving, as well as for improving or optimizing product design and manufacturing processes. Specific applications of DOE include, but are not limited to, identifying root causes to quality or production problems, identifying optimized design and process settings, achieving robust designs, and generating predictive math models that describe physical system behavior. This competency-based web seminar utilizes a blend of reading, discussion and hands-on to help you learn the requirements and pre-work necessary prior to DOE execution, how to select the appropriate designed experiment to run, DOE execution, and analysis of DOE results. You will experience setting up, running, and analyzing simple-to-intermediate complexity Full Factorial and Partial Factorial experiments both by hand and using computer software. You will also set-up and analyze Robust/Taguchi and Response Surface experiments utilizing computer software.

Each participant will receive a 30 day MinitabTM product trial copy for use in the course. Due to the nature of the online format, each participant will be expected to dedicate approximately one hour to complete

"homework" and/or short reading assignments in preparation for each session.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Determine when DOE is the correct tool to solve a given problem or issue
- Select the appropriate DOE experiment type (DOE Goal) for a given application
- Set up simple Full Factorial DOEs by hand, using cube plots
- Set up and analyze any Full Factorial DOE using Minitab
- Identify appropriate partial factorial design(s) based on one's application
- Set-up and analyze Partial Factorial DOEs, simple Robust Design (Taguchi) DOEs, and simple Response Surface DOEs using Minitab
- Recognize the structured process steps recommended when executing a DOE project

Who Should Attend:

This course will benefit engineers involved in product design and/or optimization; process design and/or optimization; quality improvement efforts such as defect elimination, warranty avoidance or similar initiatives; and technicians, analysts and managers who support engineers in these efforts. This course has no specific course prerequisites. However, participants are expected to have some math background, that includes elementary statistics. Since the course includes demonstration and hands-on use of Minitab, participants should have some familiarity with Windows-based personal computer applications.

Major Topics Include:

Session 1

- Introduction
- What is DOE (with Initial Data Collection Exercise)
- Full Factorial Experiments using Cube Plots
  - Identifying main effect and interaction terms
  - Determining effects for all terms
- Estimating How Much Experiment Data is Enough
- Assignment for Session 2: Review of Web-Based Demo of Minitab - Full Factorial DOE Set-up and Analysis; and Reading, Overview of DOE Statistics

Session 2

- Set up and Analysis of a Full Factorial Experiment using Minitab
- Minitab's DOE Results (High Level Overview of Minitab Outputs)
- Review of Methods for Determining 'Significance'
- ANOVA and Regression Overview
- Assignment for Session 3: Hands-on Exercise in the use of Minitab using Simulator to Generate Data, and Reading on the Structured DOE Process

Session 3

- Review of Exercise Assigned at the End of the Session 2
- Review and Additional Information on DOE Statistics and Interpretation of DOE Output
- Best Practice: The Problem Solving Process
- Best Practice: The Structured DOE Process
- Assignment for Session 4: Reading on Overview of Confounding and Partial Experiments

Session 4

- The Confounding Principle and Partial Factorial Experiments
- How Confounded Occurs in a DOE, including Identity Usage and Resolution
- Setting up Partial Factorial Experiments using Minitab
- Assignment for Session 5: Partial Factorial Exercise using Minitab and a Simulator to Generate Data for the DOE; Reading on Robust/Taguchi DOE

Session 5

- Review of Exercise Assigned at the End of the Session 4
- When Robust/Taguchi DOE is Appropriate
- How Robust/Taguchi DOE is Different
  - Two-Step Optimization Concept
  - Control vs. Noise
  - Importance of Control-by-Noise Interactions
  - Signal-to-Noise (S/N) and Loss Statistics
- Some Taguchi DOE Success Stories (incl. Set-up and Analysis in Minitab)
- Demonstration of Minitab for Setting Up a Taguchi DOE
- Assignment for Session 6: Robust/DOE Exercise using Minitab and a Simulator to Generate Data for the DOE, Reading on Overview of Response Surface Methodology

Session 6

- Review of Exercise Assigned at the End of the Session 5
- When Response Surface DOE is Appropriate
- How Response Surface DOE is Different
  - Box-Behnken Concepts (with Demonstration of Minitab Set-up)
  - Central-Composite Concepts (with Demonstration of Minitab Set-up)
- Class Exercise: Response Surface Set-up and

Analysis
- High-level Overview of Other Designs/Application: Plackett-Burman and Mixture
- FAQ Review
- Summary

What You Will Receive:

- Thirty days of online access (from date of purchase) to the six session, approximately twelve hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- 1.2 CEUs* (with satisfactory assessment score)

Instructor:	Kevin M. Zielinski
	1.2 CEUs

Finite Element Analysis (FEA) for Design Engineers Web Seminar RePlay

I.D.# PD331241ON
Access Period: 30 days
Duration: 12 Hours

The Finite Element Analysis (FEA) has been widely implemented by automotive companies and is used by design engineers as a tool during the product development process. Design engineers analyze their own designs while they are still in the form of easily modifiable CAD models to allow for quick turnaround times and to ensure prompt implementation of analysis results in the design process. While FEA software is readily available, successful use of FEA as a design tool still requires an understanding of FEA basics, familiarity with FEA process and commonly used modeling techniques, as well as an appreciation of inherent errors and their effect on the quality of results. When used properly, the FEA becomes a tremendous productivity tool, helping design engineers reduce product development time and cost. Misapplication of FEA however, may lead to erroneous design decisions, which are very expensive to correct later in the design process.

This six-session web seminar provides design engineers with the skills necessary for proper use of FEA in the design process and to ensure that this powerful tool is implemented in the most efficient and productive way. All topics are illustrated by hands-on examples using FEA software SolidWorks® Simulation for which participants will be provided a Student License (compatible with Windows XP, 7; IE 7,8,9; MS Excel and Word 2007 or 2010). Acquired skills, however, are not software specific and no prior exposure to FEA software is required. The eBook, "Engineering Analysis with SolidWorks® Simulation" by Paul Kurowski, will also be included in the course materials.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Select preferable modeling approaches
- Analyze errors inherent to FEA results
- Identify FEA advantages and shortcomings
- Avoid mistakes and pitfalls in FEA
- Produce reliable results on time
- Request FEA analysis and use FEA results
- Provide effective FEA project management
- Ensure quality and cost-effectiveness of FEA projects

Who Should Attend:

This course addresses the needs of design engineers who are not specialized analysts but need to use the Finite Element Analysis to analyze new product during the design process. Also non-specialist FEA users, R&D engineers and managers, project engineers, and product engineers will benefit from its coverage of different FEA formulations, tools for error analysis, common errors, traps and misconceptions, and an introduction to FEA project management.

Major Topics Include:

Session 1

- Fundamental Concepts in the FEA
- Finite Element Analysis Process
- Origins and Types of FEA Errors
- Finite Element Mesh
- In-class Exercises

Session 2

- Control of Discretization Error – Convergence Process
- Verification and Validation of FEA Results
- In-class Exercises
- Homework Assignment

Session 3

- Control of Modeling Error
- Types of Finite Elements
- Types of Boundary Conditions
- Useful Modeling Techniques
- In-class Exercises
- Homework Assignment

Session 4

- Modal Analysis
- Buckling Analysis
- In-class Exercises

- Homework Assignment

Session 5

- Nonlinear Geometry Analysis
- Nonlinear Material Analysis
- Contact Stress Analysis
- In-class Exercises
- Homework Assignment

Session 6

- Steady State Thermal Analysis
- Transient Thermal Analysis
- FEA Implementation
- FEA Project Management
- FEA Traps and Misconceptions
- Quiz in preparation to post-course learning assessment

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) access to the six session, approximately twelve hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- The eBook,"Engineering Analysis with SolidWorks® Simulation" by Paul Kurowski (loaded into MySAE library)
- Student license to SolidWorks® Simulation software
- Online learning assessment
- 1.2 CEUs* (with satisfactory assessment score)

Instructor:	Paul M. Kurowski
	1.2 CEUs

FMEA for Robust Design: What, Why, When and How Web Seminar RePlay

I.D.# PD331422ON
Access Period: 30 days
Duration: 12 Hours

Failure Modes and Effects Analysis (FMEA) is an integral part of product design activity applicable to any type of product or service. It is a quantitative and quantitative step-by-step approach for identifying and analyzing all actual and potential points of failure in a design, product or service. A successful team-based FMEA activity can use their collective experience with similar products to dramatically improve not only product performance but also reduce manufacturing issues at both a component and system and processing level.

This web seminar introduces the five basic types of FMEAs with emphasis on constructing a Design FMEA. Each column of the FMEA form is clearly explained using a typical FMEA example. This example can be a provided sample or a company sample provided candidate. The course covers various methods for clearly identifying product function at three levels, and associating distinct failure modes, effects and causes related to each function level. Special attention is given to Severity, Occurrence, and Detection and how to develop effective Risk Priority (RPN) strategies and Recommended Actions for significant RPNs.

All material is in conjunction with current industry standards.

Learning Objectives:

Upon completion, the participant should have developed a completed FMEA and, thus, be able to understand and apply the following:

- Relating Product Development, Voice of the Customer (VOC) and the FMEA
- Why and when to use System and Design FMEAs
- The FMEA as a risk management technique
- The five types of FMEAs
- Organizing effective FMEA development teams and meetings
- The steps to generating a quality FMEA, including a column by column review of the Design FMEA form
- Basics of Root Cause Analysis
- Design Control techniques, Detection Strategy, Risk Priority strategies and Risk Ranking tables
- Assignment of recommended actions

Who Should Attend:

The course is designed for individuals who are involved in the development of new products and who seek to improve that process. Product development team members including, but not limited to, project and program managers, design and development, process, product, quality, and application engineers will find the course valuable. It is aimed primarily at these managers and engineers who will be facilitating or leading such FMEA activities. Directors, marketing and purchasing personnel will also benefit by understanding why the FMEA process is important to developing a safe and effective product.

Major Topics Include:

Session 1

- FMEA Introduction
  - Background and History
  - The FMEA Standards - MIL-STD_1629, SAE J1739, AIAG
  - Relationship of Design and Process FMEA in a design & manufacturing environment

Session 2

- Five Types of FMEAs

Session 3

- FMEA and Risk Management
  - Defining Risk Management
  - FMEA and Robust Design
  - FMEA as part of Design to Cost
  - FMEA as Product Liability Protection

Session 4

- Managing the FMEA Process
  - Assembling the FMEA Team
  - Facilitator Role during the FMEA Process
  - Capturing the 6 Levels of Voice of the Customer (VOC)
  - The FMEA Database and FMEA Templating
  - Tips for standardizing concise expression of failure modes, effects and causes

Session 5

- Column By Column Review of the FMEA - Part 1
  - Header
  - Item/Function - Primary, Secondary and Customer Satisfaction
  - Failure Mode
  - Effects and Severity
  - Causes and Occurrence
  - Controls and Detection

Session 6

- Column By Column Review of the FMEA - Part 2
  - Calculating and Assessing RPN
  - Risk Tables and RPN assignment strategies
  - Recommended Actions
  - Responsibility and Target Dates
  - Verification

Instructor:	Angelo E. Mago
	1.2 CEUs

Fundamentals of Geometric Dimensioning & Tolerancing (GD&T) Web Seminar RePlay

I.D.# PD330933ON
Access Period: 30 days
Duration: 16 Hours

Geometric dimensioning and tolerancing (GD&T) is used as a symbolic way of showing specific tolerances on drawings. GD&T is a valuable tool that effectively communicates the design intent to manufacturing and inspection. It is governed by the technical standard ASME Y14.5M-1994, which was updated in 2009. This course introduces participants to the GD&T system, providing a working knowledge of the correct interpretation and application of each symbol, general rules, the datum system, and 'bonus' tolerance and highlighting some of the changes in the updated Y14.5 standard. The material is reinforced with many practice exercises.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Explain the benefits of geometric tolerancing
- Identify datum features and determine their order of precedence
- Identify and interpret each of the characteristic symbols
- Describe the material condition modifiers and how "bonus" tolerance occurs
- Correctly interpret GD&T feature control frames, and explain the impact on manufacturing and inspection

Who Should Attend:

This course is ideal for anyone who has a need to apply or interpret geometric tolerances on a product print. Product engineers, manufacturing engineers, CAD designers, quality inspectors, and other engineering and manufacturing personnel will all benefit from a better understanding of design requirements; improved communication with customers and suppliers; and improving designs by taking advantage of bonus tolerance and other GD&T benefits. Participants should have an understanding of basic blueprint reading.

Major Topics Include:

Session 1

- Why Use GD&T?
  - Review of traditional dimensioning
  - Benefits of GD&T
  - Technical standards
  - Definitions
  - Basic dimensions
  - How to read the feature control frame

Session 2

- Rules and the Form Symbols
  - Rule #1: Size controls form
  - Rule #2: Assume RFS
  - Flatness
  - Surface straightness
  - Circularity
  - Cylindricity

Session 3

- Bonus Tolerance
  - GD&T applied to a feature of size
  - Bonus and the MMC modifier
  - Virtual conditon
  - Gaging and inspection of GD&T

Session 4

- Datums
  - Datum vs. datum feature
  - The datum reference frame
  - Primary, secondary, and tertiary datums

Session 5

- Profile and Orientation
  - General definition of profile
  - Profile of a line
  - Profile of a surface
  - Use of datums with profile
  - Perpendicularity
  - Angularity
  - Parallelism

Session 6

- Position Tolerance I
  - True position
  - Position tolerance RFS
  - Using MMC or LMC
  - The "boundary" concept
  - The pitch diameter rule

Session 7

- Position Tolerance II
  - Projected tolerance zone
  - Inspecting parts for position
  - Calculating tolerance values
  - Composite position tolerance

Session 8

- Symmetry and Coaxial Controls
  - Concentricity
  - Symmetry
  - Circular runout
  - Total runout
- Wrap-up

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the eight session, approximately 16 hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to YOUR content questions
- 1.6 CEUs* (with satisfactory assessment score)

Instructor:	John-Paul A. Belanger
	1.6 CEUs

Introduction to Design Review Based on Failure Modes (DRBFM) Web Seminar RePlay

I.D.# PD331047ON
Access Period: 30 days
Duration: 6 Hours

Design Review Based on Failure Modes (DRBFM) is a methodology focused on change management and continuous improvement. It centers on early prevention and engineering knowledge, eliminating time spent debating ranking systems, waiting for lead engineers to document and list their concerns, identifying what types of concerns are open for discussion and resolution, and brainstorming without any actionable closure.

This course will explain all phases of the DRBFM methodology and provide details on how to accomplish the specific steps. With the Design Review Based on Failure Modes (DRBFM) and Design Review Based on Test Results (DRBTR) Process Guidebook that is bundled with the course, the instructor will provide specific information on each step. Formats, examples, notes and homework slides will be used to illustrate the defined steps of the new SAE J2886 DRBFM Recommended Practice. Similarities in content between DRBFM and FMEA will be discussed, however the focus will be on conducting DRBFM methodology.

This DRBFM web seminar will provide roles and responsibilities of management, design engineers, manufacturing engineers, facilitators and technical experts. Those interested in DRBFM will benefit from understanding the rationale behind this methodology and learn to guide teams through the paradigm shifts and mind set that are needed.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Outline the fundamental steps of DRBFM methodology, including:
- DRBFM Plan and analysis requirements
- Necessary preparation feeding DRBFM analysis
- The two phases of DRBFM analysis
- Documentation of design, validation and manufacturing actions
- Feedback loop into engineering knowledge documents

- Explain the intent and format of the DRBFM worksheets
- Predict what it takes to gain and maintain proficiency and consistent application of the methodology
- Find answers to most DRBFM questions

Who Should Attend:

Product engineers, manufacturing engineers, quality engineers, supplier quality engineers, validation and test engineers, and facilitators, trainers and consultants in all industries. This course will benefit beginning engineers, advanced and senior engineers and managers who must participate in FMEA's and DRBFM.

Major Topics Include:

Session 1

- DRBFM Procedure, Forms, Planning and Preparation
  - Process Guide and Workbook Overview
  - Scope and Purpose
  - Process Map – General Requirements
  - Planning – Formats, examples, homework
  - Planning Results and Output
  - Preparation – Formats, examples, homework
  - Preparation Results and Linkage with DRBFM Format
  - Definition of Change Section

Session 2

- DRBFM – Forum 1, Design Review, Action Results and Follow Up
  - DRBFM Forum 1 – Engineer analysis
  - Change Point definition
  - Identification of concerns
  - Identification of causes and influences on the vehicle
  - Identification of effects
  - Identification of severity/priority
  - Actions to gain engineering knowledge – evidence

Session 3

- DRBFM – Forum 2, Design Review, Action Results and Follow Up
  - DRBFM Forum 2 – Design Review introduction
  - Change Point overview
  - Identification of additional concerns
  - Identification of additional causes and influences on the product
  - Identification of effects
  - Identification of severity/priority
  - Actions taken to eliminate concerns
  - Design actions to gain engineering knowledge – evidence
  - Validation actions to gain evidence of reliability
  - Manufacturing, assembly, and supplier actions
  - Action results and feedback to design guidelines
  - Roles and responsibilities

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the two session, approximately six hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- The Design Review Based on Failure Modes (DRBFM) and Design Review Based on Test Results (DRBTR) Process Guidebook (e-Book, loaded into MySAE library)
- Online learning assessment
- Instructor follow up to your content questions
- .6 CEUs* (with satisfactory assessment score)

Instructor:	William A. Haughey
	0.6 CEUs

Tolerance Stack-up Fundamentals Web Seminar RePlay

I.D.# PD330842ON
Access Period: 30 days
Duration: 6 Hours

Analysis of tolerance stacks varies widely. This web seminar introduces the basic tools to create a common methodology for tolerance stack-ups, and ensure seamless documentation. Participants will create 1-D tolerance stacks for parts and assemblies that use geometric dimensioning and tolerancing using a tolerance stack spreadsheet. This simple, manual spreadsheet method produces an easily interpreted and checked documentation trail, and is easily adaptable to common electronic spreadsheet programs. Multiple examples will be provided to assist engineers in applying tolerance stack-up fundamentals to Y14.5 issues.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Perform and develop a tolerance stack-up analysis
- Correctly enter geometric feature control frame data into a tolerance stack
- Apply a common step-by-step methodology to tolerance stack analysis

Who Should Attend:

PRODUCT ENGINEERING DEVELOPMENT TOOLS & METHODS

Engineers familiar with concepts and practices contained within Y14.5 and who are looking for a fundamental step-by-step process for getting geometric dimensioning and tolerancing (GD&T) into a tolerance stack will benefit from this course. A basic understanding of GD&T symbols and concepts is required.

Major Topics Include:

Session 1 - Introduction and Review

- Introduction and tolerancing review
- Tolerancing strategies
- Review of G D & T

Session 2 - Stack Fundamentals

- How to identify the stack path
- The two-column stack spreadsheet
- Entering dimensions into the spreadsheet
- Examples with coordinate dimensions

Session 3 - Factoring G D & T into a Stack

- Location and runout tolerances
- Profile tolerances
- Form and orientation tolerances

Session 4 - Bonus and Shift Tolerance in a Stack

- Overview of bonus and shift tolerance
- Part vs. assembly stacks
- Wrap-up

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the four session, approximately six hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .6 CEUs* (with satisfactory assessment score)

Instructor:	John-Paul A. Belanger
	0.6 CEUs

WE ARE PLEASED TO ANNOUNCE GD&T TRAINING FROM EFFECTIVE TRAINING INC. (ETI), AN SAE INTERNATIONAL COMPANY.

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Course titles exclusively from ETI include:

- Engineering Drawing Requirements
- Executive Overview of GD&T
- GD&T for Manufacturing (ASME Y14.5-2009)
- GD&T Overview (ASME Y14.5M-1994)
- Intro to Statistical Tolerance Stacks
- Solid Model Tolerancing (ASME Y14.41)
- System Approach to Component Tolerancing

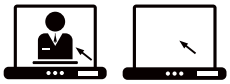
For more information visit www.etinews.com or contact sales@etinews.com

SAFETY AND ACCIDENT RECONSTRUCTION

Includes vehicle impact, accident reconstruction, occupant safety, and safety standards

Basic Hybrid and Electric Vehicle Safety Web Seminar RePlay

I.D.# PD330904ON
Access Period: 30 days
Duration: 2 Hours



High-voltage, high-current energy storage systems and electrical circuits in many current and future alternative-propulsion powertrains present unique challenges to the automotive industry. Care must be taken to minimize risk to all who come into contact with the vehicle throughout its development and life cycle, including powertrain developers, assembly line workers, service technicians, vehicle occupants, and first responders. Significant risk to life and limb can arise from technical issues surrounding these vehicles.

Learning Objectives:

By participating in this web seminar replay, you will be able to:

- Describe component functions and locations in a typical high-voltage powertrain as well as the onboard safety systems associated with such components
- Explain the general effects of electric current on the human body
- Know which national and international safety standards apply to high-voltage vehicle circuits
- Summarize HV safety working issues that may be present during a vehicle's development, assembly, service, and operation
- Identify general issues associated with extrication of occupants from vehicles with high-voltage powertrains

Who Should Attend:

Light and heavy duty engineers and technicians who work directly with high-voltage vehicle circuits in hybrid, plug-in hybrid electric, and/or fuel cell hybrid vehicles, as well as component suppliers, safety officers and/or personnel who plan to develop high-voltage safety programs or procedures, will benefit from this course.

Major Topics Include:

- General high-voltage electrical safety issues in vehicles
  - Issues with energy storage systems
  - Issues with motor controllers
  - Issues with motor-generators
  - Issues with DC-DC converters
  - Relationship between high-voltage (HV) bus and 12V bus
  - Gasoline-electric hybrids (HEV)
- Electrical injury
  - Effects of electrical energy on the human body
  - Electrical resistance of the human body
  - "Let-go" current
  - Common electrical accidents
- Industry protection against electrical injury
  - Standards and regulations organizations
  - Personal protective equipment
- On-board vehicle protection against electrical injury
  - Insulation and insulation breakdown
  - Fusing and interlocks
  - Ground-fault protection systems
  - Discharge and isolation circuits
- Powertrain development issues
  - Working with prototype battery packs
  - Working in powertrain test cells
- Service and repair issues
  - Hazards associated with routine maintenance
  - Hazards associated with HV component diagnosis and repair
  - General industry safety procedures
- Vehicle occupant and first responder issues
  - Protective measures for vehicle occupants
  - Hazards associated with vehicle occupant

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the one session, approximately two

hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .2 CEUs* (with satisfactory assessment score)

Instructor:	Jack Lelan Rosebro
	0.2 CEUs

Driver Distraction from Electronic Devices: Insights and Implications Web Seminar RePlay

I.D.# PD331140ON
Access Period: 30 days
Duration: 4 Hours

Although many have an idea of what the term "driver distraction" means, there is no common definition within the research community. Additionally, there are many studies that have investigated the topic, but with varying and sometimes conflicting results. What should be made of these discrepancies?

This four-hour web seminar will provide an overview of driver distraction (predominantly electronic devices): the problem; how to define it; the current state of research and how to critically evaluate that research to make informed decisions; and the effectiveness of state laws and fleet policies to reduce it. The conclusion of the course will summarize strategies, techniques, and technologies that have been shown to be effective in reducing distracted driving from electronic devices.

This course has been approved by the Accreditation Commission for Traffic Accident Reconstruction (ACTAR) for 4 Continuing Education Units (CEUs). Upon completion of this course, accredited reconstructionists should contact ACTAR, 800-809-3818, to request CEUs. As an ACTAR approved course, the fee for CEUs is reduced to $5.00.

Learning Objectives:

By participating in this web seminar replay, you will be able to:
- Weigh the extent of the driver distraction problem
- Define driver distraction
- Critically examine the current state of driver distraction research
- Identify the strengths and limitations of various research approaches that assess driver distraction from electronic devices
- Recognize the difference between various forms of distraction (cognitive, auditory, visual, manual)
- Assess the effectiveness of policy efforts to reduce driver distraction from electronic devices
- Explain that all cell phone "tasks" do not have equal risk
- Determine effective strategies, techniques, and technologies for minimizing distracted driving

Who Should Attend:

This course is intended for all those interested in being equipped to critically examine the current state of research in driver distraction. Although the course is aimed at driver distraction from electronic devices, the results pertain to driver distraction in general. Vehicle manufacturers, OEMs, and cell phone providers and manufacturers will be able to use the information presented in this webinar to develop engineering solutions in this area. Government and driving advocate officials will be able to use the information presented in this webinar to design and deliver informed policy decisions regarding driver distraction. Transportation safety researchers will learn about the latest research in this area as well as future research needs.

Major Topics Include:

Session 1

- Overview of Driver Distraction Problem
  - Statistics (crashes, injuries, fatalities, monetary burden)
- Forms of Distraction
  - Cognitive
  - Visual
  - Auditory
  - Manual
  - Definition of Driver Distraction
  - Overview of Methods to Assess Driver Distraction
    - Epidemiological
    - Empirical
    - Naturalistic

Session 2

- Possible Reasons for Discrepancies
  - Driver Choice
  - Self-regulation
  - Arousal
- Effectiveness of Policy Efforts to Reduce Driver Distraction from Electronic Devices
- Research Needs/Next Steps
- Minimizing Distracted Driving from Electronic Devices (what works, what shows promise, what doesn't work)
- Summary

SAFETY AND ACCIDENT RECONSTRUCTION

What You Will Receive:

- Thirty days of online single-user access (from date of purchase) to the two session, approximately four hour, recorded presentation
- Course workbook (downloadable, .pdf's)
- Online learning assessment
- Instructor follow up to your content questions
- .4 CEUs* (with satisfactory assessment score)

Instructor:	Jeffrey Hickman
	0.4 CEUs

INSTRUCTOR BIOGRAPHIES

Banish, Greg

Greg Banish is a mechanical engineer and motorsports enthusiast who works in Ford Motor Company's gasoline engine calibration group.

After studying for a bachelor's degree in Mechanical Engineering at GMI Engineering & Management Institute (Kettering University), he wrote his thesis on vehicle instrumentation and measurement. Putting this education to practical use, he founded his own performance shop outside of Detroit and has served local enthusiasts, shops, automotive companies and OEMs. Greg later worked for SiemensVDO and General Motors as a calibration engineer on programs ranging from direct injection turbocharged engines to the Chevy Volt Hybrid control system. He is a member of SAE International and SEMA and has authored two books on aftermarket EFI calibration. With thousands aftermarket calibrations performed, he has worked with a wide variety of engines and control systems in addition to his OEM calibration work.

Belanger, John-Paul

John-Paul Belanger is president of Geometric Learning Systems, a consulting firm specializing in geometric dimensioning and tolerancing (GD&T) and stack analysis. For over fifteen years, he has trained people throughout North America and Europe in the proper interpretation and application of GD&T per the Y14.5 standard by using practical examples. Mr. Belanger is certified by the American Society of Mechanical Engineers as a Senior GD&T Professional, and has worked with a wide range of companies in the automotive, aerospace, electronic, and other industries to apply tolerances and perform stack calculations. He holds a B.S. in aerospace engineering from the University of Michigan specializing in aircraft design and safety.

Bissell, Larry E.

Larry Bissell is a renowned and well respected international trainer, consultant, and auditor specializing in automotive supply chain management, supplier development, business management systems, business excellence, and continual improvement for all size automotive companies. Mr. Bissell is recognized as an authority on global supply chain requirements and global supplier development, particularly regarding the stringent requirements of automotive OEM's within the United States. His expertise, abilities, and techniques are designed and structured for automotive supplier organizations that wish to participate in the automotive global supply chain market. Mr. Bissell has over 30 years of industrial experience and has been directly involved in over 1000 highly successful management system audits and client consultations within the ISO 9001, QS-9000, and ISO/TS 16949:2002 arenas.

Blair, Julian

Julian Blair is the Calibration Process Lead of Engine Development, Calibration and Verification for General Motors. Named to this position in January 2013, Julian leads the Global Calibration Process Technical Resource Board with the charter of streamlining GM calibrations tools to enable the benefits of common process. Previously, Julian was a Calibration Specialist on V6 passenger car applications for a number of engine calibration areas namely; Torque Modeling and Control, Spark and Dilution Control, Electronic Throttle Control, and Fuel Control.

He also held positions of Lead Engine Calibrator, Test Automation Engineer and Test Technology Engineer in the GM Engine Development Dynamometer Laboratory. Julian joined GM's engineering team in 2001 after graduating from Tennessee State University with a Bachelor's and Master's degrees in Mechanical Engineering. He is also a licensed and registered Professional Engineer in the State of Michigan..

Buckman, Leonard

Leonard Buckman is president of Buckman Consulting Services, Inc., a fi with OEM and brake supplier clients in North America, Japan and Europe. Previously, he worked at Ford Motor Company as a brake specialist, heading up all heavy truck brake system design actions necessary for the initial implementation of FMVSS 121; at Rockwell International, serving as Chief Brake Engineer, Director of Worldwide Brake Engineering & Product Planning, and

INSTRUCTOR BIOGRAPHIES

Vice President of Brake and Axle Product Management; and at Meritor WABCO VCS as President and General Manager. Mr. Buckman has a unique perspective because of his experience as a brake specialist both at a major truck OEM and at major suppliers of worldwide brakes and brake systems. He was selected by the U.S. Secretary of Transportation to serve as the commercial vehicle brake specialist on the 1999 DOT Vehicle Safety Planning Group and has twice received the SAE Distinguished Speaker Award. Mr. Buckman is a registered Professional Engineer and holds a B.S. in engineering physics from Michigan Technological University. He also completed post-graduate work in engineering mechanics and mechanical engineering at Wayne State University and the University of Michigan, respectively.

Dishart, Peter T.

Peter T. Dishart manages the laminated glass business of PPG Industries Inc. He holds B.S. and M.S. degrees in mechanical engineering as well as an MBA. Dishart is a member of SAE and has served on the Glazing Committee. He is currently President of the Enhanced Protective Glass Automotive Association (EPGAA), an industry organization dedicated to laminated glass.

Fulton, Wes

Mr. Wes Fulton is the Founder and CEO of Fulton Findings. Prior, he was a program engineer/manager for AiResearch Los Angeles Division, Allied-Signal Aerospace Corporation. As a program engineer for aircraft actuation projects he had engineering and management responsibility for the Indigenous Defensive Fighter (IDF) leading edge flap actuation system (LEFAS) development and production, the Rockwell/MBB X-31A LEFAS flight test program, and the F-16 Fighting Falcon LEFAS production and deployment support. He co-patented a multi-fuseable shaft (high performance drive train device). Additionally, Mr. Fulton has over 20 years of programming experience as a private programmer and developed SuperSMITH® Visual, WeibullSMITHTM, LogNormSMITHTM, Normal+SMITHTM, Visual*SMITHTM, BiWeibullSMITHTM, and MonteCarloSMITHTM analysis software. He received his B.S.M.E. from Georgia Tech and his M.S.M.E. from California State University at Long Beach.

Gulati, Suresh

Dr. Suresh Gulati was a Research Fellow in the Science and Technology Division of Corning Inc. where he specialized in the behavior of glass, glass-ceramics and ceramics subjected to mechanical and thermal loads, their fatigue and fracture properties and their long-term reliability. He is a member of American Men and Women of Science and Who's Who in Technology Today. Dr. Gulati is the author of over 200 publications in the area of ceramic catalyst supports, fiber optics, liquid crystal display glasses, cathode ray tubes, space windows, automotive windshields, and stepper lenses made from high purity fused silica. Before joining Corning, he held positions with Cornell University, the University of Colorado, and Continental Can Company. Dr. Gulati has a Ph.D. in applied mechanics from the University of Colorado, an M.S. in mechanical engineering from Illinois Tech and a B.S. in mechanical engineering from the University of Bombay, India.

Hall, Thomas J.

Thomas J. Hall currently owns and manages MaxG Technology LLC. a technical consulting and training company, specializing in Vehicle Braking and Stability technology, formerly the Chief Engineer for Global Brake Systems - General Motors for the Robert Bosch Chassis Systems Division. Prior to that, he was the Engineering Manager for System Design and Validation at ITT Automotive, Continental Teves. His experience also includes development of ABS, TCS and Stability Control Systems, responsibility for application of system engineering principles and process to the brake industry and development and promotion of brake system proposals and advance braking technologies. Mr. Hall has a B.S. in mechanical engineering from the University of Michigan and a Master of Science in Finance from Walsh College.

Haughey, Bill

Bill Haughey is a respected consultant and instructor in the areas of Failure Modes Effects Analysis, Design for Manufacturability and Assembly, Design Review Based on Failure Modes, Design Review Based on Test Results, and other GD3 methodologies. He is a current member of the issuing committee of the SAE J1739 FMEA standard, SAE Automotive Quality and Process Improvement Committee; the SAE Automotive Electronic Systems Reliability Standards Committee; and the AIAG FMEA Fourth Edition Recommended Practice Committee. Mr. Haughey was recently approved to lead the development of a new SAE DRBFM Recommended Practice (J2886). Mr. Haughey formerly worked for GM, where he held various managerial, manufacturing, and engineering positions including Process Lead and Supervisor for FMEA and DFM/A. While at GM, Mr. Haughey also supported Tatsuhiko Yoshimura in the global implementation of the GD3 (DRBFM) methodology. Yoshimura considers Mr. Haughey to be a subject matter expert in the GD3 methodologies, including DRBFM and DRBTR. Mr. Haughey received a B.S. degree from the University of Michigan and M.S from Central Michigan University, and has the following certifications: Black Belt in GD3 (DRBFM and DRBTR); Master Design for Manufacturability and Assembly Engineer; and Certified Internal Auditor.

Heck, Ronald

Dr. Ron Heck is currently an independent consultant. Prior to that, Ron was a research manager responsible

INSTRUCTOR BIOGRAPHIES

for developing catalyst technology for Engelhard Corporation. He has worked on the development of catalytic processes in SCR NOx, NSCR NOx, automotive catalyst, diesel catalyst, PremAirTM catalyst systems, hydrogenation technology, ozone abatement, volatile organic compound abatement, ammonia oxidation, chemical feedstock purification and chemical synthesis. Ron is a member of American Men and Women of Science and Who's Who in Technology Today. He is an SAE International Fellow and a recipient of the SAE International Forest R. McFarland. He was a co-instructor for courses for SAE International in automotive emission control catalysis and diesel emission control catalysis. He was a member of the Scientific Advisory Board of the Strategic Environmental R&D Program for environmental studies in the Department of Defense. Ron has been involved in over 80 publications in commercial applications of catalysts and holds 36 U.S. patents on catalytic processes. He is the co-author of the book with Dr. Farrauto entitled"Catalytic Air Pollution Control: Commercial Technology" and is the former co-editor of the NewsBrief section of Applied Catalysis B: Environmental. Ron and his former research team from Engelhard received the 2004 Thomas Alva Edison Patent Award from R&D Council of New Jersey for the invention of close coupled catalyst technology for ultra low emission gasoline vehicles. Ron received his B.S. in Chemical Engineering and his Ph.D. from the University of Maryland.

Hickman, Jeffrey

Dr. Jeffrey Hickman is a Group Leader at the Virginia Tech Transportation Institute. His primary areas of research include community-wide applications of behavior-based safety, self-management, and organizational culture change techniques, assessing driver behavior, fatigue, work/rest cycles, and driver distraction in commercial motor operations. These research projects include competitive research awards from the FMCSA, NHTSA, Mine Health and Safety Administration, National Transportation Research Center, Inc., Transportation Research Board, Canadian Council of Motor Transport Administrators, and the AAA Foundation for Traffic Safety. He has over 60 presentations, 30 scientific publications and technical reports, scientific reviews for the National Institute for Occupational Safety and Health, and currently serves as a reviewer for the Journal of Occupational Health Psychology, Accident Analysis and Prevention, and Journal of Organizational Behavior Management. Dr. Hickman is also the President of Hickman Management Solutions. He has significant experience in the design, delivery, and implementation of targeted solutions for organizations looking to improve safety, productivity, and performance.

Khair, Magdi

Dr. Magdi Khair currently holds the position of Chief Technologist at Watlow, where he is assisting with the introduction of new technologies for the diesel engine industry. Dr. Khair recently retired from the position of Institute Engineer in the Engine, Emissions, and Vehicle Research Division at Southwest Research Institute. He is experienced in the areas of engine testing and exhaust emissions control. His prior experience was with AlliedSignal Automotive Catalyst Company with the development of catalytic aftertreatment for light-duty and heavy- duty diesel engines; Ford New Holland with primary responsibility for the development of the 6.6 and 7.8 liter midrange diesel engines to meet 1991 emissions standards; Bendix Diesel Engine Controls where he led the development of advanced electronically controlled diesel fuel injection systems and also established several cooperative engineering programs with European and North American engine manufacturers; and with Chrysler Corporation where he converted the slant six gasoline engine into an open chamber, pilot injected, and electronically controlled diesel engine, supervised a combustion kinetics project, and participated in the design and development of electronic controls for a passenger car turbine engine. Dr. Khair holds 20 U.S. patents in electronic fuel injection, turbocharging, exhaust gas recirculation, and aftertreatment systems. He has also authored and co-authored numerous SAE International and ASME papers. Dr. Khair is the co-author of the Diesel Emissions and their Control a text book marketed by SAE International. Dr. Khair received a B.S. in Automotive Engineering from Ain Shams University, an M.S. in Thermodynamics from the University of Birmingham, England, an M.B.A. from Michigan State University, and a PhD in Engineering Management from Warren National University.

Kurowski, Paul

Dr. Paul Kurowski is a professor in the Department of Mechanical and Materials Engineering at the University of Western Ontario. His teaching experience includes finite element analysis, machine design, mechanics of materials, kinematics and dynamics of machines, and product development. He is also the President of Design Generator Inc., a consulting firm specializing in product development, design analysis and training in Computer Aided Engineering methods. Dr. Kurowski has published multiple technical papers and taught professional development seminars for SAE International, the American Society of Mechanical Engineers, the Association of Professional Engineers of Ontario, the Parametric Technology Corp. (PTC), Rand Worldwide, SolidWorks Corp. and other companies and professional organizations. He contributes regularly to several engineering publications focusing on the implementation of CAE methods into the product development process. He is a member of SAE International and the Association of Professional Engineers of Ontario. Dr. Kurowski obtained his M.Sc. and Ph.D. in Applied Mechanics from Warsaw Technical University and completed postdoctoral

work at Kyoto University.

La, Chi Binh

Chi Binh La is the Business Unit Director, Gasoline and Alternative Fuels, IAV Inc. Chi Binh has over 15 years of experience in engine development covering NVH, mechanical development and calibration, as well as analysis and simulation. In 2012, he joined IAV where he is responsible for the strategic vision and profitable growth of the business unit. Technically the business unit is responsible for the development of gasoline and alternative fueled engines including base engine calibration to vehicle drivability, emissions and OBD. Chi Binh holds a Bachelor's Degree in Mechanical Engineering from University of Waterloo and a Master's Degree in Engine Systems from University of Wisconsin.

Lampman, Dewitt

DeWitt Lampman is a Staff Engineer with PPG Glass Research, where he has been in the Automotive OEM Process and Product Development Division since 1973. Mr. Lampman was a major contributor to the development of thin laminated sidelites, where he was involved with developing product specifications and process capability requirements for production, and conducting modeling and stress level measurements on vehicles to define glass and door design specifications, having worked with four automobile manufacturers in these areas. To date, Mr. Lampman holds seven U. S. Patents. Mr. Lampman graduated with a B.S. degree in Ceramic Engineering from Alfred University, Alfred, NY.

Levine, Russell Evan

Mr. Levine is a Partner at Kirkland & Ellis LLP where he has spent his entire career of over twenty-five years. He focuses his trial, appellate and alternative dispute resolution practice on patent infringement matters and disputes centered around technology transfer and patent license agreements. His trial practice includes jury trials, arbitrations and Section 337 proceedings before the U.S. International Trade Commission. His appellate practice concentrates on appeals in the Court of Appeals for the Federal Circuit. His technology transfer and licensing practice includes structuring and negotiating both licensing-in and licensing-out transactions.

Mr. Levine has received numerous accolades for his IP practice. His strategy of seeking and obtaining a Writ of Mandamus earned him "stand-out" recognition in The Financial Times, U.S. Innovative Lawyers 2011. He also won the International Law Office 2012 Client Choice Award in Litigation for the U.S. Additionally, Mr. Levine is named in the 2012 edition of IAM Patent 1000: The World's Leading Patent Practitioners and IAM Strategy 300: The World's Leading IP Strategists.

Mr. Levine is active in bar associations, industry organizations, and his community. He is the President-Elect of LES (USA & Canada); on the American Heart Association's Chicago Board of Directors; Chair of the By-Laws Committee of the Midwest Section of the United States Tennis Association; and the immediate Past-Chair of the President's Council at Chicago's Museum of Science and Industry.

Mr. Levine is an author and frequent speaker on Intellectual Property issues. He is co-editor of "International Licensing and Technology Transfer: Practice and the Law." His "Top 10" workshop at the LES Annual Meeting is consistently standing room only. Since 1988, he also has taught a course for the Society of Automotive Engineers entitled "Patent Law for Engineers."

Mr. Levine holds a B.S. in Interdisciplinary Engineering and a B.S. in Economics, both from the University of Michigan. He received his law degree from the University of Chicago, and he is on the World Intellectual Property Organization's List of Mediators and Arbitrators.

Lundstrom, Richard

Dr. Richard Lundstrom is an independent research and project engineer specializing in dynamic system engineering, automotive chassis development , and application of the science of improvement. He teaches Chassis Design, Systems Analysis and Mechanical Control Systems at Kettering University, where he also served as team leader for the annual Kettering Industry Symposium. Dr. Lundstrom previously taught several mechanical engineering courses, developed Vehicle Dynamics and Thermal System Design courses, and founded and directed the Vehicle Dynamics Lab at Lawrence Tech. He has worked as a product engineer with Ford Motor Company and developed and taught a Fundamentals of Vehicle Design course. Dr. Lundstrom is a member of SAE International, ASME, ASQ, ASEE and SCCA. He received a B.S. in Mechanical Engineering from the University of Illinois, a M.S. from the University of Michigan and a Ph.D. from Oakland University.

Mago, Angelo E.

Angelo Mago is senior consultant and owner of ATM Consulting, Inc., which provides customized training and consulting services to the supplier community in the areas of quality assurance, quality control, design engineering, document management, and customer service and improvement methods. He has over 25 years of experience in product design, quality assurance, project management and most recently worked as the Senior Supplier Quality Engineer for GM Truck Group responsible for PPAP qualification and approval. Mr. Mago is a recipient of the SAE International Forest R. McFarland Award for distinction in professional development/ education. He has a B.S. in Mechanical Engineering from Florida Institute of Technology.

Matthews, Ronald D.

INSTRUCTOR BIOGRAPHIES

Professor Ron Matthews, currently serving as a member of the SAE International Board of Directors, is Head of the General Motors Foundation Engines Research Laboratory on the campus of the University of Texas at Austin. He has been actively involved in engines research for 35 years, including engine control systems since the initial introduction of on-board computers. Dr. Matthews, a Fellow of SAE International, founded the Formula SAE competition in 1981 and has been the Faculty Advisor for a Formula SAE team each year since. He has been author or co-author on over 200 technical papers and reports, mostly in the field of engines.

McVea, William Mark

Dr. William Mark McVea, P.E., is currently Chief Technology Officer for Torvec, Inc., an industry leader in the design and development of patented powertrain engineering technology used primarily in the automotive industry. He is also President and Principal Engineer of KBE+, Inc. where Dr. McVea and his team design and develop complete powertrains for automotive and off-highway vehicles. His prior positions include Professor of Vehicle Dynamics and Powertrain Sciences in the Mechanical Engineering Department at the Rochester Institute of Technology and adjunct professor at Purdue University in their Automotive Sciences Department. He was also formerly a manager of the CAE group within a tier-one powertrain supplier to global automotive markets, a consulting engineer in vehicle dynamics with Gear Consultants, Inc., and a project manager of traction systems for off-highway vehicles with Clark-Hurth International. Dr. McVea has published extensively on the topics of transmission systems, automated design assistant systems, knowledge systems and knowledge based engineering in general. He also holds or is listed as co-inventor on numerous patents related to mechanical power transmissions. Dr. McVea holds a B.S. in Mechanical Engineering from the Rochester Institute of Technology, a Ph.D. in Design Engineering from Purdue University and is a licensed Professional Engineer..

Palazzolo, Joseph

Joe Palazzolo is employed as Chief Engineer – Geared Products at GKN Driveline Torque Technology Group where he manages the mechanical design and development of new automotive gearboxes, torque transfer devices, concepts, and integration into production applications. His prior professional experience includes all-wheel systems design and development, power transfer unit and transfer case design, and torque management device development at Visteon Corporation, Warn Industries, and Ford Motor Company.Mr. Palazzolo is an ASE certified Master Technician, chaired the SAE International All-Wheel Drive Standards Committee, and has been an active SAE International member since 1990. He is a past recipient of the SAE Forest R. McFarland Award for distinction in professional development and education (2007) and also achieved the SAE Master Instructor designation (2010). Mr. Palazzolo is the award winning author of High-Performance Differentials, Axles & Drivelines. He has designed, built, campaigned and supported various race cars and teams for both professional and amateur racing organizations. His scope of work has been entire vehicle inclusive but also focused on competitive, high-performance drivetrain systems. He holds a Bachelors degree in Mechanical Engineering from Cleveland State University and a Masters degree in Automotive Engineering from Lawrence Technological University. He has received numerous patents for his work and creativity in advancing mobility systems..

Park, Talus

Talus Park is the Calibration Skill Team Leader at AVL Powertrain Engineering based in Plymouth, Michigan. He is responsible for diesel and gasoline engine calibration, transmission calibration as well as certification services throughout North America. His team is focused on utilizing innovative tools and methods to deliver high quality calibration projects with maximum efficiency. Mr. Park has over twelve years of experience in the transportation industry focused on calibration. He earned both his Bachelor's and Master's degrees in mechanical engineering from West Virginia University.

Porter, Alexander (Alex) J.

Alexander J. Porter is the Chief Engineer for Programs, Performance, and Durability for Intertek, and has been with the company since 1992. Since 1996, he has been developing accelerated testing methods for mechanical components and systems. Mr. Porter has three patents relating to accelerated testing equipment and has authored over 40 articles and technical papers on accelerated testing. Alex is the author of the book Accelerated Testing and Validation, Elsevier 2004. His work in the past has included implementation of FEA in a laboratory setting and development of a thermal management system for an advanced data acquisition package developed by NASA's Drydon Flight Research Facility. Alex is a member of SAE International and IEEE. He holds a B.S. in aircraft engineering and an M.S. in mechanical engineering, both from Western Michigan University.

Reinhart, Thomas

Thomas Reinhart is a Program Manager for NVH in the Engine, Emissions, and Vehicle Research division of Southwest Research Institute. Previous roles include Senior Manager for NVH at Visteon Chassis Systems, where Mr. Reinhart was responsible for the NVH analysis and development of axles, driveshafts, and power steering systems. From 2001 to 2004, he was NVH Program Manager at Roush Industries, Inc. where he was responsible for NVH testing and development of diesel and gasoline engines, as well as transmissions,

axles and accessories. Diesel fuel system noise was a special focus of this work. Prior to Roush, he was Director of Noise & Vibration Technology at Cummins, Inc. Mr. Reinhart has been involved in solving noise and vibration issues in engines, as well as in a wide variety of engine applications, including pickup trucks, heavy duty trucks, construction equipment, and marine. Mr. Reinhart has developed noise reduction features for diesel engines, four of which have been patented. He has published 15 technical papers on Powertrain NVH topics. Mr. Reinhart received his B.S. and M.S. in mechanical engineering from Purdue University. He also spent a year studying automotive engineering at the Technical University of Hannover, Germany. His master's thesis focused on the application of acoustic intensity measurements to diesel engines.

Rosebro, Jack

Jack Rosebro has taught hybrid, plug-in hybrid, and electric vehicle technology to a wide variety of automotive industry professionals for the past ten years. Since 2006, he has developed and delivered curriculum for Perfect Sky, Inc. throughout the US and Canada. He also consults to community colleges that are integrating hybrid and electric vehicle technology into their curricula. Jack writes about hybrid technology, regulatory issues, and sustainable mobility for Green Car Congress, and is a frequent speaker at industry conferences. Previously, Jack developed and taught courses on hybrid and electric vehicles, air/fuel systems, OBD-II self-diagnostic systems, and emission control systems. He received his M.Sc. in Engineering from Blekinge Institute of Technology in Sweden.

Saha, Pranab

Pranab Saha is the principal consultant and co-founder of Kolano and Saha Engineers, Inc., an independent professional engineering and consulting company in acoustics, noise and vibration control. A well- known authority on automotive noise control and body interior systems, Dr. Saha has directed and participated nationally and internationally in numerous advanced noise control engineering programs and training seminars for various OEMs and suppliers in India, Mexico, and USA. Dr. Saha is currently the Chair of the SAE International Engineering Meetings Board, a Professional Development Instructor, and the Lead Faculty Member of the SAE International Vehicle Interior Noise Academy. He is also the past-chairman of the SAE Acoustical Materials Committee and has helped develop several standards in acoustics. Dr. Saha is an active member of ASA, ASME, ESD, INCE, NSPE, SAE International, and a contributing editor of Sound and Vibration publication. He has presented technical papers, organized and chaired numerous technical sessions sponsored by SAE International and other professional organizations. Dr. Saha has also won several awards presented by the SAE International and the Michigan Society of Professional Engineers (MSPE) and has been named an SAE Master Instructor. Dr. Saha holds a B.S. in Mechanical Engineering from the University of Calcutta, a M.S. in Engineering Sciences from the University of Florida and a Ph.D. in Mechanical Engineering (Acoustics Specialty) from the Georgia Institute of Technology.

Scaler, Dave

Dave Scaler is the owner of AdvantageMotorsports.com, a company that performs engineering and analysis in the field of racing data acquisition and produces data logger hardware, software and sensors for racers around the world. Celebrating his 25th year in the racing industry, Dave has worked as a race mechanic, engine builder, race engineer, and race team manager for Road Racing, Oval Track, Drag Racing and Bonneville teams. Dave has taught Data Acquisition seminars all over the US, and his practical, real-world training style has been well received in all forms of motorsports venues.

Shahed, S. M.

Dr. S. M. Shahed is Corporate Fellow at Honeywell Turbo Technologies, a business unit of Honeywell International, where he has developed and applied advanced boosting technology to reduce emissions and improve the fuel economy of gasoline and diesel engines for passenger cars, commercial vehicles and equipment. He previously worked for Cummins Inc. and Southwest Research Institute and held faculty positions at the University of California and the University of Texas. He is a Fellow of SAE International, ASME and the Institution of Engineers. Dr. Shahed served as 2002 President of SAE International. He has received several prestigious international awards including the I.Mech.E James Clayton Award, the SAE International Horning Memorial Award, the SAE International Arch Colwell Award and the University of Wisconsin Distinguished Service Citation. Dr. Shahed holds a B.E. degree from India and an M.S. and Ph.D. from the University of Wisconsin-Madison.

Sittsamer, Murray

Murray Sittsamer is founder of Luminous Group, a consulting firm specializing in streamlining and standardizing workflow for companies. Murray has over 22 years experience in operations management, strategic planning, new process launches, financial analysis, quality systems and process improvement. During the past ten years Murray has focused his work on supporting automotive OEMs and suppliers with their quality and productivity improvement efforts, especially in the areas of Advanced Product Quality Planning (APQP), Failure Mode and Effects Analysis (FMEA), variation reduction and Problem Solving. Before entering the consulting field in 1994, Murray served as director of distribution support and quality systems for Gelman Sciences. While there he led a successful 15-month effort to obtain ISO 9000 quality system registration and had the role of

project manager for a highly publicized groundwater contamination dispute. Murray earned his undergraduate degree in industrial engineering from the University of Pittsburgh and holds a Master of Science in Industrial Administration from Carnegie Mellon University.

Tuteja, Arjun D.

Dr. Arjun D. Tuteja has over 28 years of industry experience, mostly in advanced development of diesel engine systems. At Detroit Diesel Allison (a Division of General Motors), and later at GM Powertrain, Dr. Tuteja managed projects dealing with advanced diesels, stratified charged engines, aftertreatment systems, air systems, analytical modeling, and alternate fuels. He holds three patents on aftertreatment systems. Dr. Tuteja has a B.S. degree in Mechanical Engineering from India and an M.S. and Ph.D. degrees from the University of Wisconsin- Madison.

Walker, Jr. , James

James Walker, Jr. is currently a Principal Engineer specializing in chassis, brake, and electronic brake control systems at Carr Engineering, Inc. His prior professional experience includes brake control system development, design, release, and application engineering at Kelsey-Hayes, Saturn Corporation, General Motors, Bosch, Ford Motor Company, and Delphi. Mr. Walker created scR motorsports consulting in 1997, and subsequently competed in seven years of SCCA Club Racing in the Showroom Stock and Improved Touring categories. Through scR motorsports, he has been actively serving as an industry advisor to Kettering University in the fields of brake system design and brake control systems. Since 2001, he has served as a brake control system consultant for StopTech, a manufacturer of high-performance racing brake systems. In addition to providing freelance material to multiple automotive publications focusing on chassis and brake technology, Mr. Walker is the author of the book High-Performance Brake Systems: Design, Selection, and Installation. In 2005, he was presented with the SAE International Forest R. McFarland Award for distinction in professional development and education and in 2010 he was awarded the SAE International Master Instructor designation. He obtained his B.S.M.E. in 1994 from GMI Engineering & Management Institute.

Williams, Jack

Mr. Williams is the principal at Airflow & Aerodynamics Engineering, LLC and an independent consultant specializing in the design and development of thermal management systems and vehicle aerodynamics. He is an adjunct faculty member at the Lawrence Technological University (LTU) and a guest lecturer for their MSAE Program on Automotive Mechanical Systems. In addition to his consulting work, he conducts professional development seminars for engineers on cooling systems, HEV battery thermal management, and road vehicle aerodynamics. Mr. Williams has over thirty years engineering management experience in product development at Ford Motor Co. Additionally, he was an aerodynamics project leader with the USAF Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio where he specialized in engine/aircraft integration, gas turbine engine performance, inlet design, and aircraft mission analysis. An active member of the SAE International, Mr. Williams has authored over twenty technical papers, given invited lectures at major mid-west universities, and has received professional awards and international recognition for his innovative work. He is a recipient of the Henry Ford II Technology Award, the SAE International Industrial Lectureship Award, the SAE International Oral Presentation Award, and the SAE International Forest R. McFarland Award. He holds a B.S. in Aeronautical Engineering from the University of Detroit and an M.S. in Aerospace/Mechanical Engineering from the United States Air Force Institute of Technology.

Zachos, Mark

Mark Zachos is currently an adjunct professor at the University of Michigan. He is the President of Dearborn Group, Inc. and has more then twenty years of networking experience. Mr. Zachos participates in many SAE International and ISO multiplexing committees, including the following: J1850, J1939, J2284, J2411, and J2367. He holds a B.S. and an M.S. in engineering from the University of Michigan.

Zielinski, Kevin

Kevin Zielinski currently owns and operates Red Cedar Media LLC, a training and corporate communications consulting, design, development and delivery company based in Michigan. Previously, Kevin was Senior Applications Specialist for EDS (including General Motors/EDS and Hewlett Packard/EDS) specializing in technical training delivery, training consulting, courseware design and development, and e-Learning. He has designed, developed and delivered over 40 lecture- and web-based courses attended by General Motors and EDS employees worldwide. Mr. Zielinski has also served as Adjunct Professor for the Wayne State University College of Engineering and WSU/Focus:Hope for many years. His areas of expertise include: e-Learning design and development, Quality Tools and Methods (Design of Six Sigma, Robust Engineering, Design of Experiments (DOE), Statistical Tolerancing and GD&T); Design for Manufacturing and Assembly (DFMA); Engineering Economics; and Plant Floor Throughput Improvement. He has been an instructor for SAE International Professional Development since 1990, and is a recipient of SAE International's Forest R. McFarland Award (April 2005). He holds a bachelor's and master's degree in engineering from Wayne State University.

INSTRUCTOR INDEX

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