3M Co.
Ace Precision Machining Corp.
Advanced Atomization Technologies
AeroEdge
AIDC
Airbus
Albany Engineered Composites
Alcoa Fastening Systems and Rings
Alcoa Howmet Castings
AlliedSignal Inc.
American Airlines
Andover Industries
ASC Exterior Technologies
ASQ China
ATI - GE Aviation
ATI Specialty Materials
Auxitrol SA
Avio Aero
BAE Systems
Beacon Industries
BendixKing by Honeywell
Boeing Co.
Bombardier Aerospace
Cardell Corp.
Cardone Industries
Celestica Inc
Cessna
Champion Aerospace LLC
Charles E. Larson
China Aero-Polytechnology
Cinco Connectors
Consolidated Precision Products (CPP)
Continental Tire Canada
Delphi Corp.
Denso Manufacturing
Division
Dixie Aerospace LLC
Doncasters Blaenavon
Eaton Corp.
EGAP and NAFCO
EKK Eagle Industry Co., Ltd.
Elbit Systems of America
Emby-Riddle Aeronautical University
ERAMET
Establishment
Esterline/CMC Electronics
Esterline-Leach International
FAA William J. Hughes Technical Center
FACC AG Austria
Federal-Mogul Corporation
FIGEAC-AERO
Ford Motor Co.
Freudenberg-Nok
Gables Engineering Inc.
GE
General Dynamics Corp.
GKN Aerospace Sweden AB
Gogo LLC
Goodrich Aerospace Services LTD
Gulfstream Aerospace
Hamilton Sundstrand Power Systems
Henkel Corporation, Aerospace Group
Hitchiner Manufacturing Co.
Honeywell International
Howmet Dover Casting
Husqvarna Group
Hypertherm Inc.
IHI Corporation Japan
IMP Aerospace & Defense
Industrial Neotex S.A.
ITP Ingenieria Y Fabrication
ITP Tubes
ITT Industries Inc.
Jet Propulsion Laboratory
Kessington LLC
L&E Engineering
Labinal
Lewis Engineering Inc.
LG Silicon Valley Lab
Lockhead Martin
Materion Brush Inc.
MBS Fabrication, Inc.
Messier-Dowty Inc.
Mentalyn Sintered Components
Miba Gleitlager Austria GmbH
Moeller Mfg. Co.
Morgan Advanced Materials, Wesgo Metals
MTS Systems Corp.
NASA
National Renewable Energy Laboratory
Naval Air Warfare Center Aircraft Div.
Nemak
New Flyer Industries
Nicholson's Sealing Technologies
Northstar Aerospace
Northwire Inc.
NTN Bearing Corporation of America
Oerlikon Eldim (NL) B.V.
Parker Hannifin
PCC Aerostructures
PCC Airfoils SA de CV
PCC Structural, Inc.
Pilatus Aircraft Ltd.
Plexus Corporation
PPG Industries
Pratt & Whitney
Pre-Cal Spark Ltd
PT AMC Bintan
Purolator Products Co.
Rexnord Aerospace
S.C. Johnson
Safa America Inc.
Schaeffler Group USA
Securaplane
Senior Aerospace Ermeto
Sierra Nevada Corporation
SKF
Southwest Research Institute
SPS Technologies
Stant Manufacturing Inc.
Systems Research Laboratories Inc.
Taftair Fluid Controls
TAIKOO Aircraft Engineering Co. Ltd.
TATA Sikorsky Aerospace Limited
TEAM Industries
Techspace Aero
TEC Power
Teradyne Inc.
Tesla
Texas Instruments Inc.
The Spaceship Company
The Timken Co.
Toray Composites America
Triumph Composites America
U.S. Air Force, Navy, & Coast Guard
Ultra Electronics Controls
Unison Engine Components
UTC Aerospace Systems
Vector CANtech Inc.
Venture Aerobearings
Vought Aircraft
Zodiac Seats California, LLC
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

Many courses are available in multiple formats. See page VIII to get more information on the learning formats offered by SAE. In addition to finding courses that fit your technology need, look for courses with icons that fit the way you want to learn.

CLASSROOM – indicates the course is an instructor-led seminar or workshop offered in a classroom setting

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

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 XII

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

TABLE OF CONTENTS

Catalog Key .............................................................................................................................................I
About SAE International........................................................................................................................... V
SAE Corporate Learning Solutions........................................................................................................ VI
Accreditations.....................................................................................................................................VII
Learning Formats..............................................................................................................................VIII
SAE Certification, Certificate, & Credentialing Programs ................................................................. X
Instructor Index.................................................................................................................................130
Instructor Biographies......................................................................................................................131
2017 SAE Professional Development Course Schedule .............................................................139

COURSES & LEARNING PRODUCTS BY TECHNOLOGY

ELECTRICAL, ELECTRONICS AND AVIONICS
ARP4754A and the Guidelines for Development of Civil Aircraft and Systems ..................... 1
ARP4761 and the Safety Assessment Process for Civil Airborne Systems ............................... 2
Design Considerations for Electromechanical Flight Control Actuation Systems ................. 3
Applying DO-254 for Avionics Hardware Development and Certification............................ 3
Introduction to DO-178C ....................................................................................................................... 4
Power Electronics for Mechanical Engineers ............................................................................. 5
RFID Selection, Application, and Use in Aerospace, Space and Transportation ................. 6

ENGINEERING TOOLS AND METHODS
Accelerated Test Methods for Ground and Aerospace Vehicle Development ....................... 7
ANOVA for Design of Experiments .............................................................................................. 8
Design and Process Failure Modes and Effects Analysis (FMEA) ........................................... 9
Design for Manufacturing & Assembly ......................................................................................10
Design of Experiments (DOE) for Engineers .............................................................................11
Design of Experiments (DOE) for Engineers Web Seminar ......................................................12
Design of Experiments - Basic Simplified Taguchi .................................................................12
Design Review Workshop .........................................................................................................14
Design for Manufacture & Assembly (DFM/DFA) ..............................................................15
Finite Element Analysis (FEA) for Design Engineers Web Seminar ......................................16
Finite Element Analysis for Design Engineers On Demand Course ...................................17
## TABLE OF CONTENTS

Introduction to FMEA: What, Why, When, and How On Demand Course ................................................................. 18  
Failure Modes and Effects Analysis (Product and Process) in Aerospace ................................................................. 20  
Fundamentals of Statistical Process Control ........................................... 20  
Introduction to Design Review Based on Failure Modes (DBRFM) Web Seminar ..................................................... 22  
Introduction to Failure Mode and Effects Analysis for Product and Process .............................................................. 23  
Reverse Engineering: Technology of Reinvention ............................... 24  
Robust Design ................................................................................ 25  
Simplified Taguchi/DOE Methods ...................................................... 26  
Statistical Methods for Quality Engineering ..................................... 26  
Vibration Analysis Using Finite Element Analysis (FEA) ................. 27  
Tolerance Stack-Up Fundamentals Web Seminar ............................ 28  
Fundamentals of Geometric Dimensioning & Tolerancing (GD&T Web Seminar) .................................................. 29  
Advanced GD&T Competencies: Composite Positioning Web Seminar ........................................................................ 30  
Advanced GD&T Competencies: Datum Usage Web Seminar 4 4  30  
Advanced GD&T Competencies: Profile of a Surface Web Seminar ............................................................................ 31  
**GEOMETRIC DIMENSIONING AND TOLERANCING EDUCATION FROM ETI, INC. – AN SAE INTERNATIONAL COMPANY**  
Engineering Drawing Requirements .................................................. 32  
Solid Model Tolerancing (Based on ASME Y14.1) ......................... 33  
Fundamentals of GD&T (Based on ASME Y14.5M-1994) .......... 34  
Fundamentals of GD&T for Inspectors (Y14.5M-1994, Y14.5.1, and Y14.43 Standards) ........................................ 35  
Introduction to Statistical Tolerance Stacks ................................. 38  
Critical Concepts of Tolerance Stacks Based on ASME Y14.5-2009 ........................................................................... 39  
GD&T for Manufacturing (ASME Y14.5-2009 Standard) ............. 40  
Applications of GD&T (Based on Y14.5M-1994 & Y14.5-2009) .............................................................................. 41  
Functional Gaging and Measurement (ASME Y14.43, Y14.5, Y14.5.1, B89.3.1, B89.7.2, and B89.7.3 Standards) .............. 42  
Advanced Concepts of GD&T (Based on Y14.5M-1994) ............. 44  
Tolerance Stacks Using GD&T ......................................................... 46  
ISO Geometrical Tolerancing (Based on ISO 1101:2004 and related standards) ................................................................. 47  
ASME Y14.5-1994-2009 Comparison ............................................. 48  
Fundamentals of GD&T (Based on ASME Y14.5-2009) ............. 49  
ASME to ISO Standards Comparison ........................................... 50  
**GEOMETRIC DIMENSIONING AND TOLERANCING EDUCATIONAL & REFERENCE RESOURCES FROM ETI, INC.**  
Advanced Concepts of Geometric Dimensioning and Tolerancing (based on ASME Y14.5M-1994) Reference Book 52  
Tolerance Stacks Using Geometric Dimensioning and Tolerancing with Drawing Package Reference Pack .................... 52  
The GD&T Trainer: Fundamentals 2009 (based on ASME Y14.5M-2009) Software Package ................................................. 53  
ISO GPS Quick Reference Reference Software .......................... 54  
Fundamentals of Geometric Dimensioning and Tolerancing Video Training Program Video Workbook (based on ASME Y14.5M-1994) ................................................................. 55  
GD&T Workbook with Engineering Drawings (based on ASME Y14.5M-1994) .............................................................. 55  
Fundamentals of GD&T Self-Study Workbook (based on ASME 14.5M-1994) ........................................................................ 56  
Tolerance Stacks Self Study Course ................................................. 56  
Alex Krulikowski’s ISO Geometrical Tolerancing Reference Guide ................................................................................ 57  
ASME Y14.5M-1994 to ASME Y14.5-2009 New Features Comparison Chart ................................................................. 57  
ASME Y14.5M-1994 Reference Chart ................................................ 58  
The Ultimate GD&T Pocket Guide (ASME Y14.5-2009) ............... 58  
The Ultimate GD&T Pocket Guide (ASME Y14.5M-1994) .......... 58  
The ISO GPS Ultimate GD&T Pocket Guide ................................. 59  
**MANAGEMENT AND PRODUCT DEVELOPMENT**  
Aerospace Product Support: Sustaintment Throughout the Life Cycle ................................................................. 62  
Aerospace Program Management - It’s More than Scheduling and Delivery ................................................................. 63  
Creating and Managing a Product Compliance Program .................. 64  
Leading High Performance Teams .................................................. 65  
Managing Programs and Associated Risks .................................. 66  
Managing Engineering & Technical Professionals ................. 67  
Patent Law for Engineers ................................................................. 68  
Patent Litigation in the U.S.: What You Need to Know Web Seminar ................................................................. 68  
Patent Litigation Risk Management Toolkit Web Seminar .......... 69  
Principled Negotiation ................................................................. 70  
Principles of Cost and Finance for Engineers ............................. 71  
Product Liability and The Engineer ............................................... 72  
Root Cause Problem Solving: Methods and Tools Web Seminar ................................................................. 73  
Root Cause Problem Solving: Methods and Tools On Demand Course ................................................................. 74  
Strategic Leadership .................................................................. 75  
Success Strategies for Women in Industry and Business ............... 77  
The Role of the Expert Witness in Product Liability Litigation .......... 78  
Understanding the FAA Aircraft Certification Process ............... 78
# TABLE OF CONTENTS

## MANUFACTURING
Aerospace Precision Forging Design and Quality Control .................. 81
Aerospace Precision Forging Processes and Technology .................. 82
Automated Systems for Aerospace and Space Applications ............. 83
Corrosion of Metals ...................................................................... 84
Corrosion of Metals: Chemistry of Corrosion ................................ 85
Corrosion of Metals: Galvanic Corrosion ....................................... 85
Corrosion of Metals: Uniform Corrosion ....................................... 86
Introduction to Composites Fabrication and Assembly in
  Aerospace, Space, and Transportation ....................................... 86
Hardness Testing .......................................................................... 87
Metallurgy of Precipitation Strengthening .................................... 88
Metallurgy of Steel Case Hardening ............................................. 88
Metallurgy of Steel Through Hardening ....................................... 89
Metallurgy of Steel: Principles .................................................... 89
Principles of Metallurgy ................................................................ 90

## MATERIALS
Corrosion Engineering and Prevention ........................................ 91
Failure Analysis of Metals ......................................................... 92
Materials Selection Process for Engineering Designs
  Web Seminar ............................................................................. 93
Sound Package Materials for Vehicle Noise Control .................... 94
Vehicle Sound Package Materials Web Seminar ................................ 94

## PROPULSION
Aircraft Hydraulic Pumps - Application,
  Design and Integration ............................................................ 96
Aerospace Hydraulic Components ................................................ 97
Damage Tolerance for Gas Turbine Engines .................................. 97
Introduction to Aircraft Hydraulic System Design and
  Certification ............................................................................... 98
Liquid Atomization, Sprays, and Fuel Injection ............................ 99
Microbial Contamination in Aviation Fuel and
  Aircraft Fuel Systems ................................................................ 100
Seals and Sealing System Design of Actuation Systems in
  Military and Commercial Aircraft ............................................ 101

## SAFETY AND QUALITY
Aircraft Cabin Safety and Interior Crashworthiness ....................... 102
AS9100D:2016 and ISO 9001:2015 Explained
  Web Seminar ............................................................................. 103
Common Training for DPRV Personnel
  (formerly: Aerospace Supplier Quality:
  Common Training for Self-Release Delegates) ......................... 104
AS9100D Internal Auditor Training ............................................. 106
Introduction to Advanced Product Quality Planning (APQP)
  On Demand Course .................................................................. 107
Introduction to Weibull Solution Methods
  On Demand Course .................................................................. 108
Principles of ISO 9001, ISO/TS 16949 and AS9100
  On Demand Course .................................................................. 109
Understanding and Supporting Aircraft Accident Investigation
  and Reconstruction .................................................................... 110
Understanding the FAA Parts Manufacture Approval
  Process ..................................................................................... 110
Weibull-Log Normal Analysis Workshop ...................................... 112

## CALISO ON DEMAND COURSES
Good Laboratory Practices ......................................................... 113
ISO 9001 Overview ..................................................................... 113
ISO 9001:2008 Training ............................................................. 114
ISO 9001:2008 Auditor Training ................................................ 114
ISO 9001:2008 Lead Auditor ...................................................... 115
ISO 9001 Business Strategy ....................................................... 115
ISO 9001:2015 Overview ............................................................ 116
ISO 9001:2015 Training ............................................................. 116
ISO 9001:2015 Auditor Training ................................................. 117
ISO 9001:2015 Lead Auditor ...................................................... 117
ISO 14001:2004 Training ............................................................ 118
ISO 14001:2004 Auditor Training ................................................. 119
ISO 14001:2004 Lead Auditor ...................................................... 119
ISO 14001:2015 Training ............................................................ 120
ISO 14001:2015 Auditor Training ................................................. 121
ISO 14001:2015 Lead Auditor ...................................................... 121
ISO/TS 16949:2009 Training ....................................................... 122
ISO/TS 16949:2009 Auditor Training ........................................... 122
ISO/TS 16949:2009 Lead Auditor Training ................................... 123
ISO/TS 16949:2009 Lead Auditor ................................................ 123
ISO 19011:2011 Auditor Training ............................................... 123
ISO 19011:2011 Lead Auditor Training ......................................... 123
Sarbanes-Oxley (SOX) Training ................................................. 124
Six Sigma Overview ................................................................. 124

## TESTS AND TESTING
Accelerated Test Methods for Ground and Aerospace
  Vehicle Development ............................................................... 127
Practical NVH Signal Processing Methods ..................................... 128
NEED TO TRAIN YOUR WHOLE TEAM?

Bring SAE education and training to your location. Get variety, customization, quality and convenience. SAE International Corporate Learning advisors work with you to determine the best options to meet YOUR specific training challenge AND develop solutions to fit your budget and your schedule.

Through SAE Corporate Learning Solutions you can:

- Select a SAE course for delivery at your site
- Purchase a corporate subscription for a few courses or the entire library of over 50 online courses (350+ hours of content available)

Contact SAE Corporate Learning Solutions today to discuss how SAE can best meet your training needs.

TRAINING.SAE.ORG/CORPLEARNING
YOUR TRUSTED TRAINING RESOURCE.

SAE International is the world’s leader in mobility engineering knowledge. Engineers and other professionals around the globe trust SAE 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 on demand learning opportunities—learning opportunities that supply the right content to help solve your specific challenges.

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.
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 on demand course for one or many employees
• Purchase a corporate subscription to the entire library of over 50 on demand 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 including classroom, online, and on demand offerings. Integrate these options for a blended solution.
• Personalization — If you can’t find the specific topic you need or if the course content does not exactly match your requirements, let SAE customize a training program to meet your needs.
• Quality — You are assured relevant and accurate training conducted by leading academic and industry instructors. SAE offers to you ONLY courses and instructors reviewed and approved by objective industry experts.
• 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=time and cost savings. Also, our extensive network and existing course list means we can offer you extremely competitive pricing!
• 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.

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

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
- For online or on demand courses, participation can be accommodated through individual or group access

ACCREDITATIONS

The IACET CEU

SAE International is recognized as an Accredited 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 course 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.
LEARNING FORMATS

A LEARNING FORMAT TO FIT EVERY NEED
SAE offers a variety of learning formats to accommodate diverse learning styles. Explore classroom, live and online, or on demand courses. Many courses are available in multiple formats so be sure to watch for icons identifying the format for each course.

Seminars or workshops available as similar live, online Web Seminars will feature both icons. The course description for the Web Seminar will be listed immediately following the classroom title.

Live, online or classroom courses that have a similar course offered on demand will include both icons – watch for those descriptions or notes on where to get additional information.

SEMINARS AND WORKSHOPS
SAE International offers over 200 seminar and classroom titles in 100 separate technology and business skill topics. These seminars and workshops range from one-to-three days and are led by highly-qualified, industry or academic experts. SAE live, classroom courses are interactive and encourage skill-development and problem solving. Each course includes comprehensive course materials to assist the learner in implementing the knowledge gained in the course.

Additionally, we offer nearly all courses throughout the year at the SAE International Office in Troy, Michigan; or at sights across the US and the world including at SAE International Engineering Events. View the public enrollment schedule on page 139 or at training.sae.org/calendar/.

ENGINEERING ACADEMY
SAE’s award-winning Engineering Academy format is an intensive “boot camp” experience that immerses attendees in a focused technology area. The Engineering Academy is a comprehensive training experience on core engineering topics. Multiple instructors team up to provide interactive lecture, discussion, and practice – all designed to aid learning and application.

The Engineering AcademySM is perfect for newly hired engineers or those changing technical disciplines who need to quickly develop a new skill set in order to become productive on the job. The Engineering Academy format earned the prestigious Award of Excellence from the American Society of Association Executives.

For a current schedule of upcoming Academies, visit training.sae.org/academies/.

SAE E-LEARNING
Learners can take advantage of the convenience and cost effectiveness offered by e-Learning from SAE. SAE maintains a growing menu of learning products delivered online. These programs are listed throughout the catalog. Look for the icons that denote live online or on demand.

Live, Online Courses
Informative and content-rich, SAE live, online courses are instructor-led programs delivered via the internet or internet and telephone. Schedules and budgets can make it difficult to attend a classroom offering so SAE has developed a web seminar format to deliver technical courses directly. Delivered in one or a series of 90 to 120-minute sessions, Web Seminars feature audio delivered by telephone or VoIP, web-based presentations, inter-
active question-and-answer, and course-specific online forums for posting of supplemental materials, networking and course activities. Comprehensive course materials are also provided in PDF format. CEU’s are awarded when course requirements have been met. Look for the live, online icon throughout the catalog.

**On Demand Courses**

Avoid travel expenses and time out of the office, and make learning fit into your schedule. Access on demand courses right from your PC through the internet. There are more than 50 courses with over 300 hours of content. Many of our on demand courses are based on classroom offerings or are replays of our most popular Web Seminars. We also provide short-courses designed to bring team members quickly up-to-speed on a specific subject. Look for the symbol in the course description to identify those titles that are delivered on demand.

There are varying equipment requirements for the different online or on demand options. Visit the webpage for each course to determine if your system meets the course equipment requirements.

**On Demand courses INCLUDE:**

- Quick, short-duration courses on targeted topics
- Full length, self-paced courses based on our most popular instructor-led seminars
- Replays of recorded web seminars
- Courses on international standards, including ISO 9001, ISO 14001, ISO/TS 16949, and ISO 19011
- A portfolio of courses with a focus on metallurgy concepts and practices
- Powertrain and Global 8D courses produced by Ford Quality Office

Your company can subscribe to one title or the entire collection for just a few employees or for every employee. Please contact the Corporate Learning Solutions hotline, 1-724-772-8529 for additional information or to receive a proposal.
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–Certificate of Competency and Certified Vehicle Electrification Professional (CVEP). The VE Certificate of Competency validates mastery of basic systems and safety. The CVEP certification recognizes professionals who have met the required education and work experience and passed an extensive exam covering an industry-generated body of knowledge.

The Connected Vehicle Professional™ Program: designed for all engineering, technical, and industry professionals who touch the “connected vehicle”, the multi-course program provides the understanding of vehicle and infrastructure connectivity necessary to operate within the rapidly advancing field of automated and connected vehicles.
EARN A CURRICULUM-BASED, MULTI-COURSE CERTIFICATE IN A SPECIFIC TECHNICAL AREA.

Intended to provide a guide towards deeper knowledge in a specific area, SAE’s multi-course certificate outlines 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.

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; on demand I.D.# PD PD330933ON)
• Tolerance Stack-up Fundamentals Web Seminar or Web Seminar RePlay - (live, online: I.D.# C0842; on demand I.D.# PD PD330842ON)
• Root Cause Problem Solving: Methods and Tools Web Seminar or Web Seminar RePlay (live, online: I.D.# WB0931; on demand I.D.# PD PD330931ON)

Choose one elective:

• Accelerated Test Methods for Ground and Aerospace Vehicle Development (classroom: I.D.# C0316 or on demand option)
• 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; on demand I.D.# PD PD330947ON)
• 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)

Additional elective courses: Courses no longer offered by SAE but eligible to be used as electives for this program, providing they were completed within seven years of the date the Certificate is requested, include:

• Geometric Dimensioning & Tolerancing - classroom seminar (I.D.# C0133)
• Tolerance Stack-Up Analysis - classroom seminar (I.D.# C0022)

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)

For more information on the curriculum-based, multi-course certificates and to find out how to obtain your SAE certificate, visit training.sae.org/credentialing/certificate/
BUILD YOUR SKILLS & KNOWLEDGE
ADVANCE YOUR CAREER

Stay current on the latest technology, increase your knowledge, and positively affect your organization’s bottom line with:

- Practical, useable industry knowledge delivered by respected and expert professionals
- Networking with authorities and learning alongside industry peers
- The technical content you expect from online courses offering time- and money-saving training
- Customized onsite training designed for your organization’s specific needs

Build on your core education with fundamentals courses or specialize with technology-specific training - find the solution that fits your needs at SAE.

Plan Your Professional Development Now

training.sae.org
ARP4754A and the Guidelines for Development of Civil Aircraft and Systems

2 Days
I.D.# C1118

ARP4754A substantially revises the industry guidance for the development of aircraft and aircraft systems while taking into account the overall aircraft operating environment and functions. This development process includes validation of requirements and verification of the design implementation for certification and product assurance. ARP4754A provides the practices for showing compliance with regulations and serves to assist companies in developing and meeting its own internal standards though application of the described guidelines.

This two day seminar will provide attendees with an in-depth presentation of the guidelines introduced in the revised recommended practice for aircraft and systems development as well as the critical concepts used in aircraft and systems development processes for certification. The aircraft/systems development process and its interactions with the safety, hardware development and software development processes will be discussed along with the incorporated changes, with special emphasis on new material and development concepts. Additionally, the relationship and key interactions between the aircraft/system guidance material established in ARP4754A and the guidance material in DO-254 for hardware and DO-178B for software will be reviewed to ensure attendees gain insight into the expectations being established for aircraft certification.

In addition to the seminar handout, a copy of ARP4754A: Guidelines for Development of Civil Aircraft and Systems will be provided to each attendee.

Who Should Attend

This seminar is designed for engineers and other key personnel working in the design, development, and safety assessments of aircraft and aircraft systems.

Learning Objectives

By attending this seminar, participants will be able to:
• Identify the changes between the legacy ARP4754 and ARP4754A
• Explain the aircraft/systems development process and its interaction with the safety assessment process,
• Identify the key aircraft/systems development processes and their interrelationships
• Discover and be able to apply new guidelines on Functional and Item Development Assurance Levels (FDAL & IDAL)
• Apply the new guideline material within your own company context

Topical Outline

DAY ONE
• Introduction
  • Overview of seminar material
• ARP4754A Development History
  • How we got here.
  • Who contributed to the revision?
• ARP4754 to ARP4754A Change Highlights
  • Chapter by chapter change review
• Aircraft / Systems Development Process
  • Overview of Process
  • Discussion of Interactions with safety processes
  • Discussion of Interactions with hardware and software development processes
ARP4761 and the Safety Assessment Process for Civil Airborne Systems

2 Days
I.D.# C1245

ARP4761 describes guidelines and methods for performing safety assessments. This recommended practice is associated with showing compliance with certification requirements (14CFR/CS Parts 23 and 25, section 1309) and assisting a company in meeting their own internal safety standards. The safety processes described are primarily associated with civil airborne equipment but the processes and tools may be applied to many applications.

This 2 day seminar provides attendees with the guideline information for conducting industry accepted safety assessments consisting of Functional Hazard Assessment (FHA), Preliminary System Safety Assessment (PSSA), and System Safety Assessment (SSA). Discussion on various safety analysis methods needed to conduct the safety assessments is included. Safety analysis methods including Fault Tree Analysis (FTA), Dependence Diagram (DD), Markov Analysis (MA), Failure Modes and Effect Analysis (FMEA) and Common Cause Analysis (CCA). CCA is composed of Zonal Safety Analysis (ZSA), Particular Risks Analysis (PRA), and Common Mode Analysis (CMA) and will be covered in this seminar.

In addition to the seminar handout, a copy of the ARP4761: Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment standard will be provided to each attendee.

Learning Objectives
By attending this seminar, participants will be able to:
• Identify multiple safety assessment methods and tools
• Relate the key attributes of ARP4761 FHA, PSSA, SSA, FTA, DD, MA, CCA
• Identify the applications for safety tools
• Identify the interaction between the safety processes and the development processes
• Apply multiple safety methods in completing a PSSA or SSA
• Evaluate future tools and methods for inclusion in ARP4761A

Who Should Attend
This course is designed for engineers and professionals, working at all levels, who are involved in or interact with the aircraft and/or aircraft system safety assessment processes.

Topical Outline
Day One
• Course Overview
• Key Definitions
• Introduction and overview of ARP4761 course material
• Safety / Development Process
• Functional Hazard Assessment (FHA)
• Preliminary System Safety Analysis (PSSA)
• Fault Tree Analysis (FTA)
• Dependency Diagram (DD)
• Markov Analysis (MA)

Day Two
• Failure Modes & Effects Analysis (FMEA)
• Common Cause Analysis (CCA)
• Particular Risks Analysis (PRA)
• Zonal Safety Analysis (ZSA)
• Common Mode Analysis (CMA)
• System Safety Analysis (SSA)
• Contiguous Example (Appendix L)
• ARP4761A
• New tools / methods in the works
• Revision A timeline
• Summary and Review
• Review of presented material
• Question and Answer

Instructor: Eric M. Peterson
Fee $1440 1.3 CEUs
Design Considerations for Electromechanical Flight Control Actuation Systems

.5 Day
I.D.# C1207

This four-hour short course intends to present an overview of electrically powered flight control actuation systems, covering commercial applications. The scope covers issues related to the mechanical design of actuators themselves, with limited reference to their control electronics. Additionally, this course will provide participants an understanding of the design considerations behind these actuation systems.

**Learning Objectives**

By attending this seminar, participants will be able to:
- Explain electromechanical actuation systems in aircraft flight control systems
- Identify key design considerations of electromechanical actuators
- Identify a few key design considerations of electric actuator control electronics
- Evaluate overall design considerations of electromechanical flight control actuation systems

**Who Should Attend**

This seminar is designed for engineers and other key personnel with little or no previous electromechanical flight control actuation knowledge.

**Topical Outline**

- EMA Configurations
  - Rotary
  - Linear
  - Redundancy schemes
- Typical Requirements
  - Operating modes
  - Loads (applied, generated, and duty cycle)
  - Stroke
  - Rates
  - Life
  - Stiffness
  - Other typical requirements from ARP5812
- Actuator Components
  - Motors
  - Gears
  - Ball Screws
  - Roller Screws
  - Stops
  - Brakes
  - No-backs
  - Torque Limiters

Applied DO-254 for Avionics Hardware Development and Certification

2 Days
I.D.# C1703

The avionics hardware industry world-wide is now commonly required to follow DO-254 Design Assurance Guidance for Airborne Electronic Hardware for literally all phases of development: Safety, Requirements, Design, Logic Implementation, V&V, Quality Assurance, etc. The DO-254 standard is a companion to the software DO-178B standard; however, there are many differences between hardware and software which must be understood. This basic course introduces the intent of the DO-254 standard for commercial avionics hardware development. The content will cover many aspects of avionic hardware including: aircraft safety; systems; hardware planning, requirements, design, implementation and testing. Attendees will learn industry-best practices for real-world hardware development, common DO-254 mistakes and how to prevent them, and how to minimize risks and costs while maximizing hardware quality. The avionics hardware development process will be summarized including DO-254C’s relationship to other standards including ARP-4761 for Safety and ARP-4754A for Systems Development.
ELECTRICAL, ELECTRONICS, AND AVIONICS

Learning Objectives
By attending this seminar participants will be able to:
• Explain the intent of DO-254
• Explain how DO-254 fits into the avionics development process
• Implement hardware planning and standard requirements
• Assess the impact of avionic hardware requirements, design, implementation, and testing
• Employ basic configuration management and quality assurance techniques
• Identify how to mitigate common DO-254 risks and minimize cost while applying industry-best practices

Who Should Attend
This seminar is designed for Avionics Hardware Managers and Engineers from aviation industry.

Topical Outline
• DO-254 Basics
  • Avionics Ecosystem
  • Relationship to ARP-4754A and ARP-4761
  • Avionics Safety
  • Avionics Systems
• Hardware Development Planning
  • Criticality levels
  • Plan for Hardware Aspects of Certification (PHAC)
  • Hardware Process Assurance Planning (HPAP)
  • Hardware Configuration Management Planning (HCMP)
  • Hardware Development Planning - Requirements, Conceptual Design, Detailed Design, and Integration
  • Hardware Verification Planning (HVP) - Reviews, Tests, and Analysis (HVP)
• Hardware Verification and Validation Details
  • Robustness testing
  • Element Analysis & Structural Coverage
  • Hardware Validation
  • Hardware Reviews & Certification
• Hardware Traceability
• Common Avionics Hardware Development Mistakes & How To Prevent Them
• Avionics Hardware and DO-254 Best Practices
• Avionics Hardware and DO-254 Gap Analysis
  • Common gaps
  • Cost estimation
  • Project Management and SOI’s
  • Hardware review checklist walkthrough

Instructor: Vance Hilderman
Fee $1370 1.3 CEUs

Introduction to DO-178C
2 Days
I.D.# C1410

The international standard titled DO-178C - Software Considerations in Airborne Systems and Equipment Certification is the primary standard for commercial avionics software development. This standard provides recommendations for the production of airborne systems and equipment software. Compliance with the objectives of DO-178C is the primary means for meeting airworthiness requirements and obtaining approval of software used in civil aviation products.

This two-day seminar will introduce attendees to industry best practices for real-world software development and how to avoid common DO-178C mistakes. This seminar is intended to present the information necessary to help minimize DO-178C risks and costs, while also maximizing software quality during avionics development. The instructor will guide attendees through topics such as aircraft safety, systems, software planning, software requirements, and software design/code/test. The entire ecosystem of aviation avionics software development will be summarized including DO-178C’s relationship to other industry standards including the SAE standards ARP-4761 for Safety and ARP-4754A for Systems Development.

Learning Objectives
By attending this seminar, participants will be able to:
• Evaluate the premise of DO-178C
• Identify how DO-178C fits into the avionics development ecosystem
• Examine software planning and standards
• Identify software requirements, design, code, and testing for avionics
• Describe basic configuration management and quality assurance
• Analyze how to mitigate common DO-178C risks and minimize cost while applying industry-best practices

Who Should Attend
This course is designed for Avionics Software Managers and Engineers seeking a higher level of understanding of the requirements and practices of using DO-178C in software development. In addition, other personnel in need of a greater understanding of this standard will benefit from the information presented in this seminar.

Topical Outline
Day One
• DO-178 Basics
  • Avionics Ecosystem
  • Relationship to ARP-4754A and ARP-4761

Instructor: Vance Hilderman
Fee $1370 1.3 CEUs

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
Power Electronics for Mechanical Engineers

.5 Day
I.D.# C1420

This 4-hour short course provides an overview of Power Electronics (PE) in use in modern transport aircraft. This course includes the context, principles, design drivers, and the main PE components of various flight applications, including those for harsh environments. This course is designed to deliver and demystify the basic theories and best practices of mechanical, electronics, thermal management, safety, reliability and maintainability disciplines. In addition, future trends in Power Electronics will be discussed.

Learning Objectives
By attending this seminar, participants will be able to:
• Explain and evaluate the use of the power electronics in various aircraft systems
• Identify and explain the various PE architectures
• Identify the main requirements and technical drivers to develop PE units
• Identify the various components of PE equipment
• Evaluate lessons learned from existing PE products flying in various commercial aircraft

Instructors Wanted...
To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses.

We are seeking expertise in a variety of Aerospace-related topics including: Certification, Regulations, and Standards.

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568
RFID Selection, Application, and Use in Aerospace, Space, and Transportation

1 Day
I.D.# C1310

Radio Frequency Identification (RFID) is an enabling technology that has been widely adopted in the retail industry. The powers of RFID are acknowledged by many, but a lack of understanding of the technology, its limitations, and how to select the right plan for its target installation has slowed efforts to migrate the technology into the aerospace, space, and transportation industries. While RFID is not a new technology, the rate at which it has been integrated into the aerospace industry has been slow due to unique considerations regarding qualification, regulations, and safety. New Department of Defense (DoD) policies requiring an integrated material supply chain process that fully supports military operational requirements will further advance the use of RFID technologies. In addition the laws and regulations regulating its use are relevant for the proper application of this valuable technology. As industry strives for further cost reducing technologies, individuals will need to be able to identify, select, install, and operate the proper system for its application in these critical industry segments.

This one-day seminar will introduce participants to the technology of RFID and how it can be properly integrated into the aerospace, space, and transportation industries. With knowledge obtained as a project manager for the installation of over 30 successful systems, the instructor will begin with the technical aspects of RFID. The instructor will then guide participants through the business case for RFID followed by the selection, acquisition, and installation processes.

Learning Objectives
By attending this seminar, participants will be able to:
- Identify the different types of RFID systems and their applications (RFID, GLS, RTLS, GPS)
- Explain the different RFID components and their function within the system
- Identify the key areas within a factory for optimal success of an RFID system
- Evaluate the laws and regulations for using RFID in your facility
- Develop a RFID Return On Investment (ROI) for your application
- Apply a technology application roadmap for an RFID installation.
- Identify testing criteria for tag placement and optimal read rates.
- Identify the terms, power, and limitations of RFID

Who Should Attend
This seminar is intended for individuals requiring the critical knowledge that will assist them in understanding and participating in decision processes when RFID is being considered for their specific application.

Topical Outline
- Welcome, Introduction, and Assessment of Expectation
  - Overview of seminar material
  - Review of pre-submitted expectation forms
  - Introduction to RFID
  - What is RFID
  - Types of RFID
  - RFID System Components
- RFID Applications and Limitations
  - Retail applications
  - Aerospace applications
  - Transportation applications
  - Manufacturing applications
- Feasibility Analysis: Will RFID Work for You
  - How to perform a feasibility analysis
  - How to test feasible targets and optimize for success
  - Establishing expectations and accuracy
  - Participation exercise
- Developing Return On Investment (ROI)
  - Identifying current operating cost
  - System cost
  - Cost benefits analysis (ROI)
  - Participation exercise
- System Selection and Acquisition
  - Selecting the right system
  - Determining how much system to buy
  - Acquiring the system
- Summation: Out-Briefing
  - RFID technology review
  - Selection, acquisition, and installation review

Instructor: George (Nick) Bullen
Fee $810 .7 CEUs

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.

training.sae.org/credentialing/certificate

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
ENGINEERING TOOLS & METHODS

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

Accelerated Test Methods for Ground and Aerospace Vehicle Development

2 Days
I.D.# C0316

Similar content is available in the on demand course – Accelerated Test Methods for Ground and Aerospace Vehicle Development – see course info below.

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). A combination of hands-on exercises, team activities, discussion, and lecture are used throughout the course. Participants will also receive a copy of the instructor’s book, Accelerated Testing and Validation Management, which includes numerous hands-on exercises and a CD with analytical spreadsheets. Attendees are requested to bring a calculator to the seminar.

Learning Objectives
By attending this seminar, participants will be able to:
• Choose the accelerated test method for a given application
• Analyze accelerated testing results
• Explain how to accelerate one’s current test methods
• Explain how to accelerate one’s validation program
• Adjust accelerated test programs for business situations
• Describe how product development cycles can be reduced from 18 to 6 months

Who Should Attend
This seminar is designed for anyone involved in product design, life testing, reliability testing and validation for ground and aerospace vehicles, including reliability engineers, validation engineers, design engineers and their managers. Individuals who need to achieve shorter time to market or higher quality through custom test plans will find this course to be especially valuable. Purchasers or users 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.

Topical Outline
• Statistical model for reliability testing
  • Fundamentals of a statistical reliability test
  • Effects of automotive supply chain on sample size and duration
  • Common pitfalls
  • Examine and solve two or three real life statistical data set problems
• Key Accelerated Tests, Terms, and Methods
  • Definitions: Information Goal, Basic Method, Limitations
  • Full System Life Test (FSLT); Step Stress
  • Accelerated Reliability Highly Accelerated Life Test (HALT)
  • Failure Mode Verification Test (FMVT) — Development; Warranty; Life Prediction
• Test Acceleration vs. Program Acceleration
  • Advantages of accelerating a full validation program compared to an individual test
  • Examples of time/cost saved on individual test acceleration
  • Examples of time/cost saved on program acceleration
• Hybrid Acceleration Methods
  • Using information goals of individual test methods to combine and leverage tests
Accelerated Test Methods for Ground and Aerospace Vehicle Development

10 Hours

Similar content is available in the classroom seminar – Accelerated Test Methods for Ground and Aerospace Vehicle Development – see course info above.

This course offers more than 10 hours of instruction divided into fourteen modules; a coordinated handbook; and a copy of the instructor’s book, Accelerated Testing and Validation Management, which includes numerous hands-on exercises and a CD with analytical spreadsheets. Convenient, portable, and with core content from the instructor-led seminar (view description for classroom seminar above), the on demand course option offers new and alternative ways to receive the same instruction as the live classroom learning without the expense of travel and time away from the workplace.

View the complete course description and a video demo at training.sae.org/eseminars/atm.

What You Will Receive:

- 90 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: Alexander (Alex) J. Porter
Fee $1405 1.3 CEUs

ANOVA for Design of Experiments

1 Day
I.D.# C0714

This seminar is suggested for product or process experts who have a need to utilize more detailed information concerning Design of Experiments analysis. It primarily addresses the subject of ANOVA, analysis of variance, which is a statistically based, objective decision-making tool. This is an advanced seminar that covers the fundamentals required to analyze orthogonal experiments, interpret, and recommend further action based on the analysis. Emphasis is placed on the analysis phase of the DOE process. The seminar covers DOE basic review, simple and complex ANOVA situations, process capability estimation, and a review of available computer software for experimental design and analysis.

Learning Objectives

By attending this seminar, participants will be able to:

- perform ANOVA for DOE analysis
- interpret ANOVA results
- estimate process capability from ANOVA information

Who Should Attend

This seminar is designed for product and process design engineers, manufacturing engineers, quality engineers (control, assurance, or supplier), testing and development engineers, and technical managers who are interested in more comprehensive experimental analyses and information. Although, more statistical in nature, this seminar does not require a statistical education or background to comprehend the contents; only fundamental mathematical skills are necessary. This seminar is also very helpful in providing a statistical foundation for those seeking certification in quality engineering.

It is strongly recommended that the registrant attend a Basic Design of Experiments course or have experience with fractional factorial experiments based on orthogonal arrays before attending the ANOVA for Design of Experiments course.

Topical Outline

- Training Objectives
- Design of Experiments Process Flowchart
- Planning and Conducting Phase Review
- Analyzing and Interpreting Results
  - observation method review
  - column effects method review
  - raw data ANOVA - one-way; two-way; multi-way with orthogonal arrays
  - variation ANOVA
  - attribute data ANOVA
  - interpreting experimental results

Instructor: Alexander (Alex) J. Porter
Fee $595 1.0 CEU
Design and Process Failure Modes and Effects Analysis (FMEA)

2 Days
I.D.# C1510

This seminar covers the five types of FMEAs with emphasis on constructing Design and Process FMEAs. Each column of the FMEA document will be clearly explained using an actual FMEA example. The course covers various methods for identifying failure modes, effects and causes with special attention given to severity, occurrence, and detection tables and how to develop effective recommended actions strategies. Throughout the class, participants will be involved in exercises/actual projects that demonstrate and incorporate direct application of learned principles.

Learning Objectives
By attending this seminar, participants will be able to:
• Describe the benefits, requirements and objectives of an FMEA
• Describe the five types of FMEAs and how to use them
• Develop and interpret a Design and Process FMEA form
• Identify and utilize various tools when performing an FMEA
• Describe the standard requirements/recommendations for an FMEA
• Select suitable projects and teams for completing an FMEA
• Complete a typical Design and Process FMEA form

Who Should Attend
This seminar is designed for core members of a Product Development Team such as project managers, product design, test, manufacturing, quality, reliability engineers and those responsible for assisting the PDT in design and development of product, manufacturing, assembly or services processes.

Topical Outline
• Understanding and Application of FMEA
  • FMEA as Part of the Product Development Life Cycle
  • The Various Industry FMEA standards

• Why and When to use Concept, System and Design FMEAs
• The FMEA as a Risk Management Technique
• FMEA, Robust Design, and Design Reviews
• FMEA vs FMECA
• Using FMEA to Address Product and Process Liability Issues
• Managing the FMEA Process
  • The Steps to Generating a Quality FMEA
  • The Essentials of an Effective FMEA Database and Template FMEAs
  • Methods for Selecting Suitable Projects for Templating Design and Process FMEAs
  • FMEA Team Development
  • Champion and Facilitator Roles during FMEA Development
• Introducing the FMEA Exercise – Designing a Great Flashlight
• Constructing a Useful FMEA
  • The Five Types of FMEAs and the Uses
  • Design FMEA
    • Constructing the boundary and block diagrams
    • Column by column review of the Design FMEA form
    • Development of a company-specific table structure for severity, occurrence and detection
    • Techniques for RPN prioritization and developing recommended action
    • Developing effective design control techniques
    • Exercise 2 – Completing the Flashlight Design FMEA
  • Process FMEA
    • Gathering the necessary process documents
    • Column by column review of the Process FMEA form
    • Development of a company-specific table structure for severity, occurrence and detection
    • Techniques for RPN prioritization and developing recommended action
    • Exercise 3 – Completing the Flashlight Process FMEA
    • Application of the Machinery FMEA
    • Effective use of the occurrence and detection tables
    • Validating process and machinery control techniques

Instructor: Angelo E. Mago
Fee $1370 1.3 CEUs
Instructors Wanted...

To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses; we are seeking expertise in a variety of topics including:

Aerospace
- Certification
- Regulations
- Standards
- Technologies

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup
Frank.Shoup@sae.org
+1.724.772.8568

Design for Manufacturing & Assembly

1 Day
I.D.# 95032

2 Days
I.D.# 92047

Design for Manufacturing and Assembly (DFM+A), pioneered by Boothroyd and Dewhurst, has been used by many companies around the world to develop creative product designs that use optimal manufacturing and assembly processes. Correctly applied, DFM+A analysis leads to significant reductions in production cost, without compromising product time-to-market goals, functionality, quality, serviceability, or other attributes. This seminar will include information on how DFM+A fits in with QFD, Concurrent Engineering, Robust Engineering, and other disciplines. Each participant will receive and use the hard-bound authoritative reference textbook *Product Design for Manufacture and Assembly*, written by Geoffrey Boothroyd, Peter Dewhurst and Winston Knight.

Learning Objectives

Upon successful completion of this course, participants will be able to:

- Perform Design for Assembly (DFA) Analysis using the BDI Manual (Worksheet) Method
- Perform DFM Analysis (manufacturing cost estimation)
- Apply Design for Service (DFS) Principles
- Reduce your company’s production costs by analyzing and eliminating the factors that greatly affect the time, cost, and quality of manufacturing, assembly and service processes
- Utilize effective analysis, brainstorming, and trade-off techniques for redesigning assemblies and subassemblies

Who Should Attend

You should attend if you are a product designer, product engineer, or manufacturing engineer. Individuals involved in a new or ongoing product development process will benefit by learning how to help synchronize and optimize fabrication and assembly activities. This course is most effective when attended by product development teams. However, this is not a requirement for attendance.

Topical Outline

- What is DFM+A
  - The history of DFM+A
  - The various "Design fors"
  - Why companies are using DFM+A
  - DFM+A success stories
  - DFM+A benefits
  - Key factors in ensuring DFM+A success
- DFA Good Design Principles
  - The Boothroyd Dewhurst Design for Manual Assembly Method
  - Using the manual handling and insertion tables
  - Determining theoretical minimum part count
  - Filling in the BDI DFA worksheet
  - Computing the DFA Index
- DFM A Baseline Analysis Exercise (Pneumatic Piston)
- Redesign Project (Pneumatic Piston Assembly)
  - Developing design concepts
  - Identifying conservative and “stretch” designs
  - Selecting the best DFA concept
  - Analysis of redesign
  - Presentation of team results
- General Approach to Manufacturing Cost Estimation
  - Manufacturing cost drivers
  - Estimating piece cost
  - Cost calculation exercise
- BDI Design for Manufacture (DFM) Cost Estimation
  - Injection molding cost algorithms
  - Sample calculation
  - Exercise (analyzing part from pneumatic piston)
- Brief Design for Service (DFS) Overview
- DFM+A Workshop Checklist
- Institutionalizing DFM+A in Your Organization
  - How DFM+A fits in with other strategies
  - Lessons learned from other companies
  - Ideal workplace implementation plan

Instructor: Kevin Zielinski

Fee (95032) $895  .7 CEUs
Fee (92047) $1550 1.3 CEUs
Design of Experiments (DOE) for Engineers

2 Days
I.D.# C0406

Similar content is available in the live online Web Seminar – Design of Experiments (DOE) for Engineers Web Seminar – see course description below.

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 identifying proper design dimensions and tolerances, achieving robust designs, generating predictive math models that describe physical system behavior, and determining ideal manufacturing settings. This seminar utilizes hands-on activities to help you learn the criteria for running a DOE, the requirements and pre-work necessary prior to DOE execution, and how to select the appropriate designed experiment type to run. You will experience setting up, running, and analyzing the results of simple-to-intermediate complexity, Full Factorial, Partial Factorial, and Response Surface experiments utilizing manual methods as well as a hands-on computer tool that facilitates experimental design and data analysis. You will also receive an overview of Robust DOE, including the Taguchi DOE Method.

Participants will be given information on how to receive, install and configure a fully-functional 30-day trial version of Minitab™ for their use in class, and/or for their personal evaluation. While some computers will be available, attendees are encouraged to bring a laptop computer and/or a calculator to the seminar to provide additional hands-on time.

Learning Objectives
By attending this seminar, participants will be able to:
• Decide whether to run a DOE to solve a problem or optimize a system
• Set-Up a Full Factorial DOE Test Matrix, in both Randomized and Blocked forms
• Analyze and Interpret Full Factorial DOE Results using ANOVA, (when relevant) Regression, and Graphical methods Set-Up a Fractional (Partial) Factorial DOE, using the Confounding Principle
• Analyze and Interpret the results of a Fractional Factorial DOE
• Recognize the main principles and benefits of Robust Design DOE
• Decide when a Response Surface DOE should be run
• Select the appropriate Response Surface Design (either Plackett-Burman, Box-Behnken, Central Composite, or D-Optimal)
• Interpret Response Surface Outputs
• Utilize the MiniTab™ Software tool to analyze data

Who Should Attend
This seminar will benefit engineers, designers and quality professionals in research, design, development, testing and manufacturing who are interested or active in one or more of the applications listed above.

Topical Outline
• Icebreaker: Team Problem Solving Exercise Using Engineering Judgment
• What is DOE?
  • Types of Designed Experiments
  • Application Examples
  • Where DOE Fits in with Other Tools/Methods
• DOE Requirements: Before You Can Run an Experiment
  • Writing Problem and Objective Statements
  • Ensuring DOE is the Correct Tool
  • Selecting Response Variable(s) and Experimental Factors
  • Actual vs. Surrogate Responses
  • Attention to Experiment Logistics
  • Test Set-up and Data Collection Planning
  • Selecting and Evaluating a Gage
• Full Factorial Experiments
  • Introduction to Cube Plots for 3- or 4-factor 2-level Experiments
  • Experiment Set-Up
  • Factor Levels, Repetitions, and “Right-Sizing” the Experiment
  • Experiment Terms to Estimate (Main Effects and Interactions)
  • High-Level Significance Evaluation
• DOE Statistical Analysis
  • ANOVA Principles for Simple Full Factorial Experiments
    — Statistics Basics; Significance Test Methods; Effect of Non-Random Experiments; Estimating Significance Test “Power”; Confidence Intervals; Estimating Random Error
  • Analysis Plots — Normal and Half-Normal Plots; Main Effect and Interaction Plots
  • Regression Analysis of Simple Full Factorial Experiments
    — Statistics Basics; Significance Test Methods; Effect of Non-Random Experiments; Estimating Significance Test “Power”
  • Using MiniTab™ for Full Factorial DOE Experiments
• Fractional (Partial) Factorial Experiments
  • The Confounding Principle — How it Works; What Information We Lose with Confounding (and why we might not care!)
  • Selecting and Using Generators (Identities) to Set Up Confounding Strings
  • Determining Which Factor Combinations to Run
  • Analyzing Fractional Factorial Experiment Data
  • Using MiniTab™ for Fractional Factorial Experiments
• Robust Design Experiments (Overview)
  • What is Robustness?
  • Control and Noise Factors
Design of Experiments (DOE) for Engineers
Web Seminar
12 Hours
I.D.# WB0932

Similar content is available in the classroom seminar – Design of Experiments (DOE) for Engineers – see course description above.

Design of Experiments (DOE) is a methodology 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 Minitab™ product trial copy for use in the Web Seminar. Due to the nature of the Web Seminar 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
- 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 Web Seminar 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.

Topical Outline
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 2

Instructor: Kevin Zielinski
Fee $1420 1.3 CEUs
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

Instructor: Kevin Zielinski
Fee $835 1.2 CEUs

Design of Experiments - Basic Simplified Taguchi

2 Days
I.D.# C0231

Design of Experiments is a statistically based, structured approach to product or process improvement that will quickly yield significant increases in product quality and subsequent decreases in cost. Products and processes can be designed to function with less variation and with less sensitivity to environmental factors or customer usage. While still maintaining high quality from a customer’s viewpoint, products and processes can utilize lower cost materials and methods. Specifications can be opened-up with wider tolerances while still maintaining high quality for customers. In summary, products and processes can be designed and developed in shorter times to reduce costs and become more competitive in the marketplace from a delivery and profit standpoint.

This seminar covers the fundamentals required in planning, conducting, and analyzing orthogonal experiments, which are the major steps in the Design of Experiments (DOE) process. Emphasis is placed on the DOE process, which, if diligently followed will yield an effectively completed experiment.

An introduction to parameter design is included. A short video introduces the experimental approach; the end of the session allows practice with the new methods in a hands-on workshop.

Learning Objectives

By attending this seminar, students will be able to:
- Choose appropriate factors and factor levels to effectively plan DOEs
- Define an appropriate set of tests to evaluate the chosen factors and levels
- Utilize appropriate randomization strategies and choose appropriate sample sizes for conducting tests for DOE
- Utilize basic analytical methods to identify influential & non-influential factors in analyzing and interpreting DOE results
- Set specification limits for all factors for effective performance and low cost

Who Should Attend

This seminar is designed for product and process design engineers, manufacturing engineers, quality engineers, testing and development engineers. Although it would be helpful, no statistical education or background is required for this course; only fundamental mathematical skills are necessary.
Topical Outline

• Training Objectives
• Design Of Experiments Background
  • DOE definition
  • DOE and Taguchi history
  • DOE in the product life cycle
  • implementation strategy
• Design Of Experiments Process
  • flowcharts
  • injection molding case study
  • water pump leak case study overview
• Planning Phase
  • state problem(s)
  • state objective(s)
  • determine measurement method(s)
  • quality characteristic(s)
  • select factors
  • identify control and noise factors
  • select levels of factors
  • select orthogonal array
  • assign factors
  • locate interactions
  • modification of standard orthogonal arrays
  • parameter design
• Conducting The Experiment
  • trial data sheets
  • testing logistics & assignments
  • identification of trial results
  • sample size per trial
  • randomization
  • good and bad data sets
• Analyzing And Interpreting Results
  • observation method
  • column effects method
  • plotting
  • ranking
  • analyzing variability
  • factor classification
  • attribute data
  • interpreting experimental results
  • confirmation experiment
• Experimental Workshop
  • popcorn experiment review
  • pendulum experiment

Design Review Workshop

1.5 Days
I.D.# C1306

In today’s highly competitive and liability minded environment, Design Reviews (DR) are a must for all major mobility industries such as Automotive, DOD, Aerospace, Agriculture, Recreation, Marine and Rail. While Design Reviews are becoming increasingly important in product liability litigation, they also serve as an effective way to transfer organizational best practices for specific concerns and issues.

This hands-on workshop describes how formal Design Reviews can be used in conjunction with other new product development methods to improve product designs by uncovering potential problems before they are discovered at a later stage of development or application when the costs of correction are much higher. A range of effective techniques for organizing and conducting Design Reviews will be presented. Participants will receive specific guidance and tools to assist them in tailoring Design Reviews to reflect their own organization’s requirements. Topics are applicable to a broad range of new product development programs, ranging from components to complete systems, for both OEMs and suppliers.

LEARN THEN DO -
In this workshop the attendee not only learns the essential elements of a robust Design Review process but also has the opportunity to apply these principles in the conduct of a mock Design Review. Participants will also experience some of the frequently encountered real-world issues that distract from accomplishing good results. During these “reviews” the attendee will experience each of the roles in a typical Design Review-leader, facilitator, recorder, and participant. An after-action review will be performed following each DR session to discuss positive outcomes and identify opportunities for improvement.

Learning Objectives

By attending this seminar, participants will be able to:
• Describe the relationship of the process to concurrent engineering and knowledge management
• Establish the requirements for a successful Design Review process
• Describe the types and timing of reviews
• Organize a typical Design Review
• Conduct a review and get positive results

Instructor: Phillip J. Ross
Fee $1370 1.3 CEUs
Who Should Attend
The workshop 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, directors, manager, project and program managers, design, development, process, product, quality, and application engineers will find the course valuable. It is aimed primarily at engineers and managers who will be facilitating or leading such reviews, but will also benefit manufacturing, marketing and purchasing personnel.

Topical Outline
DAY ONE
Design Review Process
• Why Design Reviews Should be Part of a Product Development Process
  • Market and quality drivers
  • Schedule and cost drivers
  • Litigation considerations
• Outline of the Design Review Process
  • Design reviews as part of an overall risk management process
  • What design reviews are and are not
• Types and Timing of Reviews
  • Concept reviews
  • Preliminary reviews
  • Critical reviews
  • Production readiness reviews
  • Other types of reviews
• Scope of Design Reviews
  • Design review vs gate (or phase) review
  • Formal and informal reviews
  • Key ingredients for a successful review
  • Implementing a DR process
DAY TWO (ends at 12:30)
Design Review Hands-on Workshop
• Organizing an Effective Design Review
  • Roles during the DR
  • Selecting participants
  • Preparing for the DR
  • Assignments leading to a DR
  • Duration of a review
• Conducting a Design Review
  • Conflict Management
  • Closure and follow-up
  • Using check lists to build organizational knowledge
  • Handling problem participants

Instructor: Angelo E. Mago
Fee $1370 1.0 CEUs

Design for Manufacture and Assembly (DFM/DFA)
2 Days
I.D.# C0418
This seminar provides a functional understanding of the principles involved in conducting a Design for Manufacture/Design for Assembly study. DFM/DFA can support both manual and automated processes resulting in significant cost savings through simpler designs with fewer components. Related topics include workstation layouts, ergonomic considerations and errorproofing. Actual examples from the automotive industry are used to support the lecture and participants complete actual design efficiency using the DFM/DFA worksheet.

Learning Objectives
By attending this seminar, students will be able to:
• Recognize and list the benefits of the DFM/DFA method in creating product designs which support manufacturing processes leading to short and long term product cost savings
• Outline a Robust Manufacturing Plan that optimizes and simplifies product design without sacrificing quality
• Objectively determine which designs would be suitable as DFM/DFA candidates
• Perform the essential stages of a Design for Manufacture process including the analysis required to overcome typical manufacturing difficulties encountered in product design
• Construct an actual DFM/DFA worksheet and calculate design efficiency using an instructor provided project

Who Should Attend
Product Engineers, Designers and Managers, Manufacturing and Tooling Engineers, and Project Managers who desire to understand DFM/DFA as a product design tool to increase manufacturability of product assemblies. The course is best suited for individuals in the manufacturing industry and is beneficial to OEMs and Tier suppliers.

Topical Outline
DAY ONE
• Introduction to DFM/DFA and DFM/DFA objectives
  • DFM, DFA and Product Life Cycle
  • Six Steps of the DFM/DFA Life Cycle Model
  • DFM and DFA advantages and challenges in a Product Development environment
• Design Considerations
  • Creating the DFM/DFA Environment
  • Guidelines for selecting DFM candidates
  • Integrating FMEA and DFM/DFA
  • Material Selection process
  • Project Cost Estimation
ENGINEERING TOOLS & METHODS

- DFM Worksheet, Tables and Terms Defined
- Minimizing part count using the Minimum Part Criteria
- Finalizing the Critical Design Characteristics
- DFM introductory projects

DAY TWO
- Design Considerations (cont)
  - Operator Interface Considerations - Handling, Insertion, and Fastening issues
- Calculating initial design efficiencies
- Prioritizing Design Improvement efforts using the Worksheet codes
- Finalizing DFM project
- Process Considerations
  - Workplace Layout
- Methods of Assembly
- Lean Production Metrics
- Errorproofing
- Introduction to DFM Concurrent Costing
- Total cost savings through DFM and DFAs

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. Participants will study different types of analyses typically performed, discuss common misconceptions and traps in the FEA, and review Implementation of Management of FEA in the design environment. The Web Seminar format will allow for some customization so problems of particular interest to participants and an exchange of FEA experiences may be discussed during the live sessions. Hands-on exercises focusing on the analysis of FEA errors and proper modeling techniques will be assigned.

The eBook, *Engineering Analysis with SolidWorks® Simulation* by Paul Kurowski, will also be included in the course materials. In-class, hands-on exercises and between-session assignments will provide an opportunity to put what is learned into practice.

### Learning Objectives

By connecting with this Web Seminar, participants 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.

### Topical Outline

**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

---

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

12 Hours  
I.D.# WB1241

*Similar content is available in the on demand course Finite Element Analysis for Design Engineers (course description below).*

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.
Finite Element Analysis for Design Engineers

8 Hours  
I.D.# PD531241

Similar content is available in the web seminar, *Finite Element Analysis (FEA) for Design Engineers*. See the course description above.

Finite Element Analysis (FEA) is a computer-aided engineering (CAE) tool used to analyze how a design reacts under real-world conditions. Useful in structural, vibration, and thermal analysis, FEA has been widely implemented by automotive companies. It’s used by design engineers as a design tool during the product development process because it allows them to analyze their own designs while they are still in the form of easily modifiable CAD models, providing quick turnaround times and ensuring 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 the FEA process and commonly used modeling techniques, and 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 online on demand course provides the skills necessary for proper use of FEA in the design process and ensures that the powerful tool is implemented in the most efficient and productive way. Participants will begin with the foundational FEA process, observe expert demonstrations showing how FEA is conducted using real models, study different types of typically performed analysis, discuss common misconceptions and errors made, and explore how FEA can be implemented within the design environment. Hands-on exercises focusing on FEA fundamentals, different types of analysis, and proper modeling techniques are included.

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, is also included in the course materials. In-class, hands-on exercises and between-session assignments will provide an opportunity to put what is learned into practice.

While the course modules are approximately eight hours in length, the estimated time to completion, including knowledge checks and the learning assessments is 12 hours.

An introduction module and various bundling options are available for this topic. Contact Corporate Learning Solutions to discuss the course options that best fit your need.

**Learning Objectives**

By participating in this on demand course, the student will be able to:

- Identify the purpose of using FEA in the design process
- Identify and avoid errors inherent to FEA results
- Identify FEA advantages and shortcomings
- Recognize and avoid common FEA mistakes
- Produce reliable results on time
- Interpret and use FEA results
- Explain an effective approach to FEA project management
- Ensure quality and cost-effectiveness of FEA projects

**Major topics include:**

- Introduction to Finite Element Analysis
  - FEA Definition and Process
  - Discretizing and Characteristics of Finite Elements
  - Degrees of Freedom

---

Instructor: Paul Kurowski
Fee $870 1.2 CEUs
**Introduction to FMEA: What, Why, When and How**

25 Minutes  
I.D.# PD531422ON

Failure Mode and Effects Analysis (FMEA) is an essential part of any product design or redesign activity. FMEA is a proactive, quantitative, qualitative, step-by-step approach for identifying and analyzing all potential points of failure in any product or service. This team-based activity can dramatically improve product performance. It can also reduce manufacturing issues at the component, system, and processing level.

This module gives a high-level overview of FMEA facts: WHAT an FMEA is, WHY they are used, WHEN an FMEA is created, WHO is on the FMEA development team, and HOW the FMEA form is completed. The history of FMEAs, standards, and team responsibilities are also discussed.

Additional modules are being planned for release to provide a comprehensive FMEA curriculum. You may also consider attending the live web seminar *FMEA for Robust Design: What, Why, When and How*, led by instructor Angelo Mago. Find the course description on page 19.

All material is in conjunction with current industry standards. While the course module is approximately 25 minutes in length, the estimated time to completion, including knowledge checks and the learning assessment is one hour.

A more in-depth on demand option for the FMEA topic is in development. Contact Corporate Learning Solutions to discuss availability and learning options that best fit your need.

**Learning Objectives**

By participating in this on demand course, students will be able to:

- Describe the FMEA history, terms, standards and types
- State the benefits and advantages of using an FMEA
- Describe the composition and responsibilities of an FMEA team
- Explain when an FMEA is needed and the timing involved
- Describe the basic information and inputs required in each column of an FMEA form

**Major topics include:**

- Lesson 1: Introduction
- Lesson 2: WHAT is Failure Mode and Effects Analysis?
- Lesson 3: WHY should we use FMEA?
- Lesson 4: WHO is on an FMEA team?
- Lesson 5: WHEN should we develop an FMEA?
FMEA for Robust Design: What, Why, When and How Web Seminar
12 Hours
I.D.# WB1422

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 meets 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:

- State the relationship between Product Development, Voice of the Customer (VOC) and the FMEA process
- Recognize why and when to use the five types of FMEAs, specifically Systems and Design
- Apply the FMEA process as a risk management technique
- Organize an effective FMEA team and conduct FMEA work sessions
- Adapt the steps to generate a FMEA process to your specific company needs
- Develop and manipulate Risk Priority and Detection Strategies and customize Risk Ranking tables
- Assign effective 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.

Topical Outline
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
Failure Modes and Effects Analysis (Product & Process) in Aerospace

2 Days  I.D.# C0939

This interactive seminar introduces the participant to the analytical process by which potential failure modes, failure effects and causes of failure are identified. Engaging in a systematic method of studying failure can improve future outcomes. The severity, occurrence and probability of detection of a failure mode are used to prioritize which failure modes are most critical. Methodology is introduced for dealing with the effects of failure. The Design FMEA link to manufacturing is explained and amplified in terms of downstream Process FMEA. This course is based on “learning by doing” with interactive, in-class Design and Process FMEA generation and analysis in a lively team environment. This course will also detail relevant portions of the SAE Aerospace Recommended Practice for FMEA, ARP 5580 which is included in the course materials.

Learning Objectives

By attending this seminar, participants will be able to:

• List the benefits, requirements and objectives of an FMEA (both Product Design & Process)
• Explain the steps and methodology used to analyze a Design or Process FMEA
• Demonstrate the application of a variety of tools utilized in conjunction with performing an FMEA
• Identify corrective actions or controls and their importance in minimizing or preventing failure occurrence

• Interpret the objectives of the SAE Aerospace Recommended Practice for FMEA, ARP5580

Who Should Attend

This seminar is designed for the design engineer, process assurance engineer, reliability engineer, test engineer, quality engineer, development engineer, logistics/support engineer, manufacturing engineer and their management or anyone responsible for the design and development of design or manufacturing, assembly or service processes in the completion of a Design or Process FMEA.

Topical Outline

DAY ONE

• Introduction and Overview
  • Definition
  • Requirements for an FMEA (both Design & Process) - Who drives the requirements?
  • FMEA detail
  • Design and Process FMEA similarities and differences -- performing an FMEA
  • Prerequisites
  • Basic analysis methodology -- approach; sequence
  • Prioritization of failure modes
  • Typical forms used: examples and recommendations
• Other Quality Tools to Aid in FMEA Development
  • Pareto chart
  • Fishbone diagram
  • Design review
  • Checklists
  • Lessons learned
  • Design of Experiments (DOE)
  • Statistical process Control (SPC)
  • Fault Tree Analysis (FTA)
  • Monte Carlo simulation
• Design FMEA: Class Exercise
  • What’s the requirement?
  • Forming the team
  • Process flow
  • Brainstorm design failure modes
  • Use FMEA form to document failure modes, severity, occurrence, detection
  • Prioritize failure modes
  • Work corrective actions
  • How good are these corrective actions?
  • Redo prioritization to compare to requirement
  • Modify product based on analysis, for objective testings

DAY TWO

• Process FMEA: Class Exercise
  • What’s the requirement?
  • Forming the team
  • Process flow/Value Stream map
  • Brainstorm process failure modes
Fundamentals of Statistical Process Control

2 Days
I.D.# C0553

As competition for market share increases, so does the need to monitor processes and quality to ensure top-notch products. This hands-on seminar will provide you with the skills to apply and maintain statistical process control to assist your organization in the improvement of various processes to achieve higher percentage yield or higher quality products or services. Quality characteristics (process outputs to track), measurement systems, sampling strategies, types of control charts, construction of control charts, and control chart interpretation will be covered. The determination of the key process parameters and controlling them to provide consistent results will improve quality and lower costs, in particular, scrap and rework costs. Statistical theory and depth are kept to a minimum while you learn how to utilize the tools. Attendees will receive a copy of the Statistical Process Control Manual (SPC-3, 2nd Edition) by the Automotive Industries Action Group.

Learning Objectives

By attending this seminar, participants will be able to:
- Describe the purpose and uses of SPC
- Select the best measurement system to use for a specific application
- Identify an appropriate process sampling strategy
- Determine the basic type of control chart to use
- Collect data and construct basic control charts
- Interpret control chart results

Who Should Attend

Quality managers, engineers, and technicians, project engineers, manufacturing engineers, technical specialists and anyone with responsibility for product or process control who want to apply SPC in the workplace should attend this seminar. Individuals seeking to attain the Certified Quality Engineering status within the American Society for Quality will find this course particularly helpful.

Topical Outline

DAY ONE
- Introduction
- Viewpoints and Determinants of Quality
- SPC: Part of a Product Quality System
- SPC philosophy: prevention versus detection
  - Process control system
  - Causes of variation: common and special
  - Reactions to causes of variation
  - Requirements and specifications
  - Control charts: SPC tools
  - Benefits of SPC
  - SPC implementation process
- Quality Characteristic Determination
  - Everything is a process
  - Process flowchart and functions
  - Quality characteristics generation - intermediate/final; variable/attribute
  - Critical characteristics determination - final customer requirements; subsequent process requirements
  - Process example
- Quantification (measurement) of Quality
  - Types of characteristics - variable; attribute
  - Methods of measurement and measurement systems
  - Measurement system capability
- Sampling Strategy
  - Sample size
  - Sample frequency
  - Sample structure
- Quality Planning Workshop
- Basic Control Chart Types
  - Variable: X and R charts - AIAG example; workshops

DAY TWO
- Basic Control Chart Types (continued)
  - workshops
  - process capability indices (Cp & Cpk)
- Attribute
  - np chart - number defective - AIAG example; workshops
  - c chart - number of defects - AIAG example; workshops
- Basic Chart Interpretation
  - Basic decision rules
  - Process responses - jumps, steps, shifts; trends; cycles
  - Documented process changes

Instructor: Phillip J. Ross
Fee $1370 1.3 CEUs
Introduction to Design Review Based on Failure Modes (DRBFM) Web Seminar and Web Seminar RePlay

6 Hours
Web Seminar: I.D.# WB1047
Web Seminar RePlay: I.D.# PD331047ON

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 Web Seminar 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 mindset that are needed.

Learning Objectives
By connecting with this web seminar, participants 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 Web Seminar will benefit beginning engineers, advanced and senior engineers and managers who must participate in FMEA's and DRBFM.

Topical Outline 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

Instructor: Bill Haughey
Fee $615 .6 CEUs

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org

22
Introduction to Failure Mode and Effects Analysis for Product and Process

2 Days
I.D.# C1201

Failure Mode and Effects Analysis (FMEA) is a systematic method for preventing failure through the discovery and mitigation of potential failure modes and their cause mechanisms. Actions are developed in a team environment and address each high: severity, occurrence or detection ranking indicated by the analysis. Completed FMEA actions result in improved product performance, reduced warranty and increased product quality. This course assists team members to apply severity, occurrence and detection rankings consistently and efficiently and explores, in detail, the linkage of the Design FMEA and the Process FMEA through special characteristics development and product and process design collaboration. The relationships between FMEA and other popular tools, including Fault Tree Analysis (FTA), Design Verification Plan and Report (DVP&R) and Control Plans is discussed. Participants can expect dynamic “hands-on” activities with in-class Design and Process FMEA creation, facilitation skil development and risk analysis best practices. Instruction and clarification will be provided for relevant portions of the SAE J1739 standard, Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA), a copy of which will be included with the course materials.

Learning Objectives
Upon completion of this seminar, attendees will be able to:
• List the benefits, requirements, and objectives of an FMEA
• Demonstrate the steps used in developing an FMEA
• Follow the methodology to efficiently create an FMEA
• Describe other tools used in, or related to the FMEA
• Identify corrective actions resulting from proper FMEA development
• Identify and classify the levels of risk requiring corrective action
• Show the links between Design and Process FMEA
• Demonstrate the FMEA’s role in developing Special Characteristics and Design and Process Controls
• Summarize the objectives of the SAE standard J1739

Who Should Attend
This seminar is designed for engineers involved with manufacturing, product design, reliability, testing, quality, development, logistics/support, product assurance/design assurance, materials, and their management or anyone responsible for the design and development of manufacturing, assembly or service processes in the completion of a Design or Process FMEA.

Topical Outline
DAY ONE
• Pretest - Set baseline of knowledge and determine Voice of the Customer (participants) wants needs and desires
• FMEA Process Overview
  • Introductions and course objectives
  • What is risk?
  • The history and purpose of FMEA
  • SAE J1739 introduction
  • FMEA - where it fits in the product development process
  • System/Subsystem/component Design FMEA
  • Manufacturing and Assembly Process FMEA
• FMEA Development Methodology
  • Design FMEA development methodology - the three path model
  • Failure Mode Avoidance FMA /FPA Failure Prevention Analysis
  • Team structure and rules for efficiency - cross functional teams
• The Links between Design and Process FMEA
  • Special characteristics (critical and significant)
  • Collaboration on special characteristics
  • Characteristics as inputs to PFMEA
• Workshop 1: Review product and processes to be performed
• Practical Application of the Design FMEA Technique
  • Robustness Tools: Interface Analysis/Boundary (BLOCK) Diagrams; Parameter Diagram (P Diagram)
• Workshop 2: Construct Boundary/Block Diagrams and P Diagrams
• Workshop 3: Construction of a Design FMEA
  • Review of Days Activities and Q&A
DAY TWO
• Methodology and Hands-on Experience
• Path 1: Functions/Failure Modes/Effects of Failure/Severity
  • Severity ranking guidelines
  • Actions for high severity (9,10)
  • Workshop 3: Path 1 Exercise
• Path 2: Causes/prevention controls/occurrence
  • Occurrence ranking guidelines
  • Inputs to FTA (Fault Tree Analysis)
  • Actions to eliminate and/or reduce cause probability
  • Workshop 4: Path 2 Exercise
• Path 3: Test and verification methods
  • Detection ranking guidelines
  • Links to DVP&R
  • Actions to improve tests and verification techniques
  • RPN - Risk Priority Number
• Workshop 5: Path 3 Exercise
• Fault Tree Analysis Fundamentals
  • When to use FTA instead of or in combination with FMEA
  • Similarities and differences with FMEA
  • Symbols and structure
  • Cut set development
Reverse Engineering: Technology of Reinvention

2 Days
I.D.# C0559

During the past decade reverse engineering has become a common and acceptable practice utilized by many original equipment manufacturers and suppliers. This course focuses on the application of modern technologies used to decode the design details and manufacturing processes of an existing part in the absence of the original design data. It emphasizes the real-life practice of reverse engineering in the aerospace industry from both scientific and legal points of view. Attendees will learn the applicability and limitations of reverse engineering through case studies and hands-on exercises.

Various measurement instruments, ranging from traditional micrometers to computer-aided laser probes, will be compared for their merits and shortcomings. The statistics of dimensional measurements and the acceptable tolerance of variations, with emphasis on industrial standards in real-life practice will be discussed. Material identification, manufacturing process verification and the system compatibility of the subject part to be reverse engineered will be covered in substantial detail. In addition, the materials specifications will be exemplified as useful supporting documents for substantiation data.

Note: Participants should bring a calculator for in-class exercises.

Learning Objectives

By attending this seminar, participants will be able to:

• Define the critical elements of reverse engineering
• List the measurements and analyses required to duplicate/reproduce an OEM part by reverse engineering
• Recognize if an OEM part can be duplicated/reproduced by reverse engineering
• Judge if a “duplicated” part will meet the design functionality of the OEM part
• Evaluate the feasibility of a reverse engineering proposal/project
• Describe and implement a process to duplicate/reproduce a part by reverse engineering

Who Should Attend

This seminar is designed to assist individuals in various industries including, but not limited to, automotive, aerospace, off-highway, motorsports and parts brokerage firms. Corporate senior executives, engineering managers, engineers, technicians, government inspectors, sales managers, salespersons, lawyers and legal counselors will find the course relevant and informative.

Topical Outline

DAY ONE

• Introduction
  • Historical background
  • Reverse engineering vs. machine design
  • Three basic requirements: form, fit and function
• Geometrical Form
  • Dimensional measurement
  • Precision instruments of measurement
  • Tolerance
  • Virtual exercise of geometrical modeling
• Material and Process Identification
  • Chemical composition identification
  • Manufacturing process verification
  • Materials specification substantiation
  • Machining process identification
• Data Process and Analysis
  • Statistical analysis
  • Statistical exercise
• Reliability

DAY TWO

• Demonstration and Exercise
  • Demonstration of scanning
  • Hands-on exercise of reverse engineering
• Case study
• Regulations and Certifications
  • Government regulations
  • Industrial standards Certification requirements

Instructor: Lee D. Dawson
Fee $1445 1.3 CEUs
Robust Design
2 Days
I.D.# C1231

Engineers are taught to create designs that meet customer specifications. When creating these designs, the focus is usually on the nominal values rather than variation. Robustness refers to creating designs that are insensitive to variability in the inputs. Much of the literature on robustness is dedicated to experimental techniques, particularly Taguchi techniques, which advocate using experiments with replications to estimate variation. This course presents mathematical formulas based on derivatives to determine system variation based on input variation and knowledge of the engineering function. If the function is unknown, experimental techniques are presented to efficiently estimate a function.

The concept of designing for both nominal values and variability is expanded to multiple outputs and designing to minimizing costs. Traditionally, if the output variation is too large to meet requirements, the tolerances (variation) of the inputs are reduced. Using the approach presented in this course, the equations presented can be used to identify the contribution of each of the inputs to the output variation. The variation of the components with the largest contribution can be reduced which will reduce output variation. At the same time, the variation of the components contributing the least to the variation of the output can be increased which will reduce costs. A system of equations can be created that will allow an optimization routine to create a design optimized for total cost including the cost of poor quality and component cost.

Participants should bring a laptop computer for in-class exercises.

Learning Objectives
By attending this seminar, participants will be able to:
• Create designs that have a minimal sensitivity to input variation
• Reduce design costs
• Determine which design parameters have the largest impact on variation
• Optimize designs with multiple outputs

Who Should Attend
This course is relevant to design and manufacturing engineers, researchers and those interested in cost reduction. This methodology can link manufacturing to engineering design and help design engineering solve manufacturing problems.

Topical Outline
DAY ONE
• Basics of Variation - unique problems facing engineers; small sample sizes and the inability to obtain random samples; techniques for overcoming these problems
• Distributions
• Normal, Lognormal, and Weibull Process Capability
• Measuring process capability
• Process capability indices
• Estimating process capability for design inputs
• Robustness Concept
• Statistical bias that results from input variation in a non-linear system
• Modeling output variation
• Circuit exercise
• Projectile exercises
• Simulation
• Determining the variability of the inputs
• Random number generators
• Verification & validation
• Simulation modeling
DAY TWO
• Minimizing the Variance of a Single Output
• Polynomial exercise
• Identifying Critical Parameters
• Ranking the contribution to the output variation
• Identifying parameters that are constrained
• Pipe flow exercise
• How to Model and Optimize Multiple Outputs
• Combustion exercise
• Adding Cost to the Design Model
• Minimizing the total system cost including component, scrap and process costs
• Electronics exercise

Instructor: Bryan Dodson
Fee $1465 1.3 CEUs
Simplified Taguchi/DOE Methods

2 Days
I.D.# 96017

Companies realize that they need to do more with less which means we need to use the most efficient and effective methods. This seminar blends the philosophy of Taguchi with the simple graphical methods of Box, Hunter, & Hunter to give a powerful set of DOE tools.

Wide use of Design of Experiments or DOE methods has been hindered by complications in planning a DOE to handle interactions and by analysis complexity of ANOVA. A Preferred Columns Method simplifies planning so engineers can assign factors to an array in minutes. Graphical methods allow quality professionals to distinguish large (active) factors from small terms and portray these findings to broad audiences. By simplifying DOE’s, road blocks are removed so that more people can begin using these highly productive methods.

Learning Objectives

By attending this seminar, participants will be able to:
• Explain Taguchi’s Quality Philosophy of Closeness to Target
• Plan efficient factorial experiments using the Preferred Columns Method
• Compare data sets with dual or multiple stem and leaf plots
• Analyze the data using simple graphical methods such as dot plots and probability plots

Who Should Attend

This seminar will be most beneficial to engineers and quality professionals who work in product design, manufacturing, testing, reliability, quality, process, or development.

Topical Outline

• Taguchi Loss Function
• Comparison of Two Means
  • Dual stem & leaf plots
  • Exceedances test
  • Graphical T-test for differences
• One-Factor Experiments
  • Multiple stem & leaf plots
  • Graphical F-test for multiple comparisons
• Two-Factor Experiments
  • Response plots to see effects and interactions
  • Graphical F-tests to compare averages
• Full Factorials
  • Math model behind factorial experiments
  • Independent factors vs. interactions
  • Randomizing the runs
  • Planning Fractional Factorials Measurement system that uses continuous data

• How to select factors for a DOE
• Confounding patterns and resolution
• Preferred Columns Method to set up a fractional factorial
• Data sheets
• Customizing for a 4-level factor
• Analyzing Fractional Factorials
  • Column effects table
  • Quantifying the noise of repeats
  • Dot plots with error distributions
  • Interaction plots
  • Prediction model
  • Cube plot
  • Probability plot of column effects

Instructor: Jerry L. Roslund
Fee $1370 1.3 CEUs

Statistical Methods for Quality Engineering

3 Days
I.D.# C0554

Based on your test data or process data, do you ever wonder if:
• An improved product really performs better?
• A substitute material really processes the same?
• A cheaper material really performs satisfactorily?
• What confidence do you have in the final decision that you make?

This seminar helps individuals responsible for product or process development and testing to statistically assess the variation of the product or process performance and make effective decisions with confidence. Technical personnel are consistently making changes to product and process designs and the resultant performance changes need a statistical basis for moving ahead to the cost assessment and release phases. Various continuous and discrete probability functions are covered with the normal distribution receiving the most emphasis. Other distributions covered include Weibull, Exponential, Binomial, Poisson, Hypergeometric, and nonparametric comparisons. Various confidence intervals and tests of comparison, including Z test, Student’s t tests, Chi-Square test, F test, and ANOVA for the normal distribution for these probability functions are covered.

Learning Objectives

By attending this seminar, participants will be able to:
• Select the proper distribution model
• Determine valid sample sizes
• Design valid tests of comparison
• Make effective decisions at stated confidence levels

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529 • Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
Who Should Attend
This course applies to anyone making product or process assessment or changes and will help them to make effective decisions concerning those situations. Product design managers and engineers, process design managers and engineers, and quality managers and engineers will particularly benefit from this course. Individuals seeking to attain the Certified Quality Engineering status within the American Society for Quality will find this course particularly helpful.

Topical Outline
DAY ONE
• Introduction
  • Training objectives
  • Statistical resources
• Concept of variation
  • Common development questions
  • Histograms
  • Descriptive statistics
• Distribution Models
  • Continuous
  • Discrete
  • Applications
• Model Selection
  • Empirical distribution functions
  • Cumulative distribution functions
  • Normal probability paper
  • Small sample sizes and median ranks
  • Tests for normality
DAY TWO
• Parametric Evaluations and Tests
  • Normal and log-normal data - Z confidence intervals and tests; t confidence intervals and tests; Chi-Square confidence intervals and tests; K factor confidence intervals; F tests;
DAY THREE
• Parametric Evaluations and Tests (continued) - analysis of variance
  • Weibull distribution, confidence intervals and tests
  • Exponential distribution tests
  • Poisson distribution applications
  • Binomial distribution applications
  • Hypergeometric applications
• Nonparametric Tests
  • Sign tests, Run tests, and Rank tests

Instructor: Phillip J. Ross
Fee $1745 2.0 CEUs

Vibration Analysis Using Finite Element Analysis (FEA)
12 Hours
I.D.# WB1401

Finite Element Analysis (FEA) has been used by engineers as a design tool in new product development since the early 1990’s. Until recently, most FEA applications have been limited to static analysis due to the cost and complexity of advanced types of analyses. Progress in the commercial FEA software and in computing hardware has now made it practical to use advanced types as an everyday design tool of design engineers. In addition, competitive pressures and quality requirements demand a more in-depth understanding of product behavior under real life loading conditions. This course will enable participants to expand the scope of FEA to vibration analysis to simulate product behavior under those conditions. This six-session web seminar introduces vibration analysis performed with Finite Element Analysis (FEA). By considering time-dependent loads and inertial and damping effects, vibration analysis allows for a more in-depth product simulation thus reducing product development cost and time. The course reviews basic concepts of vibration analysis and illustrates how they are implemented in FEA to simulate product behavior. The most common types of vibration analysis such as modal, time response, and frequency response will be covered.

All topics are illustrated using FEA software, SolidWorks® Simulation, for which participants will be provided a student license and opportunity to practice skills learned. Acquired skills, however, will not be software specific and no prior exposure to FEA software is required.

Learning Objectives
By participating in this web seminar, participants will be able to:
• Evaluate the importance of dynamic effects in product simulation
• Analyze inertial and damping effects in structural response
• Perform modal analysis, time response analysis and frequency response analysis
• Apply proper FEA modeling techniques to model system vibration
• Use vibration analysis as a design tool
Who Should Attend

The course will be of interest to design, R&D, project, and product engineers who already use Finite Element Analysis (FEA) as a design tool and would like to explore if and how vibration analysis with FEA may benefit the design process. It builds on participants’ experience with static FEA and on knowledge of mechanical vibrations common to any mechanical engineer.

Topical Outline

Session 1
- Structure vs. Mechanism
- Simulation Process with the FEA
- Verification and Validation of FEA Results
- Discrete and Distributed Systems
- Mode of Vibration
- Modal Analysis
- Eigenvalues and eigenvectors
- In-class Exercises/Home Assignment

Session 2
- Modal Analysis
- Convergence of Frequencies
- Rigid Body Modes
- Properties of Lower and Higher Modes
- Modes of Vibration of Single Degree of Freedom Oscillator (1DOF) and Two Degrees of Freedom Oscillator (2DOF)
- In-class Exercises/Home Assignment

Session 3
- Modal Analysis
- Modeling Techniques in Modal Analysis
- Modes Separation
- Modal Analysis as a Tool to Find “Weak Spots”
- Modal Analysis as a Diagnostic Tool
- In-class Exercises/Home Assignment

Session 4
- Modal Analysis with Pre-Stress
- Buckling Analysis
- Analogies between Modal Analysis and Buckling Analysis
- Modes of Vibration
- Modal Superposition Method
- In-class Exercises/Home Assignment

Session 5
- Time Response Analysis
- Load Excitation and Base Excitation
- Impulse Load
- Static vs. Dynamic Response
- Time Response of a 1DOF and 2DOF Systems Time Response of a Distributed System
- In-class Exercises/Home Assignment

Session 6
- Frequency Response Analysis
- Steady State Harmonic Response
- Force and Base Excitation
- Resonance
- Modal Damping
- Frequency Response of a 1DOF and 2DOF Systems
- Frequency Response of a Distributed System
- Linear vs. Non-linear Vibration Analysis
- Summary for Post-Course Learning Assessment

Instructor: Paul Kurowski
Fee $870 1.2 CEUs

Tolerance Stack-up Fundamentals Web Seminar and Web Seminar RePlay

6 Hours
Web Seminar: I.D.# C0842
Web Seminar RePlay: I.D.# PD330842ON

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 connecting with this Web Seminar, participants 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
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.
ENGINEERING TOOLS & METHODS

Topical Outline

Session 1
• Introduction and review
  • Introduction and tolerancing review
  • Tolerancing strategies
  • Review of GD&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 GD&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

Instructor:
John-Paul Belanger

Fee $640 .6 CEUs

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

16 Hours
Web Seminar: I.D.# WB0933
Web Seminar RePlay: PD330933ON

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-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 connecting with this Web Seminar, participants 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.

Topical Outline

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 condition
  • 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
Advanced GD&T Competencies: Composite Positioning Web Seminar and Web Seminar RePlay

1.5 Hours
Web Seminar: I.D.# WB1321
Web Seminar RePlay: I.D.# PD331321ON

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 connecting with this Web Seminar, participants 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 Advanced GD&T Competencies: Datum Usage Web Seminars - see descriptions below.

Topical Outline
• 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

Instructor: John-Paul Belanger
Fee $995 1.6 CEUs

Advanced GD&T Competencies: Datum Usage Web Seminar and Web Seminar RePlay

1.5 Hours
Web Seminar: I.D.# WB1319
Web Seminar RePlay: I.D.# PD331319ON

Standard Geometric Dimensioning & Tolerancing courses cover the basics of datums but can overlook the variations that enable usage in complex ways. This advanced Web Seminar details 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. Participants 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. Web Seminar also covers 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 connecting with this Web Seminar, participants 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: Composite Positioning and Advanced GD&T Competencies: Profile of a Surface Web Seminars. See course descriptions on pages 30 and 31.

Prerequisites
For those new to GD&T, the Fundamentals of Geometric Dimensioning & Tolerancing Web Seminar is a recommended prerequisite. See the course description on page 29.

Topical Outline
• 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

Instructor: John-Paul Belanger
Fee $215 .15 CEUs

Advanced GD&T Competencies: Profile of a Surface Web Seminar and Web Seminar RePlay
1.5 Hours
Web Seminar I.D.# WB1320
Web Seminar RePlay: I.D.# PD331320ON
Basic Geometric Dimensioning & Tolerancing courses cover profile but often ignore the variations allowed with these symbols that enable usage in complex ways. This advanced Web Seminar clarifies the proper use of the profile tolerances in GD&T and uncovers the nuances of these two symbols. Profile of a surface is arguably the most powerful GD&T symbol, so its full potential is explored. It can be used to control size, form, orientation, and location and its relationship to datums can be varied. Learning these advanced techniques allow designers to better communicate certain requirements. The examples given in the course will also illustrate several of the new options for profile that were introduced in the ASME Y14.5-2009 standard.

Learning Objectives
By connecting with this Web Seminar, participants 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 Advanced GD&T Competencies: Composite Positioning Web Seminars. See course descriptions on previous pages.

Prerequisites
For those new to GD&T, the Fundamentals of Geometric Dimensioning & Tolerancing Web Seminar is a recommended prerequisite. See course description on page 29.

Topical Outline
• 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 tolerated dimensions
• Using the MMB modifier with profile
• Composite profile
• The “U” modifier
• Nonuniform tolerancing

Instructor: John-Paul Belanger
Fee $215 .15 CEUs
WE ARE PLEASED TO ANNOUNCE GD&T EDUCATION AND TRAINING AND REFERENCE RESOURCES FROM EFFECTIVE TRAINING INC. (ETI), AN SAE INTERNATIONAL COMPANY.

Getting where you need to go in your job.

A seasoned training company founded by globally recognized GD&T expert Alex Krulikowksi, ETI offers an array of training products designed to train industry engineers at all levels of GD&T usage. High-quality learning products including classroom and digital courses, text books and reference guides, and job resources all meant to produce the world’s best GD&T practitioners. All ETI instructors are ASME certified and mentored by Alex Krulikowski.

Explore public seminars, on-site training, live and on-demand web training, and other GD&T resources from ETI.

Course titles from ETI include:

- Engineering Drawing Requirements
- ASME Y14.5M-1994-2009 Comparison
- GD&T for Manufacturing (ASME Y14.5-2009)
- Functional Gaging and Measurement
- Intro to Statistical Tolerance Stacks
- Solid Model Tolerancing (ASME Y14.41)
- Tolerance Stacks Using GD&T

For more information or to arrange GD&T training or resources for your whole team, visit etinews.com or contact sales@etinews.com

Engineering Drawing Requirements

1 Day
I.D.# ET2701

This subject is offered as 12-hour or 1-day course.

Providing you have a basic understanding of engineering drawings, this course teaches how to correctly interpret engineering drawings. It will improve a student’s understanding of print reading and result in more effective communication on the job.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course focuses on practical application of print interpretation providing a better understanding of the view representation, dimensions, tolerances, and symbols used.

Learning Objectives
By attending this class, participants will be able to:

- Describe the types of engineering drawings
- Recognize common drawing formats
- Explain line conventions and lettering used on drawings
- Recognize types of drawing views
- Recognize the section views on drawings
- Describe dimensioning and tolerancing practices on drawings
- Explain surface texture standards and symbols
- Describe how weld symbols are used on drawings
- Recognize the symbols and conventions used on electronic diagrams

Who Should Attend
This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Attendees should have a basic understanding of engineering drawings prior to enrollment.

Topical Outline

- Engineering Drawings
  - Engineering drawings
  - CAD
  - The purpose and importance of engineering drawings
  - Standards used on engineering drawings
  - Types of engineering drawings
  - Layout, detail, assembly, control, and diagram drawings
- Drawing Formats
  - Drawing sheet sizes
  - Drawing zones
  - Title and revisions blocks
Solid Model Tolerancing (Based on ASME Y14.41)

1 Day
I.D.# ET2501

Providing you have a basic understanding of Y14.5 Dimensioning and Tolerancing practices, this course explains the fundamental definitions, concepts, and methods from the ASME Y14.41 Standard on Digital Product Definition Data Practices.

Utilizing the expertise of world-renowned GD&T expert and former Chairman of the Y14.41 Committee, Alex Krulikowski, the course focuses on understanding the benefits of a math-based product development process.

Learning Objectives

By attending this class, participants will be able to:

• Explain the benefits of a math-based product development process (PDP)
• Describe the history, basic information, and definitions from the Y14.41 standard
• Explain how to create product definition data sets
• Describe data set requirements
• List drawing model data set requirements
• Explain various requirements that apply to annotated model data sets
• List the requirements when using the annotated model method
• Recognize the gaps, issues, and challenges of implementing a math-based PDP

Who Should Attend

This course is valuable for designers, engineers, and managers who are considering implementation of a math-based product development process. Attendees should have a basic understanding of Y14.5 Dimensioning and Tolerancing practices.

Topical Outline

• The Product Development Process
  • The characteristics of current PDP’s
  • Problems with current PDP’s
  • What a math-based PDP is
  • The benefits of math-based PDP’s
  • The role of standards in implementing math-based PDP’s
• General Information on the ASME Y14.41 Standard
  • The history of the Y14.41 standard
  • Basic information about Y14.41
  • Y14.41 terms
• The Data Set Concept
  • The data set concept explained
  • Two methods in the standard for creating product definition data sets

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

Fee: Contact ETI for pricing information

0.7 CEUs
ENGINEERING TOOLS & METHODS

- Common Requirements for Data Sets
- Data set and design model requirements that apply to both the annotated model data set and drawing data set
- Display management requirements
- Reasons for model value query
- Requirements for resolved, basic, and size dimensions
- Requirements for the Drawing Data Set Method
  - The data set requirements that apply to the drawing data set method
  - General method requirements for drawing data set method
  - The requirements for work coordinate systems in orthographic and axonometric views
  - The requirements for specifying section views, dimensions in axonometric views, datums, and geometric tolerances
- Requirements for the Annotated Model Method
  - The data requirements that apply to annotated model data sets
  - The design model requirements for the annotated model method
  - The requirements for views, annotation, query, and notes on annotated models
- Tolerancing Using the Annotated Model Method
  - The requirements for plus-minus tolerances
  - The requirements for datum applications
  - The requirements for displaying geometric tolerances
- Gaps, Issues, and Challenges of Implementing a Math-Based Development Process
  - The benefits of the Y14.41 standard
  - The major questions that companies need to answer to implement a math-based development process
  - The gaps and issues when trying to achieve a math-based product development process

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

Fee Contact ETI for pricing information

No CEUs are offered for this course

Fundamentals of GD&T (Based on ASME Y14.5M-1994)

1 Day
I.D.# ET2601

This subject is offered in multiple course lengths.

Providing you have a basic understanding of mechanical drawings, this course teaches the terms, rules, symbols, and concepts of GD&T as prescribed in the ASME Y14.5M-1994 Standard. Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course offers an in-depth explanation of geometric symbols, including each symbol’s requirements, tolerance zones, and limitations. It also includes a comparison of GD&T to coordinate tolerancing; an explanation of tolerance zones; Rules #1 and #2; form and orientation controls; tolerance of position; runout and profile controls. Newly acquired learning is reinforced throughout the class with more than 300 practice problems.

Learning Objectives

By attending this class, participants will be able to:
- Describe engineering drawings: importance, drawing conventions, dimensions and tolerances, standards
- Explain why geometric tolerancing is superior to coordinate tolerancing
- Describe the key terms used in geometric tolerancing
- Recognize the modifiers and symbols used in GD&T
- Explain the rules used in GD&T
- Describe the concepts of basic dimensions, worst-case boundary, virtual condition, inner and outer boundary, and bonus tolerance
- Interpret the various types of tolerances (flatness, straightness, circularity, cylindricity, perpendicularity, angularity, parallelism, position, concentricity, symmetry, runout, and profile)
- Describe the datum system
- Interpret applications of datum targets, feature of size datum specifications (RFS & MMC)
- Describe the fundamental concepts of tolerance of position
- Interpret tolerance of position special applications

Who Should Attend

This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Attendees should have completed ETI’s Engineering Drawing Requirements course or equivalent.

3 ways to get a no-obligation price quote to bring a course to your company:
- Call SAE Corporate Learning at +1.724.772.8529
- Fill out the online quote request at sae.org/corplearning
- Email us at Corplearn@sae.org
Fundamentals of GD&T for Inspectors
(Y14.5M-1994, Y14.5.1, and Y14.43 Standards)

2 Days
I.D.# ET2053

Providing you have a basic understanding of geometric dimensioning and tolerancing fundamentals, this course teaches an introduction to how to inspect GD&T requirements.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, this course offers an explanation of the geometric symbols, rules, and concepts, the datum system, and how to inspect GD&T requirements using tools from the four categories of inspection tools. The scope of the course does not include how to use the various inspection tools.

Learning Objectives

By attending this class, participants will be able to:

• Describe inspection and engineering drawings
• Explain key terms used in GD&T and how they affect interpretation and inspection
• Recognize the modifiers and symbols used in geometric tolerancing
• Interpret and inspect Rule #1, Rule #2, flatness, straightness, circularity, cylindricity, perpendicularity, angularity, parallelism, concentricity, symmetry, circular and total runout
• Explain the concepts of basic dimensions, virtual condition, inner and outer boundary and bonus tolerance and their effects on inspection
• Interpret and simulate planar datums and datum targets for inspection
• Interpret and inspect feature of size datums RFS and MMC
• Explain the fundamental concepts of tolerance of position: definitions, conventions, advantages and interpretations and their effects on inspection
• Interpret and inspect tolerance of position RFS, MMC, and special applications
• Describe functional gages for tolerance of position (MMC) applications
• Explain profile tolerancing
• Interpret and inspect profile of a surface and profile of a line applications

Who Should Attend

This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Attendees should have completed ETI’s Engineering Drawing Requirements course or equivalent prior to enrollment.
ENGINEERING TOOLS & METHODS

Topical Outline

• Inspection
  • Quality parts and quality drawings
  • Inspection, importance, components, and the characteristics of an expert inspector
  • Sources of variation
  • Categories of inspection tools
• The Engineering Drawing
  • Engineering drawings, communication, and drawing errors
  • Dimension, tolerance, limit tolerance, plus-minus tolerance
  • Metric unit dimensions on drawings
  • Interpreting dimensional limits
  • ASME Y14.5M-1994 and the fundamental dimensioning rules
• Key Terms and Their Effect on Interpretation and Inspection
  • Feature, feature of size, cylindrical feature of size, planar feature of size
  • Actual local size, actual mating envelope of external and internal feature of size
  • Maximum and least material condition of a feature of size
  • Non-feature of size dimensions and regardless of feature size
• Modifiers and Symbols
  • Modifiers, geometric characteristic symbols, and controls
  • Radius and controlled radius
• Feature control frame interpreting and inspecting Rule #1 and Rule #2
  • Rule #1, envelope boundary, size dimension, overriding, and exceptions
  • Rule #1 effects on the interrelationship between features of size
  • Inspecting a feature of size controlled by Rule #1
  • Rule #2
• Basic Concepts
  • Basic dimensions, virtual condition and uses in inspection
  • Inner, outer, worst-case boundary, and virtual condition of a feature of size
  • Geometric tolerance applied to feature or feature of size
  • Bonus tolerance calculations
  • MMC and LMC modifiers and inspection
• Interpreting and Inspecting Flatness
  • Flatness, flatness tolerance zone, location, and inspection
  • Rule #1 as an indirect flatness control
  • Legal flatness specification
  • Establishing a reference plane for flatness
• Interpreting and Inspecting Straightness
  • Straightness, straightness tolerance zone, and Rule #1 as indirect straightness control
  • Legal straightness specification
  • Inspecting straightness applied to a surface
  • Determining if a straightness control is applied to a surface or a feature of size
• Interpreting and Inspecting Circularity
  • Circularity, circularity tolerance zone, and inspection
  • Rule #1 as an indirect circularity control
  • Legal circularity specification
• Interpreting and Inspecting Cylindricity
  • Cylindricity, cylindricity tolerance zone, and inspection
  • Rule #1 as an indirect cylindricity control
  • Legal cylindricity specification
• Interpreting and Simulating Planar Datums for Inspection
  • True geometric counterpart, datum feature simulator, and simulated datum
  • Datum feature symbol, planar datums, datum reference frame
  • Choosing datum features and what controls their orientation
  • Six degrees of part freedom in space and the 3-2-1 Rule
  • Datum-related and non datum-related dimensions
  • Datum reference frame for a part with inclined datum features
  • Coplanar datum features and simulation for inspection
• Interpreting and Simulating Datum Targets for Inspection
  • Datum targets, specification, requirements and the datum target symbol
  • Basic dimensions used to locate datum targets
  • Point, line, and area datum targets
  • Simulated gage for a point, line, and area datum target applications
  • Simulating datum targets for inspection
• Interpreting and Inspecting Feature of Size Datums (RFS)
  • Datum that results from a feature of size datum feature
  • Specifying an axis or center plane as a datum
  • How feature of size datum references communicate size condition
  • Datum feature simulators and coaxial datum features
• Interpreting and Inspecting Feature of Size Datums (MMC)
  • Referencing a feature of size datum at MMC
  • Special-case feature of size datums
  • Datum shift and datum application
  • Datum feature simulator – external / internal feature of size datum feature (MMC primary), MMC primary and secondary virtual condition
  • Datum axis for a pattern of features of size (MMC secondary)
  • Datum reference sequence and part to gage setup
  • Simulating datum features of size MMC for inspection
• Interpreting and Inspecting Perpendicularity
  • Perpendicularity tolerance on implied right angles, tolerance zone shapes
  • Perpendicularity of a surface and the surface flatness
  • Multiple datum references with a perpendicularity control
  • Perpendicularity of the axis/center plane of a feature of size
  • Perpendicularity control and worst-case boundary of a feature of size
  • Gage for verifying perpendicularity at MMC
  • Indirect perpendicularity controls, legal perpendicularity specification; inspection

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
ENGINEERING TOOLS & METHODS

• Interpreting and Inspecting Angularity
  • Angularity, tolerance zone, and inspection
  • Angularity of a surface and the surface flatness
  • Angularity control and the worst-case boundary of a feature of size
  • Angularity of the axis/center plane of a feature of size
  • Indirect angularity controls, legal angularity specification
• Interpreting and Inspecting Parallelism
  • Controlling parallelism when no symbol is shown
  • Parallelism, tolerance zone shapes, applied to a surface, and inspection
  • Parallelism of a surface and the flatness of the surface
  • Controlling the parallelism of the axis/center plane of a feature of size
  • Parallelism control and the worst-case boundary of a feature of size
  • Tangent plane modifier with a parallelism control
  • Indirect parallelism controls, legal parallelism specification
• The fundamental Concepts of Tolerance of Position: Definitions, Conventions, Advantages and Interpretations and Their Effects on Inspection
  • True position
  • Tolerance of position control, advantages, use of MMC modifier
  • Implied basic relationships
  • Virtual condition boundary and axis interpretation
• Interpreting and Inspecting Tolerance of Position RFS and MMC Applications
  • Tolerance of position control (RFS), tolerance zone, and tolerance zone shapes
  • Worst-case boundary of a feature of size controlled with tolerance of position at RFS
  • MMC modifier used in a tolerance of position application
  • Tolerance zone in tolerance of position (MMC) applications
  • Bonus tolerance available for a tolerance of position application
  • Datum shift available in a coaxial diameter tolerance of position application
  • Legal tolerance of position specification, inspection
• Functional Gages for Tolerance of Position (MMC) Applications
  • Functional and cartoon gages and benefits
  • Cartoon gage for a tolerance of position application
• Interpreting and Inspecting Tolerance of Position Special Applications
  • Interpreting position - applied to non-parallel holes and not perpendicular to the datum axis, a bi-directional position application, applied to elongated holes, with the projected tolerance zone modifier, in a symmetrical relationship, with the LMC modifier
  • Inspecting a projected tolerance zone
  • Bonus tolerance in an LMC application
• Position used to control the spacing and orientation of a hole pattern
  • M multiple single-segment position control and zero tolerance at MMC dimensioning
• Interpreting and Inspecting Concentricity
  • Concentricity, tolerance zone, median point, application, and inspection
  • Concentricity compared to total runout and tolerance of position (RFS)
  • Legal concentricity specification
• Interpreting and Inspecting Symmetry
  • Symmetry, tolerance zone, application, and inspection
  • Differences between symmetry and tolerance of position
  • Legal symmetry control specification
• Interpreting and Inspecting Circular Runout
  • Specifying datum axis for a runout application
  • Circular runout, tolerance zone (dia.), composite control, inspection
  • Amount of axis offset from a circular runout callout
  • Worst-case boundary in a circular runout application
  • Legal circular runout control specification
• Interpreting and Inspecting Total Runout
  • Total runout, tolerance zone (dia.), composite control, inspection
  • Amount of axis offset from a total runout callout
  • Worst-case boundary in a total runout application
  • Legal total runout control specification and circular vs. total runout
  • Distances on a part that uses runout
• Profile Tolerancing
  • Profile tolerancing with or without datum references and true profile
  • Part characteristics that profile can affect, tolerance zone coverage, advantages
  • Bilateral and unilateral profile tolerance zones, between and all around symbols
• Interpreting and Inspecting Profile of a Surface Applications
  • Tolerance zone for profile applied to planar and coplanar surfaces
  • Multiple single-segment profile application
  • Legal profile of a surface specification, inspection
• Interpreting and Inspecting Profile of a Line Applications
  • Profile of a line used in a multiple single-segment control
  • Used with a coordinate tolerance
  • Inspecting profile of a line

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski
Fee: Contact ETI for pricing information
1.3 CEUs
**ENGINEERING TOOLS & METHODS**

**Introduction to Statistical Tolerance Stacks**

1 Day  
I.D.# ET2055

Providing you have an understanding of tolerance stacks, this course teaches an introduction to statistical tolerance stacks, a crucial skill in today's competitive workplace.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course includes a brief overview of several terms used in statistical stacks. It explains four methods for applying statistics to tolerance stacks and covers precautions about when and how to use statistics in stacks. Newly acquired learning is reinforced throughout the class with stacks that allow the student to practice applying statistical methods.

**Learning Objectives**

By attending this class, participants will be able to:
- Define the terminology used with statistical tolerance stacks
- Describe common statistical tolerance stacks methods
- Calculate statistical tolerance stacks using the RSS method
- Calculate statistical tolerance stacks using the realistic method
- Apply the RPL method to statistical tolerance stacks
- Apply the Monte Carlo method to tolerance stacks
- Describe precautions needed when using statistical tolerance stacks

**Who Should Attend**

This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Please be aware that this is not an introductory course. Students should have completed ETI's Tolerance Stacks Using GD&T course or equivalent prior to enrollment.

**Topical Outline**

- Importance of statistical stacks
  - The three assumptions that apply to Worst-case tolerance stacks
  - The two laws of probability that apply to statistical stacks
  - Two common probability distribution curves used in statistical stacks
  - The probability of an assembly of six parts with uniform distributions reaching extreme limits
  - The probability of an assembly of six parts with normal distributions reaching extreme limits
- Statistical stacks terminology
  - Statistics and data
  - Uniform and normal frequency distributions
  - Range, mean, and deviation
  - Variance and standard deviation
  - Specification limits
  - Standard normal curve and the Empirical Rule
  - A Z score and parts per million rejects
  - Control limits
  - How CP and CPK relate to a normal distribution
  - The difference between dependent and independent variables
- Common statistical tolerance stacks methods
  - What a statistical tolerance stack is
  - The Realistic Predicted Limits (RPL) method its assumptions
  - The Root Sum of Squares (RSS) method and its assumptions
  - The Motorola Six Sigma Root Sum of Squares (RSS) method and its assumptions
  - The Monte Carlo Simulation method and its assumptions
  - The formulas for and results of using the different statistical stack methods
  - Three benefits of statistical stacks
  - Two common reasons why statistical stacks are done
- The ETI statistical stack form
  - How to complete the ETI statistical stack form
  - The four stack consequences that must be considered when doing statistical stacks
- The RPL statistical stack method
  - The formula for calculating the RPL factor
  - A qualified dimension used in the RPL method
  - How to do the RPL method using the ETI statistical stacks form
  - The advantages and disadvantages of the RPL method
  - Calculating a statistical stacks using the RPL method
- The Six Sigma DRSS statistical method
  - The derivation of the standard RSS statistical stack formula
  - The seven steps in calculating a RSS statistical stack
  - Calculating a stack using the RSS method with a safety (Bender) factor applied
  - The Motorola Six Sigma RSS formula and its advantages
  - The Dynamic RSS (DRSS) formula and its advantages
  - The eight steps in calculating a DRSS statistical stack
  - How to do a DRSS stack using the ETI statistical stack form
  - How to interpret the stack results shown on the ETI statistical stack form
  - How to adjust a statistical stack to handle dependent variables (bonus & shift)
  - Statistical stack results before and after adjusting for dependent variables
Critical Concepts of Tolerance Stacks -
Based on ASME Y14.5-2009

2 Days
I.D.# ET1701

This two-day course provides an in-depth explanation of how to use tolerance stacks to analyze product designs and how to use geometric tolerances in stacks. You will learn the essential methods and concepts used for creating 1D part and assembly tolerance stacks. The course was developed utilizing the expertise of world-renowned GD&T expert Alex Krulikowski and features numerous practice problems and in-depth coverage of tolerance stacks applications.

Each attendee receives a robust collection of learning resources including:
- A copy of Critical Concepts of Tolerance Stacks workbook
- A Tolerance Stacks Drawing Package
- An Excel tolerance stack spreadsheet template
- A Tolerance Stacks Summary Chart

In order to understand the course content, students should have a good understanding of GD&T based on the ASME Y14.5-2009 Standard either through work experience or knowledge gained by participating in a course such as the ETI Fundamentals of GD&T 3-Day Workshop. Find the course information on page 49. Basic GD&T concepts will not be covered in this course.

Learning Objectives
By attending this class, participants will be able to:
- Describe how virtual condition affects the assembly of parts
- Explain the importance of tolerance stacks and be familiar with stack methods, the stack form and the stack spreadsheet
- Calculate part stacks using coordinate dimensions, runout and concentricity, profile tolerances, multiple geometric tolerances, position tolerances at RFS and MMC/MMB
- Calculate assembly stacks using coordinate dimensions, runout and concentricity, bilateral and unilateral profile tolerances, multiple geometric tolerances, position tolerances at MMC/MMB
- Calculate stacks using form and orientation applied to features and features of size

Who Should Attend
This course is valuable for individuals who create or interpret engineering drawings; product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators.
Topical Outline

- Introduction to Tolerance Stacks
  - Stack definition
  - Importance/purpose/benefits of stacks
  - When stacks should be calculated
- Introduction to 1D Stack Methods
  - Definition and stack conventions
  - Effects of rounding
  - Four basic stack steps
  - Virtual condition concepts, calculations, clearance/interference between mating part features
- ETI Stack Form and Spreadsheet
  - Major parts of the stack form
  - Stack abbreviations
  - Use and limitations of the spreadsheet
- Part Stacks Using:
  - Coordinate dimensions
  - Runout tolerances
  - Profile tolerances
  - Position tolerances at RFS
  - Position tolerances at MMC
  - Position tolerances at MMB
  - Basics of datum shift
  - Datum shift exceptions
  - Multiple geometric tolerances
- Assembly Stacks Using:
  - Coordinate dimensions
  - Runout tolerances
  - Profile tolerances
  - Position tolerances at MMC/MMB
  - Form and orientation tolerances applied to surfaces and features of size
  - Multiple geometric tolerances
- Course Summary
  - The six critical concepts of tolerance stacks
  - Preview of advanced tolerance stacks course
  - Course assessment

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

Fee
Contact ETI for pricing information
1.3 CEUs are offered for this course

GD&T for Manufacturing (ASME Y14.5-2009 Standard)

1 Day
I.D.# ET2726

Providing you have an understanding of GD&T fundamentals, this course teaches an introduction to geometric dimensioning and tolerancing and its impact on the manufacturing process.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course focuses on the basic requirements of engineering drawings, size dimensions, form tolerances, and the datum system, as well as the impact of tolerancing requirements on production.

Learning Objectives
By attending this class, participants will be able to:
- Understand the basic facts about engineering drawings
- Recognize the types of dimensions and tolerances used on engineering drawings
- Explain the basic concepts and requirements of size dimensions
- Answer five basic questions for interpreting form tolerances
- Describe the basic concepts of the datum system and planar datums
- Answer five basic questions for interpreting orientation, position, runout, and profile of a surface tolerances
- Explain the purpose and limitations of in-process inspection methods
- Assess the GD&T on a typical drawing and determine the impact to manufacturing

Who Should Attend
This course is designed for product engineers, designers, checkers, and engineering managers, and supplier quality engineers. Attendees should have completed ETI’s Engineering Drawing Requirements course or equivalent prior to enrollment.

Topical Outline

- Engineering Drawings
  - Engineering drawing purposes
  - Relationship between drawings and part function
  - Applicable standards on drawings
  - Why drawings are legal documents
  - Fundamental tolerancing rules
- Dimensions and Tolerances
  - Geometry attributes of a part
  - General dimensioning symbols
  - General notes, flag notes, and local notes;
  - The 14 major GD&T symbols
  - The feature control frame
ENGINEERING TOOLS & METHODS

- Basic dimensions
- Implied specifications from assumptions
- Size Dimensions
  - Feature and feature of size
  - Maximum material condition (MMC)
  - Regardless of feature size (RFS)
  - Rule #1 and its effect on a size dimension
- Form Tolerances
  - Form deviations
  - Flatness, straightness, and circularity tolerances
  - How bonus tolerances affect part processing
  - Correctly specifying form tolerances
- Datum System and Planar Datums
  - The shortcomings of implied datums
  - The benefits of a datum system
  - Planar datums
- Datum Targets and Size Datums
  - Datum target symbols and applications
  - Datum targets establishing a datum reference frame
  - Terms used with size datums
  - Specifying an axis and a center plane as a datum
  - Recognizing when an MMB exists
  - Differences between MMB and RMB datum applications
- Orientation Tolerances
  - Interpreting perpendicularity and parallelism tolerances
  - Bonus tolerance effects on part processing
  - Correct specification of an orientation tolerance
- Position Tolerances
  - Interpreting a position tolerance of a feature of size
  - Recognizing when a bonus tolerance exists
  - Correct specification of position tolerance
- Runout Tolerances
  - Effects of a runout tolerance
  - Circular runout tolerance interpretation
  - Correct specification of a runout tolerance
- Profile of a Surface Tolerances
  - Effects of a profile of a surface tolerance
  - Basic requirements of a profile of surface tolerance
  - Profile of surface tolerance interpretation
  - Correct specification of a profile of a surface tolerance
- In-Process Inspection
  - The purpose of in-process and final inspection and their differences
  - Categories of inspection tools
  - Common in-process inspection tools
  - Limitations of in-process inspection
  - Tools capable of verifying certain applications
- Assessing GD&T on Your Drawings
  - Identifying and understanding items on a drawing:
    - Applicable standards
    - Names of geometric tolerances
    - Which symbols apply to a feature or a feature of size
  - MMC for each feature of size
  - Size of the Rule #1 boundary for the features of size
  - Datums indicated
  - Amount of bonus tolerance for the position tolerance
  - Which dimensions are related to a datum reference frame
  - If geometric tolerances are specified correctly
  - Answers to the five basic questions for interpreting geometric tolerances
  - In-process inspection methods that could be used

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski
Fee Contact ETI for pricing information
0.7 CEUs are offered for this course

Applications of GD&T (Based on Y14.5M-1994 & Y14.5-2009)

2 Days
I.D.# ET2512

Providing you have an understanding of GD&T fundamentals, this course teaches the thought processes involved in assigning GD&T to components. It will change the way many engineers think about part tolerancing.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course focuses on what constitutes good and poor drawing practices, common dimensioning methods used in industry, using GD&T to communicate system functions on component dimensions, and the logic of how to apply GD&T to components. Newly acquired learning is reinforced when students perform a design function analysis on a part assembly, then specify GD&T on assembly components during the seminar. (This is optional in case of concerns over drawings and privacy.)

Learning Objectives

Attendees will learn how to do a design functional analysis on an assembly and use this information to assign dimensions and tolerances. They will also learn how to select datum features and how to fully define component surfaces using GD&T. Establishing tolerance values is not covered. The students will work in teams and actually create GD&T tolerance mark-ups of their company parts in the workshop.

By attending this class, participants will be able to:
- Describe the importance of technically correct drawings
- List three major areas that affect the creation and interpreta-


**ENGINEERING TOOLS & METHODS**

- Explain the common approaches to part tolerancing
- Identify and specify datum features based on the fit and functional requirements of the part
- Use GD&T to communicate functional requirements of a component
- Describe how to specify nonfunctional dimensions
- Explain the five-step approach to functionally dimensioning a component
- Apply the five-step method to functionally dimensioning a component to your company product

**Who Should Attend**

This course is for product engineers, designers, checkers, and engineering managers, and supplier quality engineers. Please be aware that this is not an introductory course. Attendees should have completed 16 hours of formalized classroom training in GD&T or ETI’s Fundamentals of GD&T course, experience interpreting or applying GD&T in an industrial setting, and working knowledge of the ASME Y14.5M-1994 Standard or ASME Y14.5-2009 Standard.

**Topical Outline**

- Importance of technically correct drawings
- Principles and guidelines for making technically correct drawings
- Common approaches to part tolerancing
- Specifying datums based on mounting and performing features
- Using GD&T to describe functional relationships on a component
- Specifying secondary (nonfunctional) dimensions
- The five-step approach to functionally dimensioning a component
- Applying the five-step approach to functionally dimensioning a component

**Instructor:**

This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

**Fee**

Contact ETI for pricing information

1.3 CEUs are offered for this course

---

**Functional Gaging and Measurement (ASME Y14.43, Y14.5, Y14.5.1, B89.3.1, B89.7.2, and B89.7.3 Standards)**

**2 Days**

**I.D.# ET8200**

Providing you have a basic understanding of geometric dimensioning and tolerancing fundamentals, this course is an introduction to functional gaging design and teaches how to verify part dimensional requirements using functional gages and other measurement methods.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, this course offers an explanation of metrology, the roles of the metrologist and inspector, measurement uncertainty, inspection tools, functional gages, inspection planning and reporting, and simulating datums. The scope of this course does not include measurement systems analysis or sampling strategies.

**Learning Objectives**

By attending this class, participants will be able to:

- Describe the functions of inspection in an organization
- Define what measurement uncertainty is.
- Explain the basic operating principles, strengths, and weaknesses of the three major categories of inspection tools
- List the types, uses, and tolerance methods for attribute gages
- Explain attribute gage design fundamentals
- Develop a measurement / inspection plan
- Describe the purpose and content of an inspection report
- Inspect and report size dimensions
- Describe the basic concepts of datums related to inspection
- Understand how to simulate datums for inspection
- Verify flatness, straightness, circularity, cylindricity, orientation, position, runout, profile of a surface, and profile of a line tolerance requirements

**Who Should Attend**

This seminar is a valuable tool for individuals who inspect parts, create inspection plans, or approve inspection methods. Typical attendees include CMM operators, inspectors, gage designers, manufacturing engineers, technicians, supplier quality engineers.

**Prerequisites**

Please be aware that this is not an introductory course. In order to understand the course content, you should have:

1. Completed 16 hours of formalized classroom training in GD&T
2. Experience interpreting or applying GD&T in an industrial setting
3. Have a working knowledge of the ASME Y14.5M-1994 Stan-
Topical Outline

- Inspection in an Organization
  - Quality: the purpose and contents of a quality manual
  - Metrology and the roles of a metrologist
  - Importance and types of inspection, roles of inspector
- Introduction to Measurement Uncertainty
  - Terms, importance, and major contributors
  - Using calipers for size measurements
  - Type A, type B, combined, and expanded uncertainties
  - Measurement uncertainty standards and major contributors
  - Decision rule, requirements, and factors that affect the choice of a decision rule
  - Guard band, simple acceptance, and simple rejection
  - Pros and cons of measurement uncertainty decision rules
  - Uncertainty calculator software
- Three Major Categories of Inspection Equipment
  - Three categories, types, and pros and cons of inspection tools
  - Attribute and variables gages and data, operating principles
  - Common sources of attribute and variables gage errors
  - Operating principles of algorithmic measurement
  - Common sources of CMM errors
- Attribute Gaging Concepts
  - Supporting Y14.5 concepts, common types, uses
  - Basic concept of functional gauges
  - Options for gaging tolerance policies
  - Y14.43 recommendations and cost effects
  - The five gagemakers’ tolerance classes
- Attribute Gaging Design Fundamentals
  - Design constraints of functional gages
  - Considerations for workpiece distortion during gaging
  - In-process, final acceptance, and referee gages
  - Calculating gage pin size using absolute, tolerant, and optimistic tolerancing policies
  - Gage tolerance accumulation
  - How RMB datum references affect gage design
- Benefits of RMB Datum Feature Simulation
  - Permitted departure from MMC and LMC principles of a gage design
  - Measurement / Inspection Plan
  - Dimensional measurement plan (DMP) purposes, contents, and importance
  - Eight inputs to a DMP
  - Classification of dimensional characteristics
  - Seven steps to creating a DMP
- Inspection Reporting
  - Inspection reports, requirements, standards for reporting
  - Common methods for indicating inspection numbers
  - Mark up a drawing to number the dimensions for inspection
  - Non-conformance report and contents
- Inspecting and Reporting Size Dimensions
  - Y14.5 requirements for a feature of size
  - Relationship between Rule #1 and a size dimension
  - Inspecting MMC size limits
  - Minimum CMM probe points
  - Rule #1 MMC boundary, actual local size inspection
  - Reporting MMC & LMC size inspection results
- Datums Related to Inspection
  - Y14.5 requirements
  - Effects of datum sequence on inspection
  - Y14.5.1 candidate datum set concept
- Simulating Datums for Inspection
  - Simulate datum planes using a fixture, datum reference frame with a functional fixture
  - Effects of datum reference frame simulation with a fixture on inspection
  - Simulating datum planes and a datum reference frame using a CMM
  - Simulating a datum axis (RMB) on a functional fixture and using a CMM
  - Simulating a datum axis (MMB) on a fixture
  - How a functional gage accounts for datum shift
  - How a CMM simulates datum shift (MMB)
- Verifying Flatness Tolerance Requirements
  - Y14.5 requirements
  - Applied to a surface: verification using variable and algorithmic measurement
  - At MMC: verification with attribute measurement
  - Dimensional measurement planning and inspection reporting
- Verifying Straightness Tolerance Requirements
  - Y14.5 requirements
  - Applied to a surface using variable and algorithmic measurement
  - Applied to a feature of size at MMC with attribute and variable measurement
  - Dimensional measurement planning and inspection
- Verifying Circularity and Cylindricity Tolerance Requirements
  - Circularity and cylindricity tolerance Y14.5 requirements
  - Circularity: inspecting using variable and algorithmic measurement
  - B89.3.1 circularity verification and filtering requirements
  - Cylindricity: verification using variable measurement and a CMM
  - Dimensional measurement planning, inspection
- Verifying Orientation Tolerance Requirements
  - Y14.5 requirements for an angular dimension, perpendicularity tolerance applied to a surface and feature of size (RFS and MMC)
  - Angular tolerance verification and sources of uncertainty
Advanced Concepts of GD&T (Based on Y14.5M-1994)

2 days
I.D.# ET2411

This course is offered in a 2-day, 20-hour, and 3-day format.

Providing you have a basic understanding of geometric dimensioning and tolerancing fundamentals, this course teaches the advanced concepts of GD&T as prescribed in the ASME Y14.5M-1994 Standard.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, this course offers an in-depth explanation of advanced GD&T topics like composite tolerancing, tolerance analysis, datum selection, non-rigid part dimensioning, and many more key dimensioning topics, including the system approach for part dimensioning.

Learning Objectives
By attending this class, participants will be able to:

• Explain the importance of product design and functional dimensioning
• Define the terms “feature” and “feature of size”
• Recognize which dimensioning standards apply to an engineering drawing
• Explain the fundamentals of drawing interpretation and how to handle substandard drawings
• Recognize the difference between a rigid and a flexible (non-rigid) part
• State the requirements for tolerancing parts measured in the restrained state
• Identify the two special considerations for datum usage on restrained (non-rigid parts
• Calculate advanced applications of form controls
• Describe uses, advantages, misconceptions, and common errors of the datum system
• List nine common datum feature types
• Describe advanced datum target concepts
• Explain how to specify / interpret specialized datum feature applications
• Describe modifier usage in tolerance of position applications
• Describe the effects of simultaneous and separate requirements with tolerance of position
• Explain composite position tolerancing and multiple single-segment position tolerancing
• Interpret tolerance of position applications with a conical tolerance zone
• Explain composite profile tolerancing and multiple single-segment profile tolerancing
• Describe profile applications

Instructor:
This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

Fee
Contact ETI for pricing information
1.3 CEUs are offered for this course
ENGINEERING TOOLS & METHODS

Who Should Attend
This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Please be aware that this is not an introductory course. In order to understand the course content, attendees should have completed ETI’s GD&T Fundamentals course or equivalent.

Topical Outline (3-day format)
- GD&T Fundamentals Review
  - GD&T skills survey
  - GD&T fundamentals for further study
- Importance of Product Design
  - Product design effects on costs
  - Consequences of drawing errors
  - Advantages of GD&T
- Functional Dimensioning
  - The purpose of tolerances
  - The importance of specifying proper tolerances
  - The importance of a common tolerancing approach Tolerancing principles and benefits
- Interpretation of Feature
  - The terms “element,” “gap,” and “interruption”
  - Y14.5 definition of feature and types
  - Regular, element, complex, and interrupted feature; sub-feature
- Interpretation of Feature of Size
  - The terms “opposed,” “fully opposed,” “partially opposed,” “size dimension,” and “cylindrical”
  - Importance of distinguishing between a feature and feature of size
  - The definition of feature of size from Y14.5
  - Requirements and categories of a feature of size
  - Identifying and interpreting a complete, interrupted, partial, and bounded feature of size
- Applicable Drawing Standards
  - Determining on which standards an engineering drawing is based
  - Clarifying a drawing when no dimensioning standard is referenced
  - Reducing confusion on dimensioning standards
- Drawing Interpretation
  - Interpreting an engineering drawing
  - Drawing title block, revision column, general drawing notes
  - Fundamental rules that affect drawing interpretation
  - Surface coating and heat treat
  - Geometric controls and a valid datum system
  - Misconceptions on measuring parts that use the datum system
- Controlling characteristics for each part feature
- Proper uses for coordinate tolerancing
- Specification / interpretation
- Using Substandard Drawings
  - Categories of substandard drawing specifications Steps for dealing with substandard drawings
  - Things not to do when using a substandard drawing
- Rigid/Non-Rigid Parts Definitions
  - Free state; Restrained state
  - Rigid part; Non-rigid part and part feature
- Tolerancing Non-Rigid Parts
  - Tolerancing a non-rigid (restrained) part
  - Roles of a restraint note
  - Determining restraining conditions on non-rigid parts
  - Requirements that need to be addressed in a restraint note
  - The difference between a general note and a local restraint note
  - When a free state symbol should be used
  - Areas that need special attention when inspecting a non-rigid part
- Restrainted Part Datum Usage
  - How to use datum targets to support, orient, and locate a restrained part in the datum reference frame
  - How datum shift occurs on a restrained part
- Form Controls
  - Calculating the flatness tolerance value for a gasketed joint application
  - Calculating the cylindricity tolerance value in a support application
  - Calculating the straightness tolerance value in an assembly application
  - Overriding Rule #1 to limit flatness on a thin part
- The Datum System
  - When to use the datum system.
  - Advantages of the datum system.
  - Common misconceptions about the datum system.
  - Common errors in datum usage
- Datum Feature Types
  - Common datum feature types
  - When each datum feature type is typically used
  - Degrees of freedom restrained when each datum feature type is used
  - The datum feature simulator for the datum features referenced in a geometric tolerance
- Datum Targets
  - Reducing the impact that using datum targets has on functional dimensioning
  - Application requirements
  - Applications where datum targets should be used
  - Specifying fixed and movable datum targets
  - Special datum target types
  - Dimensioning a simulated gage for datum target applications
• Specialized Datum Applications
  • Specifying a screw thread as a datum feature and interpreting application
  • Specifying a gear or spline feature as a datum feature and interpreting application
• Temporary and permanent datum features
• Major disadvantage of temporary datum features
• Tolerance of Position Usage
  • When to use a tolerance of position control
  • Loss function curve, customer robust dimension, and customer sensitive dimension
  • Tolerance of position control and material condition used
• Simultaneous and Separate Requirements
  • Simultaneous and separate requirements, effects and where they apply
  • Tolerance of position at MMC simultaneous requirement
  • Tolerance of position controls as separate requirements
  • One exception to the simultaneous requirement
• Composite Position Tolerancing
  • Rules, advantages, and when to use it
  • “FRITZ” and “PLTZF”
  • Tolerance of position composite application
• Multiple Single-Segment Tolerance of Position Tolerancing
  • Rules, advantages, and when to use it
  • Tolerance of position vs. composite tolerance of position
• Conical Tolerance Zones
  • A conical tolerance zone and advantage of use
  • Specifying a conical tolerance zone in a tolerance of position application
  • When to use tolerance of position with a conical tolerance zone
• Profile Tolerances
  • Myths about profile controls
  • When to use a profile control
  • The four characteristics profile can control
  • Converting coordinate tolerances into profile callouts
  • The profile datum rule
• Profile and Simultaneous Requirements
  • Simultaneous requirement applied to profile
  • Profile controls with separate requirements
• Composite Profile Tolerancing
  • Composite profile tolerancing, rules, and advantages
  • Interpreting a composite profile application
• Multiple Single-Segment Profile Tolerancing
  • Rules, advantages, interpretation, when to use it
  • Profile vs. a composite profile tolerance

| Instructor: | This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski |
| Fee | Contact ETI for pricing information |
| CEUs vary based on course length | |

**Tolerance Stacks Using GD&T**

**2 Days**

**I.D.# ET2421**

This subject is offered in a 2-day, 20- hour, or 3-day format.

Providing you have an understanding of geometric tolerancing fundamentals and advanced concepts, this course teaches how to calculate tolerance stacks, a crucial skill in today’s competitive workplace.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, this course offers an in-depth explanation of how to use tolerance stacks to establish part tolerances, analyze design, create process designs, and how to use geometric tolerances in stacks.

**Learning Objectives**

By attending this class, participants will be able to:

• Explain the importance of tolerance stacks
• Explain the concepts of virtual condition
• Describe a tolerance stack
• Recognize part stacks using coordinate tolerancing
• Calculate assembly stacks using coordinate tolerancing
• Recognize the symbols and modifiers used in geometric dimensioning and tolerancing
• Explain how to assemble stacks
• Calculate part stacks using profile, position (RFS, bonus, & shift), and multiple geometric tolerances
• Calculate assembly stacks using profile, position, and multiple geometric tolerances

**Who Should Attend**

This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. This is not an introductory course. In order to understand the course content, attendees should have completed ETI’s GD&T Fundamentals and Advanced Concepts courses or equivalent.

**Topical Outline**

• Major Benefits of Stacks
  • The importance of stacks
  • Calculating the virtual condition of part features
  • Determining if parts will fit by comparing virtual condition
  • Determining if clearance/interference exists between parts
  • The definition of a stack
  • Three purposes of stacks; Four benefits of stacks
  • Determining when stacks should be calculated
ISO Geometrical Tolerancing (Based on ISO 1101:2004 and related standards)

2 Days
I.D.# ET7103

This subject is offered in a 2, 3, or 4-day format.

Providing you have a basic understanding of mechanical drawings, this course teaches how to use engineering drawings that use the International Standards Organization (ISO) standards. Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, this course teaches proper recognition of requirements for standard-compliant drawings and geometrical tolerances based on the ISO standards. The course combines information from dozens of ISO standards into a logical understandable topic.

Learning Objectives

By attending this class, participants will be able to:

• Describe the ISO standards system on technical drawings
• Recognize ISO drawing practices
• Explain the structure of GPS and the domains of features
• Recognize the symbols used in geometrical tolerancing
• Describe linear size and size conditions
• Explain the principle of independency and the envelope requirement
• Explain geometrical tolerancing concepts: MMR, LMR, RPR, virtual conditions, and collective requirements
• Describe the ISO 286 system of limits and fits
• Describe the datum system (planar datums)
• Interpret datum target and size datum specifications
• Interpret the flatness, straightness, roundness, cylindricity, perpendicularity, angularity, and parallelism tolerances
• Explain the fundamental concepts of position tolerances
• Interpret the position tolerance at MMR and special applications
• Interpret the coaxiality, concentricity, symmetry, circular and total run-out tolerances
• Interpret the profile any surface and profile any line tolerances
• Explain the ISO system for general tolerances
• Interpret work piece edge specifications
• Interpret surface texture and surface imperfection requirements

Who Should Attend

This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Attendees should have completed ETI’s Engineering Drawing Requirements course or equivalent prior to enrollment.
## ASME Y14.5 1994-2009 Comparison

1 Day  
I.D.# ET8000

Providing you have a basic understanding of geometric dimensioning and tolerancing fundamentals, this course teaches the significant revisions, additions, and deletions prescribed in the new ASME Y14.5-2009 Standard. Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course offers an in-depth cross-examination and comparison of features in the 2009 and 1994 ASME Standards.

Newly acquired learning is reinforced throughout the class with numerous practice problems, and a set of comprehensive comparison charts that highlight itemized changes in the standard are included in the course fee.

### Learning Objectives

The one-day ASME Y14.5 1994-2009 Comparison seminar will teach you about the pertinent changes made to the Y14.5 standard. You'll learn how the subject matter has been reorganized, and about new sections that have been created for profile, orientation, and form.

By attending this class, participants will be able to:
- Recognize forty new or revised terms
- Explain the revisions and additions to the fundamental rules
- Describe twelve new or revised modifying symbols
- Recognize the revisions and new symbols for datum specifications
- Describe new geometric symbols and specifications
- Describe the revisions and new additions to 3D digital data sets
- Summarize the major changes in the standard
- Describe considerations for implementing the new standard

### Who Should Attend

This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Attendees must have a basic understanding of Y14.5M-1994 Dimensioning and Tolerancing practices.

### Topical Outline

- 24 revised terms in ASME Y14.5-2009
- 16 new terms in ASME Y14.5-2009
- Revised and new modifying symbols
- The datum system
- Revisions to geometric symbols
- 3-D digital data sets

---

### Instructor:

This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

### Fee

Contact ETI for pricing information  
1.3 CEUs are offered for this course

---

3 ways to get a no-obligation price quote to bring a course to your company:  
- Call SAE Corporate Learning at +1.724.772.8529  
- Fill out the online quote request at sae.org/corplearning  
- Email us at Corplearn@sae.org
Fundamentals of GD&T (Based on ASME Y14.5-2009)

2 Days
I.D.# ET1150

This course is offered in multiple length formats. Contact ETI to determine which course length best suits your specific need.

This course is offered in multiple length formats. Contact ETI to determine which course length best suits your specific need.

Providing you have a basic understanding of mechanical drawings, this course teaches the terms, rules, symbols, and concepts of GD&T as prescribed in the ASME Y14.5-2009 Standard.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, Fundamentals of GD&T offers an in-depth explanation of geometric tolerancing symbols, their tolerance zones, applicable modifiers, common applications, and limitations. The class includes a comparison of GD&T to coordinate tolerancing; Rules #1 and #2; form and orientation controls; tolerance of position; runout and profile controls.

Learning Objectives
By attending this class, participants will be able to:
• Explain the importance of standards on engineering drawings
• Describe the types of dimensions, tolerances, and notes
• Explain why geometric tolerancing is superior to coordinate tolerancing
• Interpret the general dimensioning symbols
• Define the key terms used in GD&T
• Recognize the symbols and modifiers used in GD&T
• Explain the rules used in GD&T
• Describe the concepts of worst-case boundary, virtual condition, and bonus tolerance
• Interpret the various types of tolerance (flatness, circularity, cylindricity, straightness, perpendicularity, parallelism, angularity, position, runout, and profile)
• Describe the datum system
• Interpret applications of datum targets, size datum features (RMB), and size datum features (MMB)

Who Should Attend
This course is valuable for individuals who create or interpret engineering drawings, product and gage designers; process, product, and manufacturing engineers; supplier quality engineers/professionals; CMM operators; buyers/purchasers; checkers; inspectors; technicians; and sales engineers/professionals. Attendees should have completed ETI's Engineering Drawing Requirements course or equivalent prior to enrollment.

Topical Outline
• Introduction
  • Drawing standards
  • Dimensions, tolerances, and notes
  • Coordinate tolerancing and GD&T
  • General dimensioning symbols
• Fundamentals
  • Key GD&T terms
  • Symbols and modifiers
  • GD&T rules
  • GD&T concepts
• Form
  • Flatness tolerance
  • Straightness tolerance
  • Circularity tolerance; Cylindricity tolerance
• Datum System
  • Datum system
  • Datum targets
  • Size datum features (RMB)
  • Size datum features (MMB)
• Orientation
  • Perpendicularity tolerance
  • Parallelism tolerance
  • Angularity tolerance
• Position
  • Position tolerance introduction
  • Position tolerance - RFS and MMC
  • Position tolerance - special applications
  • Position tolerance - calculations
• Runout, Concentricity, Symmetry
  • Circular and total runout tolerances
  • Concentricity and symmetry tolerances
• Profile
  • Profile tolerance basic concepts
  • Profile tolerance applications

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

Fee Contact ETI for pricing information
1.3 CEUs are offered for this course
ASME to ISO Standards Comparison

1 Day
I.D.# ET2025

Providing you have a basic understanding of Y14.5 Dimensioning and Tolerancing practices, this course explains the major differences between the ASME and ISO standards in a concise, easily understood manner.

Utilizing the expertise of world-renowned GD&T expert Alex Krulikowski, the course focuses on how the standards compare when dealing with symbols, feature control frames, tolerances, form controls, datums, and more.

Learning Objectives
By attending this class, participants will be able to:
• Explain how ASME and ISO standards are developed
• Recognize the advantages and cautions of using ASME and ISO standards
• List the major differences in technical drawing presentation
• Recognize the major differences between ASME and ISO geometric tolerancing terms and symbols
• Recognize the major differences between ASME and ISO datum systems
• Identify the differences in ASME and ISO drawings

Who Should Attend
This course is valuable for individuals who work with ISO standards on drawings, designers, engineers, inspectors, and machinists. All attendees should have a basic understanding of Y14.5 Dimensioning and Tolerancing practices prior to enrolling in this course.

Topical Outline
• Introduction
• Standards and Technical Drawings
  • Importance of standards
  • ASME and ISO organizations
  • Stages of standard development
  • Major differences in scope of standards
• Advantages and Cautions
  • Why each standard should be used
  • ISO GPS concept
  • Three domains of ISO specifications
  • Comparing ASME and ISO GPS systems
  • Five cautions when using ASME standards
  • Six cautions when using ISO standards
• Technical Drawing Presentation Differences
  • Technical drawing standards
  • Items that are the same in both standards
  • View projection methods
• Dimensioning termination and presentation methods
• Dimensioning symbols
• Angular tolerance interpretation
• Workpiece edge requirements and general tolerance specification
• Size dimensions and limits and fits expressions
• Surface texture is specification
• Tolerancing Term Differences
  • Feature and feature of size
  • Envelope requirement and independency principle
• Eight major terms Bonus tolerance and collective requirement Datum System Differences
  • Datum specifications
  • Datum interpretations
  • Candidate and single solution datums
  • Datum target specifications
• Geometric Tolerancing Symbol Differences
  • Specification / use for each geometric tolerance symbol
  • Interpretation for each geometrical tolerance
  • Specification / use for modifiers and symbols
• ASME and ISO Drawing Differences
  • Applicable standards
  • Drawing symbol differences
  • Geometrical tolerance specification and interpretation differences

Instructor: This course is taught by one of ETI’s approved instructors, each of whom has been vetted and mentored by Alex Krulikowski

Fee: Contact ETI for pricing information

.7 CEUs are offered for this course

Instructors Wanted...
To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses.

We are seeking expertise in a variety of Aerospace-related topics including: Certification, Regulations, and Standards.

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568
GD&T EDUCATIONAL & REFERENCE RESOURCES FROM ETI

Fundamentals of Geometric Dimensioning and Tolerancing Using Critical Thinking Skills
(based on ASME Y14.5-2009)
3rd Edition
By Alex Krulikowski

A unique book that meets the needs of readers studying industrial technology, CAD, engineering technology, or manufacturing technology. This book clearly organizes geometric dimensioning and tolerancing fundamentals into small, logical units for step-by-step understanding. Measurable performance objectives help readers assess their progress. Discussion questions promote interaction and higher-order thinking, and practice problems ensure thorough understanding of the concepts presented. Fundamentals of Geometric Dimensioning and Tolerancing (2009) 3rd Edition defines and fully encompasses the ASME Y14.5-2009 Standard to keep readers current on these important industry standards.

TOPICS INCLUDE:
- Form
- Orientation
- Runout, Concentricity, Symmetry
- Key GD&T Terms, Rules, & Concepts
- Datum System
- Position
- Profile
- Position, profile, and datums

THIS BOOK IS A VALUABLE TOOL FOR:
- Designers
- Product, Manufacturing, and Quality Engineers
- CMM Operators
- Checkers

SKILL LEVEL
A basic understanding of engineering drawings is required.

Fundamentals of Geometric Dimensioning and Tolerancing
(based on ASME Y14.5M-1994)
2nd Edition
By Alex Krulikowski


CHAPTER GOALS INCLUDE:
- Understand why geometric tolerancing is superior to coordinate tolerancing
- Understand eight key terms and how they affect the interpretation of a drawing
- Understand the modifiers and symbols used in geometric tolerancing
- Understand Rule #1 and Rule #2
- Understand the concepts of basic dimensions, virtual condition, inner and outer boundary, worst-case boundary, and bonus tolerance
- Interpret: flatness; straightness; circularity; & cylindricity
- Understand the datum system (planar datums)
- Interpret datum targets
- Interpret feature of size datum specifications (RFS)
- Interpret feature of size datum specifications (MMC)
- Interpret the perpendicularity control
- Understand the fundamental concepts of tolerance of position: the definition and conventions, the advantages, and the basic theories
- Interpret RFS and MMC tolerance of position applications
- Draw cartoon gages for tolerance of position (MMC) applications
- Interpret tolerance of position special applications
• Calculate distances on a part dimensioned with tolerance of position
• Calculate tolerance of position tolerance values using the fixed and floating fastener formulas
• Interpret the: concentricity control; symmetry control; circular runout control; total runout control
• Understand profile tolerancing
• Interpret the profile of a surface control & line control

THIS BOOK IS A VALUABLE TOOL FOR:
• Designers
• Product, Manufacturing, and Quality Engineers
• CMM Operators
• Checkers

SKILL LEVEL
A basic understanding of engineering drawings is required.

Advanced Concepts of Geometric Dimensioning and Tolerancing
(based on ASME Y14.5M-1994)
2nd Edition
By Alex Krulikowski

This reference book stresses the application of GD&T in today’s industrial workplace, and it’s the perfect resource to expand and deepen your understanding of GD&T. Advanced Concepts of Geometric Dimensioning and Tolerancing includes examples and explanations of tolerancing concepts that are often problematic in real world applications. This must-have text features 26 chapters that cover a broad range of tolerancing practices common in industry, but not well documented in national standards.

TOPICS INCLUDE:
• Tolerancing non-rigid parts
• Position, profile, and datums
• Functional dimensioning
• Drawing interpretation
• Advantages and misconceptions of the datum system
• Relating tolerance applications to a loss function curve
• Tolerancing of threaded holes
• Composite position tolerancing
• Profile applications

Tolerance Stacks Using Geometric Dimensioning and Tolerancing with Drawing Package
By Alex Krulikowski

Proficiency in tolerance accumulation studies (also call stacks) separates the exceptional engineers from the rest. More than simply the study of dimensional relationships within assemblies, tolerance stacks are the key to creating robust, efficient, and successful designs. Tolerance Stacks Using Geometric Dimensioning and Tolerancing covers the techniques used to assess and convey the effects of variation and stresses typical applications found in real-world industrial situations. In addition to the textbook, this unique package includes the Tolerance Stacks Drawing Package, a spiral-bound booklet containing two complete product designs to analyze and reinforce information provided in the text.

The textbook includes 39 performance objectives to be mastered and over 50 practice stacks to calculate.

• Solve stack problems
• Work examples
• Take quizzes and tests
• Analyze illustrations
• Receive instant feedback
• Chart your progress

This package is a resource that will pay dividends for years to come.
ENGINEERING TOOLS & METHODS

THIS BOOK IS A VALUABLE TOOL FOR:

• Engineers
• Designers
• Inspectors
• Process Engineers
• Machine Builders
• Similar job functions

SKILL LEVEL

Basic blueprint reading skills are required; must have also completed courses in GD&T fundamentals and advanced concepts.

ISBN: 0-924520-05-1
276 pp.
Spiral Bound 1994
$105.00 List
Product Code PD021019

The GD&T Trainer: Fundamentals 2009
(based on ASME Y14.5-2009)

The GD&T Trainer: Fundamentals 2009 is a comprehensive training program consisting of 29 lessons covering basic rules, definitions, and concepts of GD&T. This software package contains newly updated course administration tools with enhanced student progress tracking capabilities as well as:

• Student/course records storage
• Learning assessments
• 2,000 student maximum capacity
• Simultaneous record access for multiple administrators
• Report generator to track student and course progression
• Password protection for student records
• And much more.

The GD&T Trainer can be used as:
• A complete course in GD&T, with quizzes, final exam, and certificate of completion
• A geometric tolerancing seminar
• A supplement or review for live training
• An internal GD&T certification
• An on-the-job reference

COURSE FORMATS

• A complete course in GD&T including quizzes, final exam, and certificate of completion
• A geometric tolerancing seminar
• A supplement or review for live training
• An internal GD&T certification
• An on-the-job reference

SKILL LEVEL

Users should have completed ETI’s Engineering Drawing Requirements course or use drawings regularly on the job.

VERSIONS

• Single-User
• Multi-User
• LAN (local area network)
• Corporate

SYSTEM REQUIREMENTS

• Pentium 4-based computer with a 2GHz or higher CPU
• 512 MB RAM minimum, 1024 MB or higher recommended
• 500 MB or more of free hard drive space
• Sound card with speakers
• Video card capable of displaying 24-bit color at a resolution of 1024x768
• Windows 7/8
• Adobe Flash Player 13.0 or higher
• Visual Basic 6 Runtime (Admin and Reporter only)
• .NET Framework 2.0

Starting at $755.00 List
Product Code PD021249

The GD&T Trainer: Fundamentals 1994
(based on ASME Y14.5M-1994)

The GD&T Trainer: Fundamentals 1994 is a comprehensive training program consisting of 28 lessons covering basic rules, definitions, and concepts of GD&T. This software package features newly updated administration tools for tracking student progress as well as:

• Student course record storage
• Learning assessments
• Up to 2,000 student capacity
• Simultaneous records access for multiple administrators
• Report generator and database access to track student progression
• Password protection for student records
• And much more.

The GD&T Trainer can be used as:
• A complete course in GD&T, with quizzes, final exam, and certificate of completion
• A geometric tolerancing seminar
• A supplement or review for live training
• An internal GD&T certification
• An on-the-job reference

COURSE FORMATS

• A complete course in GD&T including quizzes, final exam, and certificate of completion
• A geometric tolerancing seminar
• A supplement or review for live training
• An internal GD&T certification
• An on-the-job reference
## ENGINEERING TOOLS & METHODS

### COURSE FORMATS
- A complete course in GD&T including quizzes, final exam, and certificate of completion
- A geometric tolerancing seminar
- A supplement or review for live training
- An internal GD&T certification
- An on-the-job reference

### SKILL LEVEL
Users should have completed ETI’s Engineering Drawing Requirements course or use drawings regularly on the job.

### VERSIONS
- Single User
- Multi-User
- LAN (local area network)
- Corporate

### SYSTEM REQUIREMENTS
- Pentium III-based computer with a 1GHz or higher CPU
- 256 MB RAM minimum/512 MB or higher recommended
- 1 GB minimum of free hard drive space
- Sound card with speakers
- Video card capable of displaying 24-bit color at a resolution of 1024x768
- Windows XP (SP2)/XP/64-bit/Vista/7
- Adobe Flash Player 10.0 or higher
- Visual Basic 6 Runtime (Admin and Reporter only)
- .NET Framework 2.0
- NOTE: Windows 3.x/98/ME/2000 are not supported

**ISO GPS Quick Reference**

The ISO GPS Quick Reference software is a valuable on-the-job resource for locating technical drawing information without navigating through multiple standards. The ISO GPS Quick Reference software covers more than 250 related topics with full-color drawings and illustrations, and user-friendly navigation for easy transition between topics. The software covers the most common aspects of product design. It was created by GD&T expert Alex Krulikowski, member of ISO/TC 213-US Technical Advisory Group.

The program is based on four major ISO GPS standards:
- ISO 8015:1985
- ISO 1101: 2004
- ISO 2768-1: 1989

**REFERENCE HIGHLIGHTS**
- Explanations of more than 250 topics cover all aspects of ISO GPS standards
- “Hotwords” in topics link to a glossary of more than 250 terms and definitions
- Detailed graphics with full explanations of concepts
- Interactive charts defining symbols and abbreviations
- Topics are cross-referenced with the ISO standards
- Help screens provide a quick explanation of its features
- The subject index organizes subjects and topics
- Search subjects, topics, and terms in the glossary with ease
- Navigation between topics is quick and easy

The ISO GPS Quick Reference software is a valuable tool for anyone who creates or interprets engineering drawings.

Site and corporate licenses are available.

### COURSE FORMATS
- A complete course in GD&T including quizzes, final exam, and certificate of completion
- A geometric tolerancing seminar
- A supplement or review for live training
- Post training content review
- An internal GD&T certification
- An on-the-job reference

### SKILL LEVEL
Users should have completed ETI’s Engineering Drawing Requirements course or use drawings regularly on the job.

---

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
ENGINEERING TOOLS & METHODS

VERSIONS
- LAN 2-seat (up to 10 seats)
- Corporate

SYSTEM REQUIREMENTS
- Pentium 4-based computer with a 2GHz or higher CPU
- 512 MB RAM minimum/1024 MB or higher recommended
- 4 GB minimum of free hard drive space
- Video card capable of displaying 24-bit color at a resolution of 1024x768
- Windows XP (SP2)/XP/Professional 64-bit/Vista/7
- Adobe Flash Player 10.0 or higher

Catalog Key
Certificate
On Demand
Live, Online
Classroom
ACTAR approved

GD&T Workbook with Engineering Drawings
(based on ASME Y14.5M-1994)
By Alex Krulikowski

The GD&T Workbook enhances student skills through instruction and exercises on topics learned via ETI’s training practicum. A perfect companion to the Fundamentals of GD&T textbook, the GD&T Workbook can be used in the classroom as reinforcement to the ETI Fundamentals of GD&T training course, and as an ongoing practice guide after classroom training is complete. For instructors, the Workbook is designed for use with the Fundamentals of GD&T Digital Instructor’s Kit to complement lesson plans and teaching aids. Users will gain practical experience from the GD&T Workbook with typical industrial engineering drawings through insightful questions and examples covering key terms, concepts, and interpretations. Learning goals and objectives are clearly outlined making the GD&T Workbook the perfect supplement to your live or e-learning GD&T training.

TOPICS INCLUDE:
- Interpreting Engineering Drawings
- Understanding Why GD&T is Superior to Coordinate Tolerancing
- Recognizing Key Terms
- Identifying Modifiers and Symbols Used in GD&T
- Understanding Rules #1 and #2
- Recognizing GD&T Concepts
- Interpreting Flatness, Straightness, Circularity, and Cylindricity
- Specifying and Interpreting Planar Datums, Datum Targets, and Size Datums (RFS and MMC)
- Interpreting Perpendicularity, Angularity, Parallelism, and Position (RFS/MMC/LMC)
- Drawing Cartoon Gages
- Interpreting Tolerance of Position Special Applications
- Calculating Part Distances and Fastener Formulas
- Interpreting Concentricity, Symmetry, Circular Runout, Total Runout
- Interpreting Profile Tolerancing, Profile of a Surface, and Profile of a Liner

THIS BOOK IS A VALUABLE TOOL FOR:
- Designers
- Product, Manufacturing, and Quality Engineers
- CMM Operators
- Checkers

SKILL LEVEL
Basic blueprint reading skills is required; must have also completed courses in GD&T fundamentals and advanced concepts.

Spiral Binder
Starting at $64.00 List
Product Code PD024051

Fundamentals of Geometric Dimensioning and Tolerancing Video Training Program – Video Workbook
(based on ASME Y14.5M-1994)
By Alex Krulikowski

This unique self-study course is designed as a supplement to the Fundamentals of GD&T Video Training Package (ask your ETI sales representative for details). The GD&T Video Workbook contains 30 exercises and over 300 questions on the fundamentals of geometric tolerancing. Diagrams, tips, charts, and key points correspond to its companion video to provide reinforcement of concepts learned in each section. Users can gauge their comprehension through assessments included at the conclusion of each lesson. The GD&T Video Workbook can be used as an ongoing practice and reference guide well after the initial training is complete.

THIS BOOK IS A VALUABLE TOOL FOR:
- Designers
- Product, Manufacturing, and Quality Engineers
- CMM Operators
- Checkers

SKILL LEVEL
Basic blueprint reading skills is required; must have also completed courses in GD&T fundamentals and advanced concepts.

Starting at $1200.00 List
Product Code PD027201
ENGINEERING TOOLS & METHODS

SKILL LEVEL
Student should have taken ETI’s Engineering Drawing Requirements course or have a basic understanding of engineering drawings.

204 pp.
Spiral Bound
$36.00 List
Product Code PD024030

Fundamentals of GD&T Self-Study Workbook
(based on ASME Y14.5-1994)
2nd Edition
By Alex Krulikowski

also available
Fundamentals of GD&T Self-Study Workbook
Spanish Edition

The Fundamentals of GD&T Self-Study Workbook is a popular cost-effective option for learning GD&T at your own pace. Practical examples incorporating real world applications separate this workbook from all competitors. The Fundamentals Self-Study Workbook’s versatility goes beyond self-study and can be multi-purposed for team learning. Users will find useful charts, diagrams, innumerable tips and suggestions, assessments, and other learning resources to maximize your learning objectives.

The Fundamentals of GD&T Self-Study Workbook package also comes complete with 30 targeted lessons, self-study flash cards, and pre- and post tests to measure and track learning goals.

Product highlights: The GD&T Self-Study Workbook is packed with examples, charts, logic diagrams, on-the-job guidelines, and over 500 practice problems with solutions.

Each lesson begins with a pre-inventory test to assess your current skill level. The lesson continues with illustrated, step-by-step training in each concept and provides problems to allow you to practice those concepts. Each lesson ends with a summary quiz and a post-inventory, giving you immediate feedback on your progress. Includes a send-in final exam.

THIS BOOK IS A VALUABLE TOOL FOR:
• Designers
• Product, Manufacturing, and Quality Engineers
• Technicians

• Purchasers
• Checkers

SKILL LEVEL
A basic understanding of engineering drawings is required.

ISBN: 09245420-01-9,
Part 4002
570 pp.
Spiral Bound
Starting at $170.00 List
Product Code PD024002
Product Code (Spanish Language Edition) PD024004

Tolerance Stacks Self Study Course
By Alex Krulikowski

This unique all-in-one self-study course comes delivered in a multi-volume package and is intended as a course in geometrical tolerancing. Each volume stresses applications found on-the-job in real-world industrial situations. Practice tools replicate actual drawings to maximize knowledge transfer from the training room to the jobsite.

Volume 1 formally outlines the importance of stacks as it relates to product design, the course format, and also offers useful tips on setting personal goals to maximize user’s learning habits.

Volume 2 contains 25 practice stacks based on the ETI Drawing Package (included), progress charts, helpful tips, and solutions to gauge user’s learning progression.

Product highlights: Stresses applications that are found on the job in real-life industrial situations. The practice stacks are from actual drawings that are provided in a separate Drawing Package. It includes a skills assessment tool and exercises at the end of each chapter to practice the concepts.

Additional package items include a Stacks Summary Chart and blank stacks forms for use in documenting practice content.

THIS BOOK IS A VALUABLE TOOL FOR:
• Designers
• Product, Manufacturing, and Quality Engineers
• Inspectors
• Machine Builders

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
SKILL LEVEL
Basic blueprint reading skills is required; must have also completed courses in GD&T fundamentals and advanced concepts.

ISBN: 0-924520-03-5
Part 1005
Multiple Packaging
Starting at $210.00 List
Product Code PD021005

Alex Krulikowski’s ISO Geometrical Tolerancing Reference Guide
By Alex Krulikowski

The ISO Geometrical Tolerancing Reference Guide clarifies interpreting standard-compliant technical drawings that use ISO 1101:2004 and its companion published standards. It guides the user as to which ISO standards should be referenced on a drawing and what the standards cover. The book includes several features to help the reader find information quickly:
• A visual index inside the front cover
• Individual table of contents for each section
• Indexed page edges for each section
• Numerous cross-references
• A comprehensive alphabetical index
• A glossary of more than 100 terms
• More than 250 endnotes that reference ISO standards with clauses that support concepts
• Numerous authors’ comments that provide insights about concepts
• Hidden spiral binding allows it to lay flat
• Comprehensive reference charts and drawings inside the foldout covers

TOPICS INCLUDE:
• ISO drawing conventions
• GPS basics
• Size and boundary conditions
• Limits and fits
• The datum-system
• Form tolerances
• Orientation tolerances
• Location tolerances
• Run-out tolerances
• Profile tolerances
• General tolerances
• Workpiece edges
• Surface texture
• ISO/ASME comparison

• Non-rigid parts
• Restraint specifications

THIS BOOK IS A VALUABLE TOOL FOR:
• Engineers
• Designers
• Inspectors
• Machinists

ISBN: 978-0-924520-17-4
376 pp.
Spiral Bound 2010
$110.00 List
Product Code PD027101

ASME Y14.5M-1994 to ASME Y14.5-2009
New Features Comparison Chart
(based on ASME Y14.5-2009)

Compare the features of ASME Y14.5M-1994 and ASME Y14.5-2009 quickly and easily with the New Features Comparison Chart Set. This set of two, 2-sided charts illustrates the itemized changes in the standard for quick, on-the-job drawing interpretation. An ideal tool for the working designer, engineer or design manager, this pair of fully illustrated, 11” x 17” charts fits in a 3-ring binder.

• Provides itemized changes in the standard for quick, on-the-job drawing interpretation
• Compares features of ASME Y14.5M-1994 and ASME Y14.5-2009
• Includes references to the ASME Y14.5-2009 Standard so you can quickly find additional information
• Makes an excellent teaching aid or on-the-job reference

ISBN: 978-0-924520-22-8
(2) 11”x17”
$13.00 List
Product Code PD021030
ASME Y14.5M-1994 Reference Chart

Compare features of ANSI and ASME Standards, and Tolerance Stacks quickly and easily with these handy comparison sets. Each chart contains a fully illustrated breakdown of changes in the standard for quick, on-the-job drawing interpretation. These easy-to-read charts are the ideal tools for the working designer, engineer and design manager. Order one or multiple copies for your home, office and/or remote job site.

• Defines and illustrates important GD&T terms, modifiers, and symbols.
• Shows examples of each tolerance with facts about datums, MMC/RFS, bonus tolerances, and tolerance zone boundaries.
• Explains the new datum system.

ISBN: 00-924520-12-4
(1) 11”x17”
$5.50 List
Product Code PD024012

The Ultimate GD&T Pocket Guide
(based on ASME Y14.5M-1994)

The Ultimate GD&T Pocket Guides are the perfect on-the-job reference tools for anyone who uses GD&T on the job or in the classroom. Each guide delivers a wealth of concise practical information on current ASME Standards and GD&T topics through helpful tips, charts and detailed illustrations for easy reference. Use The Ultimate GD&T Pocket Guides to reference datum applications, conversion charts, formulas, tolerancing, and much more.

PRODUCT HIGHLIGHTS INCLUDE:
• Over 100 detailed drawings to illustrate concepts
• More than 40 charts for quick reference
• Explanation of each GD&T symbol and modifier
• Examples of datum application
• Sections on surface texture and composite tolerancing
• A conversion chart for coordinate measurement to diameter tolerance zone
• Full definitions of major concepts
• Clarification of important rules and topics
• Definitions of fixed and floating fastener formulas

ISBN: 0-924520-14-0 Part 4071
Saddlestich
77 pp.
$12.00 List
Product Code PD024071

Spanish Edition
ISBN: 0-924520-14-0 Part 4072
$12.00 List
Product Code PD024072

The Ultimate GD&T Pocket Guide
(based on ASME Y14.5-2009)

The Ultimate GD&T Pocket Guides are the perfect on-the-job reference tools for anyone who uses GD&T on the job or in the classroom. Each guide delivers a wealth of concise practical information on current ASME Standards and GD&T topics through helpful tips, charts and detailed illustrations for easy reference. Use The Ultimate GD&T Pocket Guides to reference datum applications, conversion charts, formulas, tolerancing, and much more.

PRODUCT HIGHLIGHTS INCLUDE:
• Over 50 detailed drawings to illustrate concepts
• Explanation of each GD&T symbol and modifier
• Examples of datum application
• Sections on surface texture and composite tolerancing
• A handy inch/millimeter conversion chart
• A conversion chart for coordinate measurement to diameter tolerance zone
• Full definitions of major concepts
• Clarification of important rules and topics
• Definitions of fixed and floating fastener formulas

Spiral Bound
122 pp.
$20.00 List
Product Code PD024070

Kindle Edition (e-book)
$9.99 List

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
The ISO GPS Ultimate GD&T Pocket Guide


More than 15 standards were directly reviewed and more than 30 standards indirectly used in creating the book. One entire section is devoted to a quick comparison of ASME and ISO standards. Author’s comments throughout the text provide insights about concepts and how to apply or interpret geometrical tolerancing in a cost-effective manner.

TOPICS INCLUDE:

- GPS basics
- View projection options
- Linear size
- Non-size dimensions
- Datum systems
- Geometrical tolerances
- General tolerances
- Non-rigid workpieces
- Workpiece edges
- ASME/ISO comparison

ISBN: 978-0-7680-8258-6
Spiral Bound
$39.95 List
Product Code PD027104

eBook Edition
$39.95 List
RELATED TRAINING SOLUTIONS
Some of our courses apply to more than one technology category. Consider these related courses described in other sections of this resource guide.

Root Cause Problem Solving: Methods and Tools
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. Read more about this course on page 73.

Creating and Managing a Product Compliance Program
You will learn best practices in creating a compliance program for your products and markets, and how to use this program at all stages of product development and production. Read more about this course on page 64.

Introduction to Advanced Product Quality Planning (APQP)
Newly released! provides an overview of the best practices / methodologies for planning and managing the successful launch of a new product. Read more about this course on page 109.

Introduction to Weibull Solution Methods
Instructor Wes Fulton will provide a solid overview of Weibull Solution Methods including an explanation of 16 additional Weibull Analysis capabilities, or Weibull Extensions. Read more about this course on page 109.

Weibull-Log Normal Analysis Workshop
New and advanced Weibull techniques are a significant improvement over the original Weibull approach. This workshop, originally developed by Dr. Bob Abernethy, presents case studies in addition to the latest techniques in SuperSMITH® Weibull for risk forecasts with renewal and optimal component replacement. Read more about this course on page 112.

Materials Selection Process for Engineering Designs
This course covers the engineering process for selecting materials to use for components and joints within a product. Applying the process enables selection of materials that optimize product performance, reliability and cost, while helping keep projects on schedule. Read more about this course on page 92.
INTRODUCING SAE MOBILUS™
YOUR DESTINATION FOR MOBILITY ENGINEERING RESOURCES

The SAE MOBILUS™ platform is the place for the latest technical resources - including over 200,000 technical papers, standards, books, magazines and more. Get the same trusted content you need in a new user-focused tool.

Quickly and efficiently access information needed to solve project challenges or address knowledge gaps. The SAE MOBILUS platform enables you to:

- Facilitate an environment of collaboration across your organization
- Provide single-point access to all users
- Offer your constituents the latest, most-reliable content specific to the industry
- Deliver peer-reviewed research on a wide range of technologies

For more information visit SAEMOBILUS.ORG
Or contact SAE Customer Sales
(p) +1.888.875.3976
(e) CustomerSales@sae.org
Aerospace Product Support: Sustainment Throughout the Life Cycle

2 Days
I.D.# C0945

In today’s aerospace industry, product life-cycles are often being extended far beyond a product’s original design expectations. With fewer and fewer new aerospace products being introduced into the marketplace, there is a dramatic need for increased emphasis on supporting these products in the most efficient and effective manner possible throughout the entire product life-cycle. In addition to the initial product acquisition cost, customers are becoming more aware and sensitive to the product’s total life-cycle cost. The long-term costs to operate, maintain, and otherwise sustain these products are often a determining factor in the initial product acquisition.

This two day seminar is intended to introduce participants to the various approaches, technologies, and tools available to support a product throughout the product’s total life-cycle in the most efficient manner possible. Major topics presented and discussed during this seminar include The Elements of Logistics, Performance Based Logistics, Product Support Integration, and regulatory requirements. Collectively, the information presented in this seminar will equip attendees with the skills and techniques needed to help them comfortably and confidently develop the best tailored support package, satisfying the needs of both the customer and the provider.

Learning Objectives

By attending this seminar, participants will be able to:

• Identify and apply basic concepts of Product Support, including Contractor Logistics Support, Total System Performance Requirements, Performance-Based Logistics, and Primary Support Integration

• Evaluate elements of cost associated with life-cycle support/sustainment opportunities
• Compare and contrast the different approaches that may be taken to provide total life-cycle support in aerospace programs
• Assess relative risks to both the provider and the customer in the various approaches
• Determine how to best integrate sustainment activities within the OEM as well as after-market provider business plans

Who Should Attend

Technical professionals, as well as current and prospective Program/Project managers, Product Support Managers, and Sustainment Specialists will benefit by attending this seminar. This seminar will also be of value to individuals in other disciplines, including marketing and general management, that require an understanding of the concepts and strategies of effective life-cycle sustainment programs.

Topical Outline

DAY ONE

• Introduction to Aerospace Product Support
  • Developing the class definition of product support -- Attributes; Shared experiences
  • Setting expectations

• Elements of Product Support Offerings
  • Characteristics of Product Support
  • Compare and Contrast -- Logistics Support; Product Support; Customer Support
  • ”Bits and pieces” of product support
  • What constitutes success?

• Support Integration
  • How Support Integration works
  • Primary Support Integrator -- How PSI works
  • Third-Party Logistics Provider -- Definition; How 3PL works
Aerospace Program Management - It’s More than Scheduling and Delivery

3 Days  
I.D.# C0818

Effective and efficient management of today’s complex and integrated programs requires both the refinement of interpersonal and basic leadership skills as well as the application of appropriate technologies and tools. This seminar is intended to introduce basic program management skills and techniques to first-line and mid-level leaders to help them comfortably and confidently assume their role and to aid in assuring program success.

Areas of special concentration will include: role of project management, communication, interpersonal skills, schedule management, interfacing with other units, Task Scoping (Estimating, Pricing, Financial Measures, etc.), project management software use, compliance reporting, risk management and more. This seminar will include lecture, dialog, and case-study approaches. Active participation of the class attendees will ensure a dynamic baseline for learning and honing valuable skills.

Learning Objectives

By attending this seminar, participants will be able to:
- Communicate more effectively in all media - verbal, written, and electronic modes
- Refine interpersonal skills as they relate to dealing with diverse personal perspectives, attitudes, and motivational techniques
- Develop and utilize task schedules
- Demonstrate effective management of all resources (people, tools, and budgets)
- Apply techniques for scoping programs/projects (resource needs, schedules, level of tasking, etc.) and effectively monitor and measure progress
- Identify critical milestone events and how to develop alternate schedule recovery plans
- Utilize basic project management tools and techniques more effectively

Who Should Attend

This course is designed for current and prospective Program/Project Managers with a level of experience ranging from in-training to mid-level program management leadership.

Topical Outline

DAY ONE
- Introduction to Program/Project Management
- Clarifying and Giving Identity to Tasks
  - Who are the stakeholders? What do they want?
  - What are the resource allocations? (budgets, tools, facilities, personnel)
  - What constitutes program/project success?
- Communication Skills Essentials
  - Elements of effective presentations (verbal, e-mail, internet)
  - Appreciation of differing perspectives and how to integrate them
  - Interpersonal skills
- Interfacing with Other Units
  - Use of integrator personnel
  - Importance of shared goals as well as shared responsibilities

DAY TWO
- Establishing and Developing of Performance Schedules
  - Ensuring dependencies are identified and commitments are defined
  - Determining critical milestones and potential impacts
  - Introduction to use of commercial software tools
- Creating Meaningful Performance Metrics and Monitoring Techniques
  - The “critical life signs” of a program/project (cost, schedule, quality)
  - Role of program/project integrator and methods of in-process performance monitoring
  - Keeping all stakeholders informed and satisfied
- Compliance Reporting, Test Plans, and Contingencies
  - Regulatory documents and reports
  - FAA certification
  - Use of “critical life signs”, milestones, and monitoring
  - Notification of problems and re-plans to stakeholders
  - Refining the art of asking for and receiving help

DAY THREE
- Managing the Individual Components of the Program/Project
  - Financial aspects (pricing, ROI, ROIC, etc.)
  - Marketing coordination, warranties, and after-market support

Instructor: Drexel L. Rutledge
Fee $1370 1.3 CEUs
Creating and Managing a Product Compliance Program

2 Days
I.D.# C1213

Around the world, and more often than not, government bodies require formal certification of products. As product developers expand into new markets, they will be confronted with new standards, regulations, and customer expectations that may require new compliance processes. A properly run compliance program improves your product’s quality and safety, broadens your product’s market, ensures compliance with regulations and laws, and helps provide protection from future product liability issues.

This two-day seminar presents a process development methodology that can be used repeatedly as new compliance requirements emerge. You will learn best practices in creating a compliance program for your products and markets, and how to use this program at all stages of product development and production. Sample spreadsheets will be used to demonstrate tailoring the program to your product, your markets, and your organization. A properly managed compliance program simplifies the certification or approval of your product, and ensures that you regularly apply and document good engineering practices for product safety and reliability.

Learning Objectives
By attending this training program participants will be able to:
- Summarize how a formal compliance program adds value to your goods and services
- Develop a compliance checklist
- Identify effective strategies for researching compliance requirements
- Describe how to manage the ongoing compliance process
- Explain the importance of documenting compliance and retaining records

Who Should Attend
This seminar is designed for managers with implementation authority for product safety and compliance; product development engineers, designers and managers; new business development managers; risk managers and compliance or certification managers. Companies considering expanding or modifying their product line, or attempting to enter new export markets, will especially benefit. Suppliers who are involved in product development and compliance, regulatory agency representatives, industry safety organization representatives, and corporate compliance lawyers will also benefit.

Prerequisites
Prior experience in product development, and/or product testing, and/or product certification is beneficial. The course content is geared for individuals with previous academic or work related experience in these fields.

Topical Outline

DAY ONE
- Introduction to Compliance
  - What do we mean by compliance
  - The 3 basic forms of compliance
  - Why we need to show compliance: Legal requirements in different countries; Commercial advantages; Product liability risks
  - What is a formal compliance program
- Creating a compliance checklist - getting started
  - An introduction to the compliance process
  - Defining your markets in terms of compliance requirements
  - Finding applicable regulations, standards, and guidelines
  - Documenting best practices in the compliance checklist

DAY TWO
- Completing the compliance checklist
  - Extracting relevant requirements from the regulations, standards and guidelines
  - Selecting methods of compliance
  - Assigning tasks from the checklist
  - Sorting and presenting the blank checklist
- Applying the compliance checklist to a development project
  - Introducing the checklist within your organization: Integrating the checklist process into existing policies and procedures; Identifying key players, and getting them on your side
Leading High Performance Teams

2 Days  
I.D.# C0410

Product development is organizationally a complex undertaking that requires effective coordination within a company and between companies. During product development, teams are confronted with a number of ongoing organizational challenges and there is a high potential for conflict between participants in the process.

This course addresses teamwork and other “soft-side” factors that largely determine whether product development programs are successfully completed on schedule. The content is relevant for both OEMs and suppliers.

Learning Objectives

By attending this seminar, participants will be able to:
• Explain the importance of effectively managing ‘soft-side’ issues that cause problems and delays during product development programs
• Employ successful practices of chartering and launching teams
• Implement techniques to successfully lead and facilitate effective teams
• Effectively troubleshoot problems on a team and employ techniques to remain productive
• Implement proven tips for conducting effective team meetings

Who Should Attend

Engineers and business people involved in various product development team activities will find the subject matter practical and useful. The content is of particular value to professionals from engineering, manufacturing, purchasing, quality, marketing, and finance functions in ground vehicle OEMs and suppliers.

Topical Outline

• Designing High Performance Team
  • Characteristics of effective teams
  • Systems aspects of team design
  • Addressing systemic variables
  • Identifying key stakeholders
  • Establishing the team’s charter
• Leadership and Group Dynamics
  • Responsibilities of the team leader
  • Understanding human behavior in groups
  • Motivating team members
  • Establishing a productive team culture
  • Developing team support
  • Productive and destructive team roles
  • Effective communications
  • Influence of personality styles
• Launching the Team
  • Stages of team development
  • Pre-meeting considerations
  • Selecting the team
  • Common reasons meetings fail
  • Managing the first team interface
  • Establishing group norms
  • Structuring the agenda
• Making Sound Decisions
  • Situational analysis: problems, decisions and polarities
  • Common errors in decision making
  • Essential steps in the decision process
  • Quality and acceptance factors in decision making
  • When to use and avoid group consensus
  • Identifying the decision makers
  • Facilitating consensus decisions
• Flawless Facilitation
  • Recognizing and defusing common group problems
  • Managing conflict and providing feedback
  • Mind mapping, story boarding and other techniques
  • Making work assignments
  • Assessing group performance
  • Concluding the meeting

Instructor: Joseph Doyle  
Fee $1370 1.3 CEUs
Managing Programs and Associated Risks

2 Days
I.D.# C0409

This course presents a proven eight-step method for program planning and control, including: definition of customers’ requirements, roles of the program team, determination and flowcharting of program tasks, scheduling and costing, quality aspects of critical tasks, and risk management. Easy to grasp, each of the eight steps evolve from common-sense questions that should be answered for any program, regardless of size or complexity.

With shortened development cycles and greater reliance on information in programs, this course emphasizes the value of communication within a program team, between the team and functional areas, and between the team and the program customer. Since the appropriateness of communication vehicles vary depending on purpose and audience, alternative modes of communication and change control are discussed.

Learning Objectives

By attending this seminar, participants will be able to:
• Explain the eight-step method for program planning and control
• Implement the eight-step method to improve program outcomes as measured by cost, schedule and quality
• Make plans and progress visible to team members and to the program customer

Who Should Attend

Engineers and business people involved in various product development team activities will find the subject matter practical and useful. The content is of particular value to professionals from engineering, manufacturing, purchasing, quality, marketing, and finance functions in ground vehicle OEMs and suppliers.

Topical Outline

• Program and risk management overview
  • Process approach to planning programs
  • Competition drives us to perform better
  • Why programs sometimes fail
  • Reference materials and website
• Defining program outcomes and measurables
  • Building quality and performance targets into program planning
  • Financial impact of poor planning
  • Roles and responsibilities of project team members
  • Design reviews
  • Product performance measurement
  • Program/project metrics
• Team formation and task planning
  • Team development
  • Roles and responsibilities
  • Matrix management
  • Meeting management
• Scheduling work
  • Critical Path calculation
  • Fast tracking
  • Developing a baseline schedule
  • Gantt chart creation
  • Software tools for scheduling
  • Software tools for program management
• Resource planning
  • Resource planning (quantity, skills, resource conflicts, anticipating needs)
  • Adding contingencies
  • Constraint management
• Risk Management
  • Proactive assessment and mitigation of risks
  • Types of risk
  • Failure mode and effects analysis applied to programs/projects
• Optimizing work performance
  • Spheres of influence and control
  • Cause-effect diagrams
  • Assessing critical information flows
  • Managing human performance
  • Responsibility matrix (RASIC)
• Project initiation
  • Establishing a war room
  • Authorization to begin
  • Meeting management
• Tracking program performance

Instructor: Murray Sittsamer or Kenneth B. Woodside
Fee $1415 1.3 CEUs
MANAGEMENT AND PRODUCT DEVELOPMENT

Managing Engineering & Technical Professionals

3 Days
I.D.# C0608

In the fast paced and competitive environment of today’s global economy, the work of technical professionals is often the difference between success and failure in an organization. Providing leadership for engineers is uniquely challenging, and the transition from working engineer to first-line technical supervisor is one of the most difficult career challenges that an engineer may face. First-time engineering supervisors and mid-level managers who wish to sharpen their skills and learn new techniques for guiding, coaching, and motivating working engineers, technicians, and designers will find this seminar valuable. A mix of lecture and attention-grabbing exercises are used to develop intense and lasting learning results.

Learning Objectives
By attending this seminar, participants will be able to:
• Describe the basic value proposition of management: what managers bring to an organization that makes them worthwhile
• Avoid the most common errors of supervisors and managers
• Describe the evolution of management thought, and utilize the latest proven concepts for improving the performance of people in complex organizations
• Explain the issues that drive the psychology of effective leadership and develop greater emotional intelligence
• Implement strategies to enhance your skills in meeting management, coaching, and performance review that are essential in today’s professional workplace

Who Should Attend
Engineers and technical professionals either recently promoted into a management position or have some experience as a manager but would like to learn how to become more effective, will benefit from attending this workshop. The concepts and skills developed during this interactive experience will be of interest to those involved in product development, manufacturing, service, or quality engineering, and all related technical activities in automotive, aerospace, manufacturing, and off-highway industries.

Topical Outline
DAY ONE
• The Management Perspective - How Managers Earn Their Keep
  • The value proposition of management
  • The “Peter Principle” and how to avoid this trap
  • Understanding the most important errors that managers commonly make - and how to steer clear of major supervisory pitfalls

• Why people usually struggle to cooperate, and how you can reduce this
• What You Need to Know about Today’s Workforce
  • The evolution of leadership thought, and why recent events have significantly changed effective leadership methods
  • Understanding what leadership is really about
• Why teamwork and cooperation are necessary in modern corporate structures
• How you can generate consistent focus and daily commitment among technical and engineering professionals
• Playing “The Tower Game” - applying focus and commitment
• The Psychology of Successful Modern Leadership
  • Process centered leadership: getting sustained results
  • Task and relationship balances
  • Why “Output Leadership” is ineffective and counter-productive
  • Different kinds of team models - and which is most effective
• How to reduce the influence of “bad” politics in an organization through constructive decision making processes

DAY TWO
• The Psychology of Change
  • Why change is often stressful
  • Five stages of change
  • How to make change exciting and interesting
• Emotional Intelligence: Building an Effective Leadership Style
  • Why “emotional intelligence” is important - the research results
  • The five elements of emotional leadership
  • How to practice and develop greater emotional intelligence
• Solving typical meeting problems with emotional intelligence
• Coaching in Supervision
  • Building trust
  • Coaching roles
  • Improving communication for constructive coaching
• Using Meeting Time Effectively
  • Five key issues for successful meetings
  • How teamwork breaks down in meetings, and how to correct this

DAY THREE
• Dealing with Practical Issues
  • Dealing with difficult people
  • Learning how to delegate effectively
• Basic Negotiation Principles
  • Soft & hard negotiating approaches
  • Win-win negotiation
  • Positions, interests, & goals
• How to Make Performance Reviews Constructive
  • Legal requirements
  • Style issues
  • 360 reviews

Instructor: Eric Timmis
Fee $1895 2.0 CEUs
MANAGEMENT AND PRODUCT DEVELOPMENT

Patent Law for Engineers

1 Day  I.D.# 88007

This information-packed seminar focuses on the intricacies of patents, patent infringement litigation and patent licensing. Attendees will explore the important subjects of obtaining U.S. and foreign patents, maintaining U.S. and foreign patent rights, enforcing patent rights, defending against patent rights asserted by competitors, and licensing patent rights for revenue. After this seminar, you will effectively understand patents and ways to protect your company’s valuable inventions. Your new knowledge will help your company maintain and enhance its position in the marketplace.

Learning Objectives

By attending this seminar, participants will be able to:
• Obtain an overview of U.S. patent litigation
• Understand 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

Participants should have a mid- to upper-level managerial role. Research and development, in-house legal staff members such as in-house lawyers, patent agents, or patent liaisons will especially benefit.

Topical Outline

• Overview of Patent Litigation
  • Issues the Patent-Owner Has to Prove
  • Issues the Accused Infringer Has to Prove
• Who Decides Liability and Damages
  • Jury
  • Judge
  • Mediator/Arbitrator
• 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 is the Scope of Discovery
  • Documents, including e-documents
  • Depositions
  • Third parties (e.g. customers, suppliers)
  • Confidentiality of discovery materials

• What Changes are on the Horizon
  • Supreme Court
  • Patent law reform

Instructor: William Cory Spence
Fee $810 .7 CEUs

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

4 Hours
Web Seminar: I.D.# WB0940
Web Seminar RePlay: I.D.# PD330940ON

In today’s economic environment, patents have become an increasingly important asset for both individuals and corporations. More and more, individuals and corporations, including those in the automotive and aerospace industries, are recognizing that revenue can be generated from their patent rights, whether those rights consist of a single patent, a family of patents or an entire portfolio. Indeed, some companies do not make or sell products; their entire revenue is derived from the licensing of their patents. Suffice it to say, licensing revenue has become a significant source of value in the global intellectual property economy.

This Web Seminar 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. You will learn what’s involved in a patent case, including the issues that the patent owner has to prove, e.g. infringement, and the issues the accused infringer has to prove, e.g., invalidity. You will increase your awareness of the role of the judge and the jury in patent cases and you will hear about the increasing use of alternative dispute resolution mechanisms, such as mediation, to resolve patent disputes. Among other topics, this course also will increase your appreciation for the time it typically takes to go from the filing of a case to trial, and the fees and expenses associated with the case.

Learning Objectives

By connecting with this Web Seminar, participants 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.

Topical Outline
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

Instructor: William Cory Spence
Fee $425 .4 CEUs

Instructors Wanted...
To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses.

We are seeking expertise in a variety of Aerospace-related topics including: Certification, Regulations, and Standards.

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568

Patent Litigation Risk Management Toolkit Web Seminar
4 Hours
Web Seminar: I.D.# WB1525

In recent years, total annual United States patent grants have increased to over 300,000, while patent infringement lawsuit filings have exceeded 6,000 per year. Only a small fraction of granted patents ever end up in litigation. Of the many causes for the disparity is the growing awareness and sensitivity of companies to patent infringement risk management practices. This course addresses a number of those practices (and tools for implementing the practices), placing them into context, and providing a practical overview for how to implement them to help reduce the prospect of patent infringement litigation.

Participants will receive a basic working knowledge of various common, but most misunderstood, practices for reducing the risk of patent infringement litigation. The course will teach the role and significance of patent claims, address pragmatic record keeping practices, reveal ways to monitor competitive patent filings, explain common practical pitfalls in analyzing a patent landscape, and illustrate alternative ways that risk can be managed (e.g., by use of contracts).

Learning Objectives
By connecting with this Web Seminar, participants will be able to:
• Identify causes why many companies end up in litigation
• Discover ways to help avoid poor patent litigation outcomes
• Expand existing practices to help avoid the risk of litigation in the first place

Who Should Attend
Small to mid-size company CFO’s, as well as technology officers, engineering managers, patent liaisons, and in-house counsel for companies of all sizes will benefit from this course. These people will typically have at least five years of industry experience, and some may have two or three decades of experience.

This course complements the Patent Litigation in the U.S.: What You Need to Know web seminar, which focuses on what engineers and business managers need to know to effectively manage patent procurement, patent infringement litigation, and patent licensing.

Topical Outline
Session 1
• Infringement: The Theme that Brings Us Together?
  • Patent statistics
  • Glossary of terms
  • Infringement and its consequences
MANAGEMENT AND PRODUCT DEVELOPMENT

- Hypothetical Case: Fact Review
  - The market generally
  - The patent landscape for the market
  - The product sought for market entry
  - Perspective
- The Tools in the Kit: For the Market Entrant and Existing Participants
  - Internal policies and practices
  - Prior art
  - Contracts
  - Patent applications/patents
  - Design arounds
- Internal Policies and Practices
  - Intellectual property policy of company
  - Confidentiality obligations
  - IP Ownership obligations
  - Invention disclosures
  - Patent searches and competitive patent watches
  - Product clearance
  - Archiving internal activities
  - Sending and receiving accusations of infringement
- The Role of Prior Art in Defining Boundaries in the World of Patents
  - Patents and non-patent literature
  - First inventor to file
  - Public accessibility requirement
  - Public use
  - Possible relevance of prior invention activities

Session 2
- Contracts
  - Employment agreements
  - Nondisclosure agreements
  - Joint development agreements
  - License agreements
- Patent Applications/Patents
  - Overview of patents
  - Utilitarian features
  - Ornamental features
  - International filings
  - Continuation/Divisional/Broadening Reissue Applications
- Design Arounds
  - Lawful
  - Precautions
- Toolkit Laboratories
  - The marketplace
  - Patent Offices
  - The Courts
  - Comparison of proceedings in Patent Offices and Courts
- Summary

SAE PROFESSIONAL AND LEGAL ISSUES CERTIFICATE PROGRAM

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

This program focuses on legal and risk management issues critical for you to master to facilitate the successful design and deployment of products from a safety and reliability perspective. View the list of required and elective courses and more information on enrolling in this SAE certificate program—training.sae.org/credentialing/certificate/legalissues.htm

Principled Negotiation

1 Day
I.D.# C1602

This highly interactive workshop focuses training on negotiation strategy and skills. This is not the manipulative, win-lose negotiation approach frequently taught today, where the “winner” eventually spends time and effort protecting his negotiated advantage against erosion, while the “loser” continually exploits loopholes and shortcuts to recover lost ground. Traditional negotiation is a wary dance based on mistrust, the true cost of which is lost in quality and brain fatigue – usually for someone other than the negotiator – over the life of the agreement.

Successful negotiations occur when all parties want the agreement to stay in force and when everyone has a vested interest in making things work. There is no desire to find loopholes or shortcuts, there is little time given to supervising the agreement, and both product and relationship quality is enhanced. When the Principled Negotiation guidelines are followed, negotiated outcomes simply cost less.

Learning Objectives

By attending this seminar, participants will be able to:
- Assess your current approach to negotiation
- Utilize a principled approach when preparing for negotiations
- Practice principled negotiation techniques
- Develop a personal action plan for change

Who Should Attend

This course is particularly useful for front-line employees in manufacturing, design, and customer liaison – those who manage daily human interactions with both suppliers and customers. It also easily applies to procurement, estimating, sales, testing, and business development.

Instructor: Eric Dobrusin
Fee $425 .4 CEUs
Topical Outline

• Principled Negotiation Overview
  • Setting the stage
  • Exploring where we are today
• Principles, Guidelines, and Techniques
• Negotiation: Operational Definition
• Three General Negotiation Approaches – Soft, Hard, “Win-Win”
• Personal Goals and Expectations
• Paradigm Stretcher
• Key Elements of Principled Negotiation
  • Interests
  • Options
  • Standards
  • People
  • Alternatives
• Emotional Intelligence (E.I.) - the Pre-requisite 21st Century Leadership Skill Set for Principled Negotiation
• Explore Practical Ways to Enhance the E.I. Skills You Will Need
  • Self-Awareness
  • Self-Regulation
  • Self-Motivation
  • Empathy
  • Social skill
• Positional Bargaining vs. Principled Negotiation
  • Using role play scenarios to assess and select strategies for each key element that fits your particular situation
• Action Planning – Using a Proven 10 Step Approach
  • Putting it to work for you
  • What do you want to do better, stop doing or do differently?

Instructor: Eric Timmis
Fee $810 .7 CEUs

Principles of Cost and Finance for Engineers

3 Days
I.D.# C0828

In today’s corporate environment of shrinking budgets, required structural cost reductions, sharing of global designs/services, and pricing pressures, it is critical that engineers possess a working knowledge of engineering economics principles. To fully understand the economic viability of engineering decisions, engineers need to find the appropriate balance between design alternatives, resulting costs, and impact on their enterprise. This seminar introduces participants to the cost, finance and economic concepts and their applications to products and services. This three-day course provides you with practical information normally obtained through university level economics and business management courses and will help you to maximize efficiencies from both an engineering and business perspective.

Note:
Attendees are requested to bring with them a business or scientific calculator capable of doing exponential calculations.

Learning Objectives

By attending this seminar, participants will be able to:
• Understand the hierarchy of economics, finance and cost in making financial decisions
• Review financial statements and ratios in assessing the financial state of a business
• Select the best decision-making criteria in making project decisions and allocating capital
• Implement a benchmarking plan to establish a competitive market position
• Determine the enterprise costs of raising capital through debt and equity offerings
• Analyze make-buy and buy-lease options and other alternative decisions based on the best financial strategies
• Understand the financial sensitivity of project decisions and the use of decision tools for integrating business requirements
• Determine and optimize all costs in the production process
• Select the optimum cost accounting strategy and inventory plan
• Identify the appropriate cost estimation methodology for metallic, electronic & plastic components
• Select cost control alternatives from marketing, engineering, commercial & geographic options

Who Should Attend

This seminar will benefit engineers having responsibilities in manufacturing, maintenance, research, design, product and process development, program and project management, trouble-
shooting, and materials management. Additionally, individuals in non-engineering disciplines, including marketing and general management, will benefit from an introduction to the engineering perspective.

Topical Outline

DAY ONE - Principles of Economics & Finance
- Process & Responsibility for Determining Cost
- Economics, Finance & Cost Principles
  - Macroeconomics and Growth
  - Microeconomics, Supply & Demand
  - International Economics & Comparative Advantage
- Finance
  - Financial Statements & GAAP
  - Financial Analysis & Ratios, Case Analysis
- Time Value of Money and Decision Making
  - Interest: simple and compounded
  - Inflation
  - Worth: present and future values
- Decision Making
  - Net Present Value, Payback Period
  - AAR, Internal Rate of Return, Profitability Index
  - Case Analysis
- Benchmarking Module

DAY TWO - Cost Impact & Enterprise Decisions
- Cost Impact on the Enterprise
  - Cost of capital, cost of equity and debt, WACC, Case Analysis
  - Cost of Ownership, Depreciation; Accelerated cost recovery; Depletion
  - The influence on tax obligations
- Alternative Financial Decisions Using Case Analysis
  - Make-Buy; Buy-Lease
  - Repair-Replace
  - Investments of Unequal Life
- Sensitivity & Scenario Analysis
  - Matrix Priority Rating Systems

DAY THREE - Cost Management
- Production Cost Relationships
  - Break-even Point
- Marginal Costing
- Elements of the Production Process
  - Pricing influences -- Quality; Competition
  - Elasticity of Demand
- Cost Principles & Definition
  - Accounting, Opportunity, Estimating
  - Fixed, Variable, Cost Function, Transfer Pricing
  - Economies of Scale
- Managerial & Cost Accounting
  - Cost Volume Profit Analyses
  - Standard Costing
  - Throughput Costing & Case Analysis
  - Activity-based
- Inventory Management
  - Types
  - Accounting
- Cost Estimating Methodology
  - Activity-based costing
  - Cost analysis process examples (metallic, electronic, plastic)
- Cost Control Alternatives
  - Marketing & content evaluation
  - Engineering & redesign (DFSS, DFMA, VE, Benchmarking)
  - Commercial Decisions (Purchasing, Economies of Scale)
  - Regions of manufacture & transportation

Instructor: James Masiak
Fee $1745 2.0 CEUs

Product Liability and The Engineer

1.5 Days
I.D.# 82001

In the past few decades, product liability law has dramatically changed the manufacturer’s outlook in the design and manufacture of product. The concept of safety and reliability has been altered from a purely engineering/manufacturing concept to a legal/manufacturing approach. This new approach requires an understanding of legal concepts as related to the manufacturing and design process. The engineer’s role has shifted to include a safety audit analysis to minimize the existence of a product defect and/or to defend the product in a way that is responsive to the legal concerns. An overnight assignment will be made by the instructor. It will consist of problems drawn from actual cases and a group project that examines the design, instructions, and warnings of a product.

Learning Objectives

By attending this seminar, participants will be able to:
- Relate legal concepts as they apply to the manufacturing/design process
- Use safety audit analysis techniques to minimize or eliminate product defects during design, thus reducing product liability
- Discuss defense of product from a legal perspective
- Recognize the importance of potential liability as it relates to the manufacturer
MANAGEMENT AND PRODUCT DEVELOPMENT

Who Should Attend
Persons responsible for product design, including managers and designers; corporate risk managers; persons responsible for developing and approving product instructions and warnings; marketing personnel; production and quality assurance managers and personnel; personnel responsible for product safety and those persons, including lawyers, who oversee and manage product liability issues.

Topical Outline
(Day two will end at approximately 1:00 p.m.)
• Legal Concepts
  • Negligence: elements, defenses
  • Strict liability: section 402A (elements, defenses)
  • Warranties: express, implied
• Analysis of Defect
  • Meaning of unreasonable danger
  • Production defect
  • Design defect
  • Defect by words
• Designing for Reasonable Safety
  • Products’ use, users & environment
  • Product safety audit
• The Role of Standards in Design
• Warnings
  • Guidelines for design & warnings
  • Functions & use
• Problem Analysis by Participants
• Review of a Product Design by Participants

Instructor: Charles F. Seyboldt
Fee $1370 1.0 CEUs

Root Cause Problem Solving: Methods and Tools Web Seminar
8 Hours
Web Seminar: I.D.# WB0931

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 connecting with this Web Seminar, participants 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

SAE GENERAL MANAGEMENT AND LEADERSHIP CERTIFICATE PROGRAM
Watch for the certificate icon to indicate course titles that are part of an SAE multi-course 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. View the list of required and elective courses and more information on enrolling in this SAE certificate program--training.sae.org/credentialing/certificate/generalmgmt.htm
Topical Outline

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

Instructor: Murray Sittsamer
Fee $640 .8 CEUs
MANAGEMENT AND PRODUCT DEVELOPMENT

Is this On Demand Course for You?
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

Topical Outline
• Module 1: Foundations for Adopting Root Cause Analysis
  • Identifying Problems
  • How to Approach Problem Solving Using a Process Approach
  • Methods and Tools for Problem Solving: An 8 Step Approach
  • Roles and Responsibilities in Problem Solving
  • Setting Up a Problem Solving Team
• Module 2: Describing the Problem and Implementing Containment
  • How to Describe a Problem
  • Symptoms vs. Causes
  • Methods for Collecting and Analyzing Data
  • Problem Statements
  • Methods for Protecting the Customer
• Module 3: Discovering Root Causes
  • Recognizing Potential Causes
  • Methods for Identifying Causes and Root Causes (cause-effect diagram, 5-why)
  • Validating Potential Root Causes
• Module 4: Designing a Solution and Implementing Permanent Corrective Action
  • Strategies for Planning and Designing Effective Solutions
  • Methods for Evaluating Potential Solutions
  • Error Proofing Strategies
  • Planning Implementation
  • Project Management Strategies
  • Completing System Changes
  • Measuring and Verifying Effectiveness
• Module 5: Preventing Reoccurrence
  • Ensuring the Problem is Eliminated
  • Holding the Solution in Place
  • Leveraging What is Learned
  • FMEA and Problem Solving
• Module 6: Recognizing Efforts
  • Solutions that don’t work
  • Process Controls and Error Proofing
  • Standardized Work
• Step 6: Implement Permanent Corrective Actions
  • Methods of Team and Individual Recognition
  • Capturing Lessons Learned and Moving the Forward
  • Problem Solving and Continuous Improvement

What You Will Receive
• 90 days of online single-user access (from date of purchase) to the course
• Integrated knowledge checks to reinforce key concepts

Fee
This course may not yet be available. Contact SAE Corporate Learning Solutions for pricing and CEU information.

Strategic Leadership
3 Days
I.D.# C0620

As a strategic leader, it is your responsibility to ensure that your organization is moving in the right direction. Executives and high-level managers must have the practical insight necessary to address competitive business challenges. Each segment of this three day course is designed to impart simple, but powerful lessons that will equip participants to more fully engage in strategic discussions, ask pertinent questions, facilitate critical decisions and shape high performing organizations. In addition, the course provides students with a personal leadership profile that illustrates their strengths and potential limitations. Participative exercises assist emerging executives with practical and effective methods of gaining organizational credibility and avoiding common errors in strategic leadership.

Learning Objectives
By attending this seminar, participants will be able to:
• Describe the role and responsibilities of strategic leadership
• Manage the critical factors that drive the success and failure of business strategies
• Anticipate the longer term impact of strategic initiatives
• Attain credibility and support as you assume the helm of a new operation
• Avoid common errors made by leaders in transitioning to higher levels of responsibility
• Select the most effective approaches when framing strategic decisions
• Think strategically and systemically as you plan organizational change
MANAGEMENT AND PRODUCT DEVELOPMENT

- Influence the emergence of a more positive and functional corporate culture
- Eliminate turf battles, dropped balls and organizational duplication of effort
- Analyze and correct dysfunctional organizational dynamics
- Manage the strengths and limitations of your personal leadership style

**Who Should Attend**
This seminar is designed for executives, senior level managers, and engineering managers or technical specialists who are called upon to formulate or provide input into strategic decisions and business strategies.

**Topical Outline**
- Introduction to Strategic Leadership
  - What exactly do we mean by leadership?
  - Who is and is not a leader?
  - At what point do we become leaders?
  - Critical elements of leadership support
  - Managing versus leading - is there really a difference?
  - Critical factors in assessing leadership performance
  - The relationship between leadership, strategy, human behavior, decision-making and organizational systems
- Understanding the Human Dimension
  - Similarities between animal behavior and human behavior
  - Influence of brain structure on human behavior
  - Creating long term employee motivation
  - Rules of thumb for predicting human behavior in organizations
  - Recognizing the symptoms of pathological leadership
  - Managing and defusing dysfunctional behavior
- Assuming the Helm
  - Managing the transition to a new workgroup
  - Common and avoidable errors of leadership
  - Developing and maintaining the support of your workgroup
  - Simple, but effective steps to improve workgroup performance
- Shaping Corporate Culture
  - Understanding the critical components of corporate culture
  - Forming productive organizational norms
  - How leaders contribute to dysfunctional cultures
  - Establishing a high performance work environment
- Creating Organizations that Work
  - Creating an organizational charter
  - Selecting an effective management team
  - Thinking systemically
  - Importance of managing image and expectations
  - Creating meaningful performance indicators
  - Eliminating turf battles and duplication
  - Limitations on the application of common systems
- Facilitating Strategic Decisions
  - Critical distinctions between problems, decisions and polarities
  - How to properly frame a decision
  - Selecting the decision makers
  - Common errors in decision making process
  - Essential elements of effective decision making process
  - Knowing when the decision has been made
- The Leader’s Role in Creating Effective Strategies
  - What exactly is a strategy?
  - Why business strategies fail
  - Internal and external considerations
  - What constitutes effective strategy?
  - Anticipating the impact of adaptive responses
  - Framing strategic initiatives
  - Barriers to strategy implementation
- Leading Strategic Change
  - Planning a change initiative
  - Critical variables in organizational change
  - The leader’s role in fostering change
  - Anticipating and dealing with resistance
  - Culture as a barrier to change
- Political Reality versus Dysfunctional Idealism
  - Gaining credibility in executive circles
  - Sources of leadership power
  - How power is gained and lost
  - The importance of building networks and relationships
  - How to avoid getting derailed
- Lessons of History for Strategic Leaders
- Developing a Leadership Profile
  - Charting your personal leadership profile
  - Identifying your leadership assets and liabilities
  - Creating a plan of action

**Instructor:** Joseph Doyle
**Fee:** $1745 2.0 CEUs
Success Strategies for Women in Industry and Business

1 Day
I.D.# C1202

It is a well-known fact that the number of women in science, engineering and business fields is growing, yet men continue to outnumber women, especially at the upper levels of these professions. Many women appear to encounter a series of challenges at early or midcareer stages that contribute to them leaving their careers prematurely due to feelings of isolation, an unsupportive work environment, extreme work schedules, and unclear rules about advancement and success.

This program serves as a unique opportunity to obtain both formal and informal mentoring tips from a successful woman engineer who spent over 25 years in the petrochemical/specialty chemical industry. She has seen and has experienced significant changes in the number of professional women active in the technical/scientific field and is convinced that more positive change can happen in the future.

This seminar will provide detailed guidance, based on real life examples, on how female professionals can become proactive in creating career opportunities via self-assessment, self-motivation, an objective view of one’s own abilities, and continuous steps in self-improvement. The program will take participants beyond theory to case studies and real life examples exemplifying potential for immediate use.

Learning Objectives

By attending this seminar, participants will be able to:
• Identify obstacles and common challenges that hold you back in your career
• Develop and utilize critical communication skills
• Develop focused and well defined criteria for professional progress
• Define your professional relationships with clear boundaries and respect
• Create a flexible career plan
• Handle criticism and difficult situations with composure

Who Should Attend

This seminar will benefit professional women who want to positively impact their careers. Recent engineering graduates, as well as experienced female engineers and/or scientists having responsibilities in research, design, product and process development, manufacturing, quality, information technology, sales/marketing, and management will learn skills to help them navigate these male-dominated fields. Additionally, individuals currently working in non-engineering disciplines, including general management, human resources, academia, business, and law as well as current engineering students, will also benefit from this unique perspective.

Topical Outline

• Course Motivation: Why are you here?
• Historical Perspective - Women in Engineering and Scientific Professions
  • Dr. Ewa Bardasz - personal story
  • Survey data - status of women professionals: tenure, promotions, salary trends, recognitions, etc
• Case Study #1: What holds you back in your career?
• Common Challenges
• Case Study #2: Career Goals: Success Defining Questions
• Work Climate Changes
• Definition of Professional Success
  • Technical know-how
  • Leadership skills
• Refining Critical Verbal Communication Skills
  • Presentations/ public speaking
  • Negotiations/ conflict communications
  • Getting your points across
  • How to speak up without coming across as to aggressive
  • How to find balance between “being to nice” and “coming on too strong”
  • How you can say “no” without feeling guilty
• Case Study #3: How can you successfully negotiate with a group of aggressive men?
• Refining Critical Written Communication Skills
  • Reports, technical papers
  • Email, social media
• Networking
• Behaviors and Relationships
  • Handling emotions at work
  • Mentors/Advisors - pros and cons
• Work-Life Balance
• Key Resources
  • Professional organizations
  • Community activities
• Reflections and Final Thoughts
• Take Away Message
• Case Study #4: What will I do next?

Instructor: Ewa Bardasz

Fee $610 .7 CEUs
The Role of the Expert Witness in Product Liability Litigation

1.5 Days
I.D.# 92054

According to the Federal Rules of Evidence, an expert witness is anyone who can assist the trier of fact (the jury) in understanding any issue in dispute at trial. The witness’ ability to give this assistance can be derived from any specialized training, education, background, or experience. To be effective in providing this assistance, however, requires that the expert witness understand the true role that he or she is to play both before and at the trial.

This seminar will address the critical issues that every person who may be, has been, or is, an expert witness must understand to assist both the attorney and the product manufacturer, regardless of which side the expert serves.

**Learning Objectives**
By attending this seminar, participants will be able to:
- Employ the risk/utility balancing process necessary for effectively addressing the issue of design defect
- Recognize the critical elements that govern the interaction between human behavior and product behavior
- Apply the technical/legal elements that will enhance your effectiveness as an expert witness

**Who Should Attend**
This seminar is intended for anyone who is or may become an expert witness in product liability litigation. In-house experts typically have engineering, engineering management or field technician responsibilities. In addition, insurers, risk managers, corporate product safety personnel, attorneys and those who manage product liability litigation will benefit from insight into selecting and using expert services and witnesses more effectively and efficiently.

**Topical Outline**
(Day two ends at 1:00 p.m.)
- The Legal Framework of Negligence and Strict Liability
- The Relationship Between the Attorney and the Potential Expert Witness
- Investigation of an Accident Years After an Occurrence
- Developing the Background Necessary to Understand the Product and its Environment
- Understanding How to Alleged or Refute the Existence of a Product Defect
- Analyzing the Role of Human Behavior and its Relationship to the Cause of an Accident
- Guidelines for Effective Presentation Before Trial and on the Witness Stand
- The seminar will also include overnight problem assignments and a demonstration of direct and cross-examination of an expert witness.

**Understanding the FAA Aircraft Certification Process**

2 Days
I.D.# C0821

The task of certifying an aircraft or part can be overwhelming given the lengthy process and the many steps that are required. Understanding the process can greatly enhance the outcome and reduce unnecessary delays or frustrations. This course will provide an overview of the Federal Aviation Administration (FAA) organizational structure, its policies, guidelines and requirements leading to Type and Supplemental Type airworthiness approvals. It will also cover the rule-making process and rules applicable to aircraft parts and products. The course will define the roles and responsibilities of the Aircraft Certification Office (ACO), Manufacturing Inspection District Office (MIDO), Flight Standards District Office (FSDO), and the Aircraft Evaluation Group (AEG). Type and Supplemental Type Certification (TC and STC) processes, and Change Product Rule for alterations and modifications to previously type certified aircraft will be discussed. FAA rule-making process will be examined including review of FAA Orders, Notices, Advisory Circulars and other guidance material.

**Learning Objectives**
By attending this seminar, participants will be able to:
- Manage certification programs more efficiently, schedule the required milestones accordingly, and identify problems and address them promptly
- Describe the principles of Type Certification and Supplemental Type Certification requirements and process
- Converse intelligently and enter negotiations with others involved in FAA certification programs
- Describe the FAA system, FAA orders, Advisory Circulars, FAA rule making process
- Define what exemptions and special conditions are and how to obtain them
- Identify the difference between airworthiness standard and operational rules
Who Should Attend

This course is designed for engineering and certification managers, design engineers, airworthiness and certification engineers, quality assurance inspectors and engineers, program managers, consultants, Federal Aviation Administration designated engineering and airworthiness representatives (DER and DAR) and other technical administrative personnel involved in FAA certification activities. The course will help newcomers to aircraft certification as well as experienced attendees better understand the certification process and be able to present and negotiate certification matters with the Federal Aviation Administration Aircraft Certification Office.

Topical Outline

DAY ONE
- FAA History, Organization and Hierarchy
  - FAA certification “lingo”
  - FAA system organizational chart and hierarchy
  - How regulations are developed
- FAA Roles and Responsibilities
  - Aircraft Certification Office
  - Manufacturing Inspection District Office
  - Flight Standard District Office
  - Aircraft Evaluation Group
- Issue Papers - What They Are and How They Are Used
  - Exemptions; Special conditions
- Equivalent level of safety
- Certification Basis
- Change Product Rule

DAY TWO
- Type Certificate Data Sheet - The “Birth Certificate” of an Airplane
- Documents and How to Develop Them
  - Airplane Flight Manual Supplements
  - Instructions for Continued Airworthiness
  - Type Inspection Authorization
  - Request For Conformity
  - Certification Plan; Conformity Plans
- FAA Advisory Materials
- Support Documents
  - Parts Manufacturing Authorization
  - Technical Standard Order
  - Field approvals
  - FAA Form 337 approvals
  - 8110-3 approvals
- Type and Supplemental Type Certification Process
  - Certification Plans and FAA coordination
  - Data generation and approvals
  - Conformity inspections; Testing; Approvals

Instructor: Ken Farsi
Fee $1370 1.3 CEUs

SAE CAREER COUNSELOR SERIES

Concise, effective training videos focused on your career needs:
- Time Management
- Goal Setting Strategies
- Communication Strategies
- Generations in the Workplace
- And more...

View the episodes at go.sae.org/careercounselor.html

P1624864
SAE ENGINEERING ACADEMIES

Immersive training covering core engineering topics. Cost-effective and time-efficient educational programs taught by experts dedicated to helping the industry.

- Engineering Management
- Diesel Engine Technology
- Vehicle Noise Control
- Hybrid and Electric Vehicle
- Gasoline Engine Calibration
- Transmission

training.sae.org/academies
Aerospace Precision Forging Design and Quality Control

2 Days
I.D.# C1348

One of the main advantages of the precision forging process is the reduction in material consumption due to the achievement of close tolerances and the reduction of machining requirements to meet final component specifications. However, to achieve these results comes at a cost. One of the primary issues with precision forging is the reduction in life of the tools used in the forming process. Manufacturers can mitigate some of these concerns by better understanding how tools can be designed specifically for the precision forging process and how personnel can effectively apply precision forging techniques.

This two day seminar will introduce participants to tooling design practices that can be successfully applied to precision forging methods. The instructor will guide participants through critical die design requirements to optimize die life. Participants will be provided detailed information related to inspection and calibration techniques and requirements. The instructor will then provide participants the requirements of an effective quality control system, including the rigorous requirements for aerospace and medical parts manufacturing.

Learning Objectives
By attending this seminar, participants will be able to:
- Identify key die design requirements and best practices
- Identify and evaluate gage requirements and techniques
- Analyze set-up requirements and processes
- Describe accepted inspection techniques and related devices
- Identify required components of an approved aerospace quality system

Who Should Attend
This seminar is intended for engineers desiring a comprehensive understanding of the requirements to implement precision forging processes. Individuals involved with design, materials, manufacturing, special processes, tooling, quality, and inspection and testing will benefit most from the information presented.

Topical Outline
DAY ONE
- Die Design for:
  - Upset
  - Extrusion
  - Bending
  - Pre-final and final forging
  - Trimming
  - Hot sizing
  - Cold sizing
- Related Tooling Design for:
  - Die holders & Heating system
  - Kissing plate
  - Thickness sort
  - Glass coating
- Die Repair
  - Tooling and equipment
- Gage Designed Related Technologies
  - Special gages for all forging steps (ten steps)
  - Final inspection gages and Coordinate Measuring Machine (CMM) program
  - Raw materials
  - Block
  - High speed CNC and CNC program
  - Cutter choice
  - Manufacture tolerance
  - Surface finish requirements and inspection
Aerospace Precision Forging Processes and Technology

3 Days
I.D.# C1347

The advancement of forging technologies and processes has enabled the increased use of forged products to meet the demanding requirements of strength, durability, and reliability. While forgings are commonly used in aerospace manufacturing, the ability to make use of precision forging processes and techniques is critical when manufacturing gas turbine components. Realizing the benefits of accuracy and quality that precision forging brings to product manufacturing requires those involved with design and manufacturing have an understanding of industry-accepted technology and processes.

This three day seminar will introduce participants to the precision forging processes and technologies currently in use in industry. The instructor will begin with an overview of the benefits of precision forging and the various manufacturing industries that currently make use of this approach. The instructor will discuss equipment, processes, and quality control requirements. Using examples derived from gas turbine engine rotor blade and vane manufacturing, the attendees will then be presented with the technical requirements to set-up precision forging and the various special processes. The instructor will also provide attendees with the information required to analyze customer drawings, key parameters, raw material requirements, and forging press selection.

Learning Objectives

By attending this seminar, participants will be able to:

- Identify the key characteristics and advantages of precision forging
- Identify requirements for equipment and layout
- Analyze set-up requirements and processes
- Evaluate and identify special process requirements
- Analyze customer drawings and related material requirements

Who Should Attend

This seminar is intended for engineers desiring a comprehensive understanding of the requirements to implement precision forging processes. Individuals involved with design, materials, manufacturing, special processes, tooling, quality, and testing will benefit most from the information presented.

Topical Outline

DAY ONE

- Precision Forging Overview
  - When precision forging is needed
  - Industry and components that require precision forging processes
  - Requirements: Equipment; Engineering Staff; Process Technology; Quality Control
- Requirements for Accepted Parts
  - Requirements
  - Influencing factors
- Quality System
  - Basic quality procedures
  - Classroom examples

DAY TWO

- Set-Up of Precision Forging Processes
  - Rotor blades
  - Vanes blades
- Set-Up of Special Processes
  - Cutting, vibro-milling, blasting, polishing, hot sizing, cold sizing, graphite lubrication
  - Glass coating, chemical surface treatment, NDT, heat treat, upset, extrusion
  - Pre-final forging, final forging, trimming, bending
- Defects
  - Prevention and removal at each step

DAY THREE

- Analyzing Customer Drawings and Process Set-Up
  - Key parameters in blade and structure drawings
    - Raw materials
    - HT requirements
    - NDT requirements
  - Airfoil tolerance
  - Thickness tolerance
  - Twist angle
AUTOMATED SYSTEMS FOR AEROSPACE AND SPACE APPLICATIONS

2 Days
I.D.# C1313

The rapidly evolving demand for cost reductions and shrinking budgets makes the application and use of automated processes within the aerospace and space industries a necessity. While some view aerospace automation as the solution to reducing costs, others view automation technologies and processes as something that should be avoided when possible. Misunderstandings and assumptions about these complex systems can result in the improper selection and application of these systems, often leading to undesirable interactions with other elements of the assembly process and potentially, project failure. This two-day seminar introduces participants to the critical components of automation necessary to be informed and knowledgeable about the acquisition, installation, and maintenance of automated systems for aerospace and space applications. The instructor will guide participants through the types, components, operation, application, cost benefits, laws, strengths, and limitations of automation. The information presented in this seminar will cover the breadth and scope necessary for participants to be an effective participant in the decision process when automation has become a consideration to replacing tasks previously done by hand.

Attendees will receive a copy of the textbook, Automated/ Mechanized Drilling and Countersinking of Airframes, by instructor George (Nick) Bullen.

LEARNING OBJECTIVES
By attending this seminar, participants will be able to:
- Understand the function of automation in an aerospace factory
- Decide if automation is right for your factory or application
- Select the right automation for your application
- Install, transition to production, and maintain the selected automation
- Perform a feasibility analysis and a Return on Investment (ROI) for factory automation

WHO SHOULD ATTEND
This course is designed for all personnel interested in acquiring an understanding of the power and pitfalls of automation before purchase and how to select and install the right automation.

TOPICAL OUTLINE

DAY ONE
- Historical Perspective: Why Airframes Have Holes
  - The Airframe
  - Aluminum
  - Rivets
  - Assembly Tooling
  - Titanium
  - Hand Tools and Drills
  - Composites
  - Tooling and Composites
  - On-Assembly Drilling
- Airframe Manufacturing Cost Drivers
  - Why Reduce Cost
  - Defining Cost
  - Identifying Manufacturing Related Costs
- Incentives and Disincentives to Automate
  - Military Automation Disincentive
  - Military Producers Incentives to Automate
  - Commercial Disincentives
  - Commercial Incentives
- Types of Automation
  - Motion
  - Action
  - Controller
  - Calibration
  - Sustainability
- Considerations before Replacing Hand operations with Mechanization or Automation
  - Before the Decision to Automate
  - “Go- Ahead” Decision Criteria
- How to Choose the Right Automation
  - Three Don’ts
  - References
  - Requirements Document
MANUFACTURING

• DAY TWO
• Installation Steps
  • Mapping the Existing Process
  • Mapping the New Process
  • Requirements Document
  • Platform Specification
  • Request for Proposal
  • Manufacturing Readiness level (MRL) Consideration
  • Performance Measurement Tools
  • Factory Acceptance
  • Installation and Test
• Test Procedures
  • Unique Tests
  • Volatile Organic Compounds (VOC)
• Transition To Production
  • TTP Document and Transfer of Responsibility, Accountability, and Authority.
  • TTP Technology Readiness Levels
  • TTP Manufacturing Readiness Level
  • TTP and Product Delivery Team Composition and Selection
  • TTP Document
  • TTP Risk Identification and Assessment
  • Validation of System to Production Requirements: Exit Criteria
• Training
  • Who to Train
• Maintenance
  • Complexity-New Normal
  • Impact Prevention
  • Predictive Maintenance (PdM)
  • Prognostic Health Monitoring (PHM)
  • Maintenance
  • Buying Maintenance
  • Troubleshooting
• Social Impact
  • Pacifying the Human Capability-Machine Experience
  • Perception of ubiquitous automation
  • Safe, secure, and ethical automation
  • Management for Automated Systems
  • Organizations
  • Customers
• Future State of Airframes and Automation Summary
  • Economics
  • Manufacturing Exodus
  • Exit the autoclave
  • Automation or Labor
  • Fastener alternatives

Corrosion of Metals

5 Hours
I.D.# PD261328ON
This on demand 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.

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

Is this Metallurgy On Demand Course for You?
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 on demand course (I.D.# PD261322, page 90) or have basic knowledge of the following topics: grains, grain boundaries, crystal lattice, substitutional solid solution, diffusion, phases, precipitation, precipitation hardening, microstructure, tensile testing.

What You Will Receive
• 90 days of on demand access (from date of purchase) to the five hour presentation
• Integrated knowledge checks to reinforce key concepts
• Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC
Fee $330

Instructor: George (Nick) Bullen
Fee $1370 1.3 CEUs
Corrosion of Metals: Chemistry of Corrosion

1 Hour
I.D.# PD261334ON

This on demand 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.

**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

**Is this Metallurgy On Demand Course for You?**

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.

**What You Will Receive**
- 90 days (from date of purchase) of on demand access to the one hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

**Author:** Industrial Metallurgists, LLC
**Fee:** $70

---

Corrosion of Metals: Galvanic Corrosion

1 Hour
I.D.# PD261336ON

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

**Major topics include:**
- Galvanic corrosion cell components
- Factors that influence galvanic corrosion rate
- Galvanic series and its use
- Methods to control galvanic corrosion

**Is this Metallurgy On Demand Course for You?**

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 on demand course (I.D.# PD261334ON, just before this course).

**What You Will Receive**
- 90 days (from date of purchase) of on demand access to the one hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

**Author:** Industrial Metallurgists, LLC
**Fee:** $70

---

Instructors Wanted...

To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses.

We are seeking expertise in a variety of Aerospace-related topics including: Certification, Regulations, and Standards.

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568
MANUFACTURING

Corrosion of Metals: Uniform Corrosion

1 Hour
I.D.# PD261335ON

This on demand 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.

Major topics include:
• Uniform corrosion mechanism
• Why uniform corrosion occurs
• Appearance of uniform corrosion
• Methods for controlling uniform corrosion

Is this Metallurgy On Demand Course for You?
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 on demand course (I.D.# PD261334ON, page 85).

What You Will Receive
• 90 days (from date of purchase) of on demand access to the one hour presentation
• Integrated knowledge checks to reinforce key concepts
• Course workbook (.pdf, downloadable)
• Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC
Fee $70

Introduction to Composites Fabrication and Assembly in Aerospace, Space, and Transportation

1 Day
I.D.# C1311

The challenges associated with using composites as a replacement for aluminum reside primarily in the complex manufacturing processes and technologies for fabricating composite parts. The high cost of composites material and its manufacturing complexity have been inhibitors to the wide transfer of this technology to the non-aerospace market. The search for solutions to high manufacturing costs and efficient manufacturing processes have resulted in intense research by government, aerospace industry companies, and space agencies worldwide. This one day seminar will introduce participants to composites technologies that have applications beyond aerospace, including such markets as trucks, automobiles, and wind turbines. The instructor will define, illustrate, and describe the innovative manufacturing processes and technologies that have been used to solve the “composite challenge” for aerospace and space vehicles. The information presented in this seminar, derived from the successful application and demonstration of these technologies and processes on flight hardware, will serve to provide solutions for the manufacturing processes and technology challenges that have slowed the migration of this technology beyond the aerospace and space industries.

Attendees will receive a copy of the textbook, Automated/Mechanized Drilling and Countersinking of Airframes, by instructor George (Nick) Bullen.

Learning Objectives
By attending this seminar, participants will be able to:
• Define the current state of composites manufacturing
• Evaluate critical emerging technologies that will enable expansion of composites
• Identify innovative manufacturing processes that enable low cost composite manufacturing
• Determine the critical features for successful composite part assembly
• Evaluate the key characteristics of various composites manufacturing processes

Who Should Attend
This seminar is intended for individuals looking for information related to efficient solutions for composites manufacturing and includes engineering disciplines from manufacturing, design, industrial, tooling, quality, and mechanical. In addition, non-engineering management and staff will benefit from information presented in this seminar.
Hardness Testing

30 Minutes
I.D.# PD261331ON

This on demand 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.

Major topics include:
• Rockwell hardness testing
• Brinell hardness testing
• Knoop and Vickers microhardness sample preparation and testing

Is this Metallurgy On Demand Course for You?
This on demand 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 on demand course (I.D.# PD261334ON, page 85).

What You Will Receive
• 90 days (from date of purchase) of on demand access to the thirty minute presentation
• Integrated knowledge checks to reinforce key concepts
• Course workbook (.pdf, downloadable)
• Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC
Fee $45

Instructor: George (Nick) Bullen
Fee $855 .7 CEUs
Metallurgy of Precipitation Strengthening

2 Hours
I.D.# PD261329ON

This on demand 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.

Major topics include:
- Introduction
- Phase diagrams
- Precipitation strengthening heat treatment
- Heat treatment details
- Quality control and course review

Is this Metallurgy On Demand Course for You?
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 on demand course (I.D.# PD261322, page 90).

What You Will Receive
- 90 days (from date of purchase) of on demand access to the two hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC
Fee $140

Metallurgy of Steel Case Hardening

1 Hour
I.D.# PD261333ON

This on demand 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.

Major topics include:
- Carburizing
- Carbonitriding
- Nitriding
- Nitrocarburizing
- Flame hardening
- Induction hardening

Is this Metallurgy On Demand Course for You?
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 (I.D.# PD261322, page 90) and Metallurgy of Steel: Principles (I.D. PD261326ON, page 89) or knowledge of the concepts covered in those courses.

What You Will Receive
- 90 days (from date of purchase) of on demand access to the one hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC
Fee $80
Metallurgy of Steel Through Hardening

1 Hour  
I.D.# PD261330ON

This on demand 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.

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

**Is this Metallurgy On Demand Course for You?**

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 on demand course.

**What You Will Receive**
- 90 days (from date of purchase) of on demand access to the one hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC  
Fee $80

---

Metallurgy of Steel: Principles

3 Hours  
I.D.# PD261326ON

This on demand 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, and 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 tool steels. The course is divided into six modules followed by a quiz.

**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

**Is this Metallurgy On Demand Course for You?**

This on demand 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 on demand course (I.D.# PD261322, page 90).

**What You Will Receive**
- 90 days (from date of purchase) of on demand access to the two hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

Author: Industrial Metallurgists, LLC  
Fee $195
**Principles of Metallurgy**

4 Hours  
I.D.# PD261322ON

This on demand 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.

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

**Is this Metallurgy On Demand Course for You?**

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

**What You Will Receive**
- 90 days (from date of purchase) of on demand access to the four hour presentation
- Integrated knowledge checks to reinforce key concepts
- Course workbook (.pdf, downloadable)
- Proof of Participation (Transcript)

**Author:** Industrial Metallurgists, LLC

**Fee $225**

---

**RELATED TRAINING SOLUTIONS**

Some of our courses apply to more than one technology category. Consider these related courses described in other sections of this resource guide.

**Understanding the FAA Parts Manufacturer Approval Process**

This two-day course covers the crucial subjects and steps of the FAA-PMA approval process. Throughout this course the instructor will combine classroom lecture with real-world examples to provide participants both a formal as well as practical learning experience.

Read more about this course on page 111.

**RFID Selection, Application, and Use in Aerospace, Space, and Transportation**

This one-day seminar introduces participants to the technology of RFID and how it can be properly integrated into the aerospace, space, and transportation industries.

Read more about this course on page 6.
Corrosion Engineering and Prevention

2 Days
I.D.# C1217

The transportation industry, including motor vehicles, aircraft, rail, marine, commercial, off-road and defense vehicles, as well as infrastructures, energy sectors, raw materials, manufacturing, health and food industries all experience significant issues with corrosion which results in billions of dollars of loss each year. Corrosion education and prevention is essential to improve and increase the service life of parts and components which may have a significant impact on the economy of various industries and nations.

The focus of this course will be on the fundamentals of corrosion engineering and corrosion prevention of metallic and alloy structures as well as non-metallic composites and hybrid materials. Recent challenges and opportunities in corrosion of advanced composites used in the automotive, aerospace, and marine industries as well as for underground structures for oil, gas, geothermal and tidal wave technologies will also be included. Different types of corrosion, methods of corrosion protection and prevention, optimum engineering design of corrosion resistance parts and components, standard corrosion tests, responsibilities of corrosion engineers, and a process for setting-up an advanced corrosion laboratory will be discussed. This course also covers most traditional and non-traditional tests for corrosion studies, including real-time characterization techniques and analysis of corrosion phenomenon and corrosion monitoring principles.

Learning Objectives

By attending this seminar, participants will be able to:

- Describe the basic electrochemical concepts of various corrosion processes
- Articulate and utilize corrosion prevention strategies and estimate corrosion behavior of materials and components
- Describe the role of ion-diffusion, crystal structure, and grain size on corrosion of metals and alloys
- Design and engineer corrosion resistive components for different industries
- Define methods of corrosion protection and interpret corrosivity maps
- Perform standard corrosion tests, in-depth analyses of test results
- Define anodic/cathodic protections and coatings specifications for various components
- Formulate corrosion prevention coatings materials for metallic and non-metallic structures

Who Should Attend

This course is designed for engineers working in automotive, commercial vehicle, off-road, aerospace, marine, rail, energy sectors, electronics and related industries who are interested in corrosion and corrosion prevention. Engineers working for chemical companies on the production of corrosion resistive materials and chemicals and scientists working for government and national laboratories working in the area of conservation, national infrastructures, and advanced energy technologies, as well as academicians will benefit from this course.
Topical Outline

DAY ONE
- Fundamentals of Corrosion and Corrosion Prevention
  - Overview of corrosion problems and their economic impacts
  - Basic electrochemical principles of corrosion and corrosion prevention
  - Types of corrosion and role of electromotive force, ion diffusion, crystal structure, and grain size
  - Corrosion of composite materials and impact of combined cyclic loading and corrosion
  - Standard corrosion tests, and recent software and hardware for corrosion testing
- Mechanisms and Prevention of Corrosion
  - Automotive components
  - Aerospace components
  - Marine and underwater infrastructures
  - Electronics and energy related systems
- Corrosion Engineering and Coating Technologies
  - Design principles to minimize corrosion
  - Passive and active coating technologies

DAY TWO
- Surface Coating Technologies for Corrosion Prevention
  - In-situ surface coating and coating optimization
  - Anodic and cathodic protections and engineering principles
  - Application of metal oxides, carbides, nitrides and composite coating
- Supply and Manufacturing of Corrosion Prevention Materials
  - Inorganic base coating materials and their applications
  - Organic based coating materials and mode of operation
  - Composite coatings and their applications in auto and aerospace industries
- Corrosion and Corrosion Prevention of EVs and HEVs with Batteries, Supercapacitors and Fuel Cells
  - Corrosion prevention and role of high voltage, electromagnetic sources
  - Corrosion in fuel cells and component design to optimize corrosion
  - Corrosion in renewable alternative energy sectors

Instructor: Gholam-Abbas Nazri
Fee $1370 1.3 CEUs

Failure Analysis of Metals

5 Hours
I.D.# PD261505ON

Quickly getting to the bottom of a metal failure is critical for preventing future failures, keeping customers happy, and keeping manufacturing lines running. This course will teach you how to perform failure analysis of fracture, corrosion, and manufacturing failures.

Major topics include:
- The relationship between failure analysis and root cause analysis
- How to select, collect, handle, and prepare samples for failure analysis
- The background information required to determine failure mechanism and root cause
- The common techniques used for failure analysis and the data obtained
- Which metallurgical analyses are appropriate for specific failures
- How to determine fracture mode based on the appearance of a fracture surface
- How to perform a failure analysis on fracture, corrosion, and manufacturing failures
- The categories of failure root causes for specific failures

Is this Metallurgy On Demand Course for You?
This course is targeted towards design, manufacturing, supplier quality and quality control engineers, sales people and purchasing agents with technical backgrounds.

What You Will Receive
- 90 days (from date of purchase) of on demand 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
Fee $330

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
Materials Selection Process for Engineering Designs Web Seminar

8 Hours
Web Seminar I.D.# WB1520

Any product is a collection of materials that have been manipulated into various shapes to form the components and joints used within the product. In fact, up to 70% of the cost to make a product is due to its materials. Therefore, getting the materials right will have a big impact on the success of a product. However, many organizations have difficulties getting the materials right and end up facing problems such as repeating product verification tests because sub-optimum materials fail, product failures associated with materials that degrade too fast, components that cost too much or are difficult to manufacture, suppliers incapable of providing materials and components that consistently meet requirements, and low manufacturing yields. These problems result in increased costs, missed schedules, and unhappy customers. A major reason for these problems is that design teams do not use a methodical approach for selecting materials.

This eight-hour web seminar covers the engineering process for selecting materials to use for components and joints within a product. Applying the process enables selection of materials that optimize product performance, reliability and cost, while helping keep projects on schedule. The topics covered include identifying materials selection criteria, selecting candidate materials, and evaluating materials to determine their suitability. Considerations include design for reliability and design for manufacturability. Case studies will be used to reinforce the concepts taught.

Note: Because this content is focused on product design, discussion of the science of specific materials is outside the scope of this course. Examples used will be based on input from participants about products on which they are actively working or have developed in the past.

Learning Objectives
By connecting with this Web Seminar, participants will be able to:
• Explain the steps for the materials selection process
• Describe the categories of product design requirements that must be considered for materials selection
• Identify materials selection criteria based on the product design requirements
• Explain how to select potential materials for use in a component or joint
• Identify the evaluations needed to determine whether materials are suitable for an application

Who Should Attend
This course will be beneficial to design engineers (mechanical and electrical) of all levels who select materials to use in products and to program engineers who have to plan product development schedules. This includes engineers within any industry supported by SAE. The information will enable design teams to more quickly assess risks to meeting development schedules and budget and improve the probability of developing products that meet performance, reliability, and cost requirements. The course will also be beneficial to engineering managers, program managers, and manufacturing engineers.

Topical Outline
Session 1
• Materials Selection Process Steps
• Iterative Process and Trade-offs
• Design Hierarchy Between Component Physical Construction and Materials
• Design Requirements Categories
• Identify Product, Sub-assembly, and Component Requirements for the Different Design Requirements Categories
• Identify Component Materials Selection Criteria

Session 2
• Identify Potential Materials
• Risk Management

Session 3
• Identify and Perform Tests to Evaluate the Materials
  • Properties, microstructure, composition, manufacturing defects
  • Performance
  • Reliability
• Ease of use in manufacturing and assembly processes

Session 4
• Determining Whether Materials Satisfy Selection Criteria
• Making the Final Choice

Instructor: Michael Pfeifer
Fee $640 .8 CEUs
Sound Package Materials for Vehicle Noise Control

2 Days
I.D.# 92032

A similar course is available as a live, online Web Seminar - Vehicle Sound Package Materials Web Seminar - see course description below.

The sound package materials for vehicle noise control seminar provides a detail and thorough analysis of three different classes of acoustical materials – namely absorbers, barriers, and dampers, how they are different from each other, and acoustical properties that materials should possess for optimum vehicle noise control. The seminar addresses new advances in acoustical materials, primarily in absorption materials that impact the vehicle acoustics. The seminar covers ways to evaluate the acoustical performance of these materials using different test methods, including material, component, and vehicle level measurements. The two day seminar starts with the fundamentals of NVH and sound quality related to sound package materials and discusses the importance of various noise sources that impact the development of sound package treatments in a vehicle.

Learning Objectives
By attending this seminar, participants will be able to:
• Identify various descriptors that are used in NVH and sound quality while working with sound package materials
• Recognize various noise sources and paths in a vehicle
• Identify three different classes of acoustical materials
• Describe ways that acoustical materials work and how they differ from each other
• Road map for vehicle sound package development
• Distinguish test methods used to evaluate the acoustical performance of material

Who Should Attend
Designed for OEM or supplier employees responsible for various noise activities, such as design, evaluation, trouble-shooting, procuring, supplying, and/or manufacturing noise control treatments and parts, this seminar will also benefit those with responsibilities including the areas of manufacturing, design, engineering, process, noise and release engineering, supervision or management. Attendees should have an undergraduate engineering degree and/or a working knowledge of noise control and automotive acoustics.

Topical Outline
• Fundamentals of NVH and Sound Quality
  • Defining acoustical performance of acoustical parts
  • Definition of terms
  • Human response to sound
  • Various noise and vibration instrumentation
• Vehicles Noise Sources and Solutions
  • The noise system
  • Vehicle noise sources
  • Road and wind noise
  • Miscellaneous noise sources
  • Noise control solution - source, path, receiver
  • Noise control system using sound package materials
• Materials for Vehicle Noise Control
  • Absorber, including case studies and test methods
  • Barrier, including case studies and test methods and the effect of holes
  • Damper, including case studies and test methods
  • Isolator
• Different Automotive Measurements
  • Vehicle
  • Component
  • Material

Vehicle Sound Package Materials Web Seminar and Web Seminar RePlay

8 Hours
Web Seminar I.D.# WB1204
Web Seminar RePlay I.D.# PD331204ON

A similar course is available as a classroom seminar - Sound Package Materials for Vehicle Noise Control - see course description above.

This four-session Web Seminar 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.

Learning Objectives
By connecting with this Web Seminar, participants will be able to:
• Identify various descriptors that are used in acoustics while working with sound package materials
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 Web Seminar 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.

Topical Outline

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 and targets for NVH studies

Instructor: Pranab Saha
Fee $640 .8 CEUs

RELATED TRAINING SOLUTIONS

Some of our courses apply to more than one technology category. Consider these related courses described in other sections of this guide.

Corrosion of Metals – read more about this course on page 84
Corrosion of Metals: Chemistry of Corrosion – read more about this course on page 85
Corrosion of Metals: Galvanic Corrosion – read more about this course on page 85
Corrosion of Metals: Uniform Corrosion – read more about this course on page 86
Hardness Testing – read more about this course on page 87
Metallurgy of Precipitation Hardening – read more about this course on page 88
Metallurgy of Steel Case Hardening – read more about this course on page 88
Metallurgy of Steel Through Hardening – read more about this course on page 89
Metallurgy of Steel: Principles – read more about this course on page 89
Principles of Metallurgy – read more about this course on page 90
Introduction to Composites Fabrication and Assembly in Aerospace, Space, and Transportation – read more about this course on page 86
Aircraft Hydraulic Pumps - Application, Design and Integration

.5 Day
I.D.# C1419

This 4 hour short course offers an overview of aircraft hydraulic pumps focusing on their application in hydraulic systems, design and performance characteristics, and integration issues. These topics will examine the various pump technologies available for aircraft system applications, their design, performance and operational characteristics and limitations, and discuss the challenges and lessons learned in the integration of pumps in hydraulic systems.

Learning Objectives

By attending this seminar, participants will be able to:
• Identify the various pump and pump control technologies used in common hydraulic systems
• Evaluate the design characteristics and limitations inherent in applying the various technologies of pumps in their application in hydraulic systems
• Evaluate the critical aspects of integration of pumps in hydraulic systems, such as controlling air entrainment, heat removal, and back-up strategies
• Evaluate the interfaces between pumps, hydraulic systems and other aircraft systems

Who Should Attend

This seminar is designed for engineers, executives, and other key personnel with some experience in hydraulic pump design or system integration. The former will benefit in understanding the application and integration of pumps, while the latter will benefit in understanding the complexities and limitations of current pump designs.

Topical Outline

• General
  • Hydraulic systems overview
  • Brief history of aircraft hydraulics
  • Hydraulic pump technologies overview
• Application of Hydraulic Pumps
  • Engine Driven Pumps
  • Electric Driven Pumps
  • Others, such as Air Driven and Hydraulic Driven Pumps (PTU’s)
• Design of Hydraulic Pumps
  • Pumping Technologies
    • Fixed / Variable displacement
    • Axial piston inline; Bent axis
  • Critical Design Factors
    • PV factors
    • Dynamic characteristics
    • Inlet conditions
    • Control of pumps
  • Flow / Pressure / Torque performance characteristics
• Integration Challenges and Lessons Learned
  • Starting Issues
  • Air ingestion control
  • Fluid conditioning
  • Heat rejection / Case drain flow
  • Pressure ripple control
• Overview of Industry Specifications and Other Reference Material

Instructor: Peter A. Stricker
Fee $315 .4 CEUs
Aerospace Hydraulic Components

.5 Day
I.D.# C1421

This 4 hour short course will provide an overview of the hydraulic components used on aircraft. There will be a brief overview of hydraulics, aircraft hydraulic systems, and aircraft flight controls. You will learn the function of each component used within the hydraulic system, and then look in depth at each component’s design.

Learning Objectives
By attending this seminar, participants will be able to:

• Explain how a hydraulic system is used in an aircraft
• Identify the various components used in a hydraulic system
• Explain the functions of hydraulic components
• Identify the design styles of hydraulic components
• Explain the strengths and weaknesses of hydraulic components

Topical Outline

• General
  • A History of Hydraulics
  • Hydraulics in Aircraft Systems
• The Aerospace Hydraulic System
  • Principles
  • System Architecture
  • Hydraulic Actuation
  • Hydraulic Issues (Contamination, Air, Cavitation)
• Hydraulic Power Sources
  • Pumps, Accumulators, RAT
  • Theory of Operation
  • Designs
  • Filtration
  • Restrictors
  • Check Valves; Relief Valves
  • One Way Restrictors
  • Pressure Regulating Valves; Thermal Relief Valves; Selector Valves; Solenoid Valves; Shuttle Valves
  • Power Sources (EHA, EBHA)

Instructor: Jeffrey C. Dickey
Fee $295 .4 CEUs

Damage Tolerance for Gas Turbine Engines

2 Days
I.D.# C1323

The simultaneous demands for reliability and minimum weight for aircraft and propulsion systems offer some of the most challenging technical problems that structural and safety engineers can encounter. Although much information is available on fracture mechanics and aircraft damage tolerance, this course specifically relates to damage tolerance for gas turbine engines. The need to consider damage tolerance more broadly in new engine designs has just recently been written into FAR 33.70 and new EASA guidelines. With an increasing need for education, both in the U.S. and internationally, this seminar relates directly to the growing interest and priority the AIA, FAA, and engine OEM’s have placed on turbine engine damage tolerance.

This two-day seminar offers a broad survey of damage tolerance, one of the many principles behind one of the safest industries in the world. Although the basics of fracture mechanics will be covered, this is not an advanced fracture mechanics course. Attendees will be presented information on how experts in the propulsion community use the principles of prevent, quantify, and improve to keep air travel safe. The instructor will guide participants through notable historical events as well as experiences within a leading engine manufacturing company. The basics of fracture mechanics will be covered with a view towards practical application. Traditional deterministic and the newest probabilistic approaches will be introduced. Finally, attendees will be exposed to a broad range of improvements that have been made to address specific threats within the propulsion business.

Learning Objectives
By attending this seminar, participants will be able to:

• Evaluate the sensitivity of structures to different types of damage
• Explain what it means for a design to be “damage tolerant”
• Identify three pronged approach of prevent, quantify, and improve aimed at safety
• Discuss basic principles of fracture mechanics
• Identify steps involved in deterministic and probabilistic approaches

Who Should Attend
This seminar is intended for engineers working in the gas turbine industry. In addition, employees at overhaul shops and individuals involved in product certification will also benefit from the information presented in this seminar.
### Topical Outline

**DAY ONE**
- Introduction to Gas Turbine Engine Components
- Historical Perspectives on Safety
- Safe life approach (FAR 33.14)
- Notable events
- Experiences at Rolls-Royce Corporation
- Safety across the industry
- Containment strategies
- Emerging need for damage tolerance
  - Supplementing Safe Life: FAR 33.70 / EASA CM
  - Modern design considerations
  - Economic considerations
  - Growing fleets
- Anomaly types
  - Surface
  - Sub-surface

**DAY TWO**
- Prevent:
  - Top priority: Stop damage from occurring
- Quantify:
  - Understanding the environment - stress, temperature, and time
  - EIFS concept
  - Deterministic analysis methods
  - Inspection methods
  - Probabilistic methods
- Improve:
  - Manufacturing
  - Handling

### Introduction to Aircraft Hydraulic System Design and Certification

**.5 Day**  
**I.D.# C1205**

This four-hour short course provides an overview of hydraulic system design of recently developed business and commercial aircraft. Topics will include hydraulic principles, system architectures, power sources, and the main components and technologies of hydraulic systems including hydraulic power generation, filtration, fluid storage, distribution, sensing and control. The step by step process of designing a hydraulic system will also be reviewed. Finally, the instructor will guide participants through a discussion of future trends in aerospace hydraulic systems.

#### Learning Objectives

By attending this seminar, participants will be able to:
- Explain the operating principles and design process of an aircraft hydraulic system
- Identify system architectures attributes, including those that affect aircraft safety
- Identify power sources for hydraulic systems and how they operate
- Identify the various components of hydraulic systems
- Describe the hydraulic system design and certification process

#### Who Should Attend

This seminar is designed for engineers, executives, and other key personnel with little or no previous hydraulic system knowledge or experience.

#### Topical Outline

- General Introduction to Aircraft Hydraulic Systems
- Hydraulic System Terminology and Standards
- System Engineering - principles and practices
- Hydraulic System Design and Certification
  - Proposal Phase
  - Preliminary Design Phase
  - Detail Design Phase
  - Aircraft Production Build and Test Phase
  - Flight Test and Certification Phase
- Fluid Conveyance System Design
- Introduction to Hydraulic Fluids
- Market Trends and Future Technologies

### Instructors Wanted...

To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses.

We are seeking expertise in a variety of Aerospace-related topics including: Certification, Regulations, and Standards.

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568

### Instructor:

**Jeffrey Stillinger**

Fee $1370  |  1.3 CEUs

---

### Instructor:

**Jon R. Jeffery**

Fee $315  |  .4 CEUs

---

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529  
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
Liquid Atomization, Sprays, and Fuel Injection

3 Days
I.D. # 98019

Liquid fuel atomization and spray formation is the heart of the majority of stationary and mobile power generation machines that we rely on. This seminar focuses on the process of liquid atomization and spray formation and how it relates to fuel injection systems and emission of pollutants in modern engines. The seminar begins with background coverage of terminology, the purposes of liquid atomization and spray formation, and different designs of atomizers and nozzles employed in various industries. The focus is then directed to gasoline and diesel fuel injections, injector designs, and performance requirements for optimum engine operation with lowest possible emission of harmful pollutants. Based on the idea that knowledge of technical practices and advances in one area (i.e. diesel fuel injection) is beneficial to engineers in other areas (gasoline direct injection, rocket engines), this seminar takes an interdisciplinary approach. Attendees will understand the technology and logic behind different injector designs, and gain the knowledge to judge, adapt and transfer technology advances from one discipline to another.

Learning Objectives

By attending this seminar, participants will be able to:

- Explain important terminology commonly used in atomization and sprays
- Describe important processes in atomization and spray formation
- Articulate the effects of injection system design and operating conditions on engine performance, combustion, and emission of pollutants
- Describe different injector designs and the rationale for the use of each
- Define the role the injection system plays in combustion and emission and how it is used to provide guidance in design of low-emission combustion systems
- Implement appropriate design concepts and logic in the design of critical components such as intake valves and induction systems
- Evaluate future trends and technology developments in fuel injection

Who Should Attend

Automotive and aerospace engineers, technical and project managers, researchers and academicians will benefit by attending this seminar. Automotive engineers working on the design of combustion engine components, reduction of harmful pollutants emissions, software development and application for modeling of thermal-fluid, combustions and emissions and engineers and managers directly involved in fuel injection systems will also benefit. Aerospace engineers involved in the design of gas turbine or rocket engines’ combustion chambers will benefit as well.

Topical Outline

DAY ONE

- Description of the Atomization Process
- Disintegration of the Liquid Jets
  - Rayleigh criterion (no viscosity)
  - Weber’s criterion (effects of viscosity)
  - Ohnesorge criterion for atomization (Ohnesorge Number)
  - Rayleigh, first and second wind-induced breakup and atomization regimes
- Influence of some parameters -- jet velocity profile; nozzle length-to-diameter ratio; ambient pressure
- Disintegration of liquid sheets
- Drop breakup in air flow, turbulent flow, and viscous flow
- Types of Atomizers: Pressure, Air-Assist, Air-Blast, Effervescent, Electrostatic, Ultrasonic, Diesel Injector and Gasoline-Fueled Injectors
- Drop Size Distribution and Measurements
  - Graphical and mathematical representation of drop size distribution
  - Averaged diameter and representative diameters
  - Measurement techniques -- patternation; drop size measurements and spray characterization
- Mechanical methods -- drop collection on slides; molten-wax and frozen-drop approach; cascade impactors; electrical; charged-wire and hot-wire methods; optical methods; imaging - photography and holography; single-particle light scattering (Phase Doppler Particle Analyzer, etc.); diffraction size analyzer
- Drop evaporation

DAY TWO

- Diesel Fuel Spray, Injector and Injection System
  - Fuel injection system -- pumps: in-line injection, distributor-type injection, single-barrel injection, and unit injector & unit pumps; injector designs: nozzle holder, nozzles, others
  - Overall spray structure
  - Liquid fuel atomization
  - Spray angle
  - Intact core length
  - Spray evaporation
  - Ignition delay
  - Mixing-controlled combustion
  - HC emission mechanisms in diesel engines and its relation to fuel injection
  - Soot formation and fuel sprays
  - Advanced topics (details of split injection, common-rail injection, interacting-sprays injection, ultra-high pressure fuel injection, effects on performance and emissions, and others)
DAY THREE
• Gasoline Port Fuel Injectors and Injection System
  • Multipoint port injection system -- classes of gasoline port injectors: low pressure, medium pressure, high pressure, air-assisted, swirl, heated vaporizing, ultrasonic, and electrostatic; key requirements of gasoline port injectors; deposit considerations
  • Single-point throttle body injection system
  • Feedback system
  • Effects of injection parameters on engine performance and emission: injection timing, spray targeting, spray momentum, mean drop size, pulse-to-pulse variability, and others
• Flow of Fuel and Air in Intake Manifolds
• Details of Gasoline Direct Injection (GDI) and its Effects on Engine Performance and Emission of Pollutants
• Fuel-air mixing processes
• Spray Modeling and Demonstration of Computer Software for Spray Calculation in Engines
• Summary and Conclusion

Microbial Contamination in Aviation Fuel and Aircraft Fuel Systems

1 Day
I.D.# C0728

Microbial contamination in aviation fuel creates biomats that clog filters and scavenge systems, coat fuel quality indicator systems (FQIS) probes, and lead to structural corrosion, impacting the operational and economical aspects of turbine powered fixed wing and rotary wing aircraft. From inaccurate fuel level readings to aborted take-offs and air interrupts, microorganisms can wreak havoc on the entire aircraft and the system operations. Attendees will learn how microorganisms enter and survive in the fuel distribution and storage network, and how a routine surveillance program can manage risk and mitigate lost profits. Students will have the opportunity to experience hands-on techniques to detect and remediate contamination in aviation fuel systems.

Learning Objectives
By attending this seminar, participants will be able to:
• Describe the impact of microorganisms on aircraft fuel systems
• Explain how microorganisms survive in an aviation fuel environment
• Determine how microorganisms enter the fuel storage and distribution system
• Detect and remediate microbially contaminated fuel systems
• Improve the overall operational reliability of aircraft and reduce maintenance costs

Who Should Attend
This seminar is appropriate for aircraft fuel systems design engineers, aviation fuel quality managers in manufacturing, storage and distribution facilities, aircraft fuel quality managers, and aircraft maintenance technicians.

Topical Outline
• Microorganisms
  • Brief overview of the operational and economic impact of microorganisms to the aviation industry
  • Regulatory, FAA Flight Standards Information Bulletin for Airworthiness (FSAW) FSAW 05-08A “Air Carrier Implementation of Inspections for Fuel Microbial Contamination”
  • Brief description of microorganisms related to aviation fuel
  • Requirements for microorganisms to survive in a fuel storage system
  • Aircraft fuel system water scavenger maintenance and periodic aircraft fuel tank sump draining
• Aviation Fuel Storage and Distribution
  • Entry and movement of microorganisms throughout the aviation fuel storage and distribution network
  • The Impact of Microorganisms on Aircraft
• Detection of Microorganisms
  • Types of detection equipment and procedures
  • Practicum - test methods and equipment -- Culture test; Immuno assay test; Bioluminescence test
• Remediation of Microorganisms
  • Microbial pesticides approved for use in aviation fuel
  • USEPA regulations governing the sale of microbial pesticides in the U.S.
  • Characteristics of an efficacious microbial pesticide
  • Methods for treating storage and distribution systems
  • Industry practice for introducing a microbial pesticide into aircraft
• Surveillance Program
  • Benefits of a routine surveillance program
  • Developing a surveillance program

Instructor: Ed English and Howard Chesneau
Fee $810 .7 CEUs
Seals and Sealing System Design of Actuation Systems in Military and Commercial Aircraft

1 Day
I.D.# C1212

These seminars present an overview of seals and sealing system design for military and commercial aircraft. It is aimed to provide engineers having some previous actuator and control valve design background with an understanding of the general hardware groove standards, standard parts for static applications and how seal designs and sealing systems can be best used in dynamic reciprocating and rotary applications. Information will be provided regarding seal material and fluid compatibility, friction drag, expected wear rates depending on operating conditions and duty cycle, hardware surface finish and topography. Also included will be information on seal installation procedures and potential pitfalls to avoid.

Learning Objectives

By attending this seminar, participants will be able to:
- Identify the standards relevant to seals and seal systems
- Summarize key characteristics of dynamic reciprocating applications
- Summarize key characteristics of rotary applications
- Evaluate seal material characteristics and proper applications

Who Should Attend

This seminar is designed for engineers and other key personnel with some actuator and control valve design knowledge.

Topical Outline

- First O-Ring Patent
  - 1932-Niels A. Christensen
- Parker: Development of Range of Sizes
  - Tables
- AS568
  - Range of sizes
  - Cross sections
  - Tolerances to Class 2- Tables
- History and Application of Aerospace Gland Dimensional Standards for Seals and Scrapers
- MIL-P-5514 Revs A and B
- MIL-P-5514 Revs C, D, and E
- MIL-G-5514 Rev F
- AS4716, AS5857, MS33675, AS4088, AS4052
- History of Backup Ring Standards
  - MIL-R-8791, MS28774, MS27595, MS28782, MS28783
  - AS8791, AS5781, AS5782, AS5860, AS5861
- EPDM History and Applications
  - NAS1613, NAS1611, NAS1612, AECMA specs
  - prEN 6111, prEN 6075, prEN6076
- Elastomer Materials and Applications
  - In red oils; In fuels; In turbine oils
  - Properties
- Storage of Elastomers
  - ARP5316
- Plastic Materials and Applications
  - AMS3678 and slash sheets
  - Effects of fillers on PTFE materials
- High Modulus Plastics
  - PEEK; PEKEKK
  - Carbon fiber composites
  - Properties and uses
- Reciprocating Seals for AS4716 grooves
- Piston Seals
  - Bi-directional – to fit std. and non-std grooves - examples
  - Uni-directional – to fit std. and non-std grooves - examples
- Rod Seals
  - Bi-directional – to fit std. and non-std grooves - examples
  - Uni-Directional – to fit std. and non-std grooves - examples
- Scrapers for MS33675, AS4088, and AS4052
- Reciprocating Sealing Systems
  - Tandem and tertiary sealing systems with scrapers
- Face Seals
  - Types for internal and external pressure
- Seal Design Notes: An Appreciation
  - Low/High temperature considerations
  - Friction calculations: C of F for PTFE compounds
  - Friction calculations: Elastomers
  - Consideration of elastomer shear strength
  - Consideration of elastomer tensile strength
  - Consideration of elastomer elongation percentage
- Thermal cycling: Reciprocating PTFE seal components
- Rotary shaft seals
  - Metal can types: Elastomeric lip(s)
  - Metal can types: PTFE lip(s)
  - Flanged spring energized seals: Thermal cycling
- Hardware Surfaces, Coatings, and Roughness Finishes
  - Dynamic
  - Static
- Installation Tools and Procedures
- Hardware Design Tips: Avoiding Installation and Performance Catastrophes
- Pump/Motor Function Applications

Instructor: Alan Schofield
Fee $810 .7 CEUs
SAFETY AND QUALITY

Aircraft Cabin Safety and Interior Crashworthiness

2 Days
I.D.# C0926

The certification of transport category cabin interiors requires a thorough understanding of Part 25 Transport Category aircraft cabin interior safety and crashworthiness regulations and compliance requirements. Regardless of whether it is a simple modification, a specialized completion (VIP or VVIP) or airline passenger configuration, engineers, designers, and airworthiness personnel must understand and adhere to these requirements.

This two day seminar will begin with a discussion of Commercial off the Shelf (COTS) test requirements. The instructor will then guide participants through the various cabin interior emergency provisions and their requirements such as supplemental passenger oxygen, emergency equipment, seats, flammability, emergency exits, emergency lighting and escape path markings, and various other cabin interior systems. Additionally, DO-160 environmental, cooling and ventilation requirements will be discussed to provide participants a comprehensive introduction to cabin interior safety and crashworthiness requirements as specified in the CFR Part 25 Airworthiness Standards.

Learning Objectives

By attending this seminar, participants will be able to:
• Identify key strategies to managing certification programs effectively
• Recognize cabin safety and design problems in a timely manner so they may be addressed in advance
• Communicate intelligently on the requirements and effectively negotiate with others involved in FAA certification programs
• Interpret and identify the reasoning behind cabin safety rules and regulations
• Demonstrate an understanding of cabin safety and crashworthiness regulations
• Examine and evaluate current cabin safety issues and their solutions through open discussions between instructor and attendees

Who Should Attend

This course is designed for engineering and certification managers, design engineers, airworthiness and certification engineers, program managers, consultants, Federal Aviation Administration designated engineering representatives (DER) interested in gaining interior arrangement authorization added to their delegated functions and authorized areas, and other technical and administrative personnel involved in FAA certification activities.

Topical Outline

DAY ONE
• Introduction to Part 25 Airworthiness Standards Requirements
• Commercial Off The Shelf equipment (COTS) and Super COTS
• Galleys
  • Electrical disconnects
  • Water shut-offs
  • Latches
• Passenger Oxygen and Oxygen Masks
  • Reach (5th percentile female)
  • Quantity and duration requirements
• Emergency Equipment
  • Ditching requirements -- Life rafts; Life vests; Survival kits
  • First aid kits
  • Defibrillators
  • Fire extinguishers
  • Smoke detectors

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
SAFETY AND QUALITY

- Access
- Placards
- Seats
  - Dynamic (C127a)
  - Static (C39b)
  - Divans
  - Seat belts and shoulder harness
  - Head strike
  - Oxygen mask requirements
  - Recline and rotations at exit rows
  - Exit access
  - Foot/leg rests
- Beds
- Latches and Secondary Latches
- Placards
  - Visibility; Contrast; Size; Locations
- Flammability
  - Bunsen Burner flammability tests and materials
  - Fire blocking on seat and back cushions and markings
  - Fire containment -- COTS; Lavatory and galley waste containers
  - Smoking and ash trays
- Smoke Detection and Penetration for Cabin Accessible Baggage Compartments

DAY TWO
- Emergency Exit Types and Requirements
  - Floor level
  - Window
  - Flight deck
- Exit Signs and Requirements
  - Size -- Equivalent safety
  - Visibility
  - Types and requirements -- Bulkhead; Locator; Marker
- Aisle Clearance Requirements
  - Cabin main aisles -- Cross aisles
- Exit Passageways
- Emergency Lighting Systems
  - Luminosity tests -- Cabin color contrast
  - Fuselage transverse separation
  - Emergency Escape Path Markings (EEPM) -- Luminous; Incandescent; Visibility; Seat baggage bars
- Crew Areas
  - Crew assist space
  - Crew assist handle
  - Crew visibility
  - Crew rest area
  - Oxygen
  - Communication
- Flight Deck Door
- Cabin Doors and Curtain Dividers

- Ordinance Signs
  - Visibility
  - Legibility
- Cross Aisle Visibility
- Passenger Address (PA) System
- Cabin Hand Sets and Egress Issues
  - Constant retention cord reels
  - Ratcheting
- EMI/RFI Tests
- DO-160 Environmental, Cooling and Ventilation Requirements
- Lithium Ion batteries
- Water systems

Instructor: Ken Farsi
Fee $1370 1.3 CEUs


4 Hours
Web Seminar: I.D.# WB1617
Web Seminar Replay: I.D.# PD331617ON

In a global economy, aviation, space and defense organizations are presented the challenge of producing and delivering safe and reliable products across a wide range of customer requirements and expectations. In an effort to address diverse quality requirements and expectations while also reducing costs throughout the supply chain, the SAE AS9100 family of standards was developed by international aerospace industry representatives to standardize international aerospace quality management system requirements.

This live online course will provide insights into the SAE AS9100D:2016 and ISO 9001:2015 significant changes as they adopt the common management system structure. It will include material on the standard’s development process including timelines, new Common Management System Structure, AS9100D:2016 and ISO 9001:2015 Requirement Review and reference material for gap analysis and successful implementation.

Learning Objectives

By participating in this web seminar, participants will be able to:
  - Recognize the impact to new Quality Management Principles on the revision to the standards
  - De-mystify the new 10-clause Common Management System structure and understand the impact on your organization
  - Grasp the new language like organization and its context, interested parties, documented information, and risk-based
SAFETY AND QUALITY

thinking
• Realize the Aviation, Space & Defense proposed additions to understand benefits
• Gain an understanding of the SAE AS9100D:2016 and ISO 9001:2015 requirements and intent
• Define the timeline for AS9100D:2016 transition period

Who Should Attend
The course is designed for quality managers, management representatives, auditors, engineers, supply chain managers and other professionals. AQMS Implementers will comprehend SAE AS9100D:2016 requirements for application at your organization. AQMS Internal Consultants will understand the intent to apply value-added implementation of the requirement. AQMS Auditors will comprehend requirements to confidently audit requirements at your organization. AQMS Executives and Management Representatives will better understand how to use AS9100D:2016 requirements to drive cost savings improvement. Individuals wanting an improved AQMS process understanding to integrate AS9100D:2016 requirements into company processes will also benefit.

Topical Outline
• Standards Development Process
• New Common Management System Structure and Language
• ISO 9001:2015 and AS9100D:2016 New Requirements
  • Introduction of additions to the standard
  • Impact of new AS9100D and ISO 9001:2015 requirements to your business
  • Context of the Organization
  • Leadership
  • Planning
  • Support
  • Operation
  • Performance Evaluation
  • Improvement
• Summary
  • Techniques to ensure the QMS is effective in meeting customer expectations
  • Reference resources for gap analysis and successful implementation

Instructor: L.L. ‘Buddy’ Cressionnie
Fee $425 .4 CEUs

Common Training for DPRV Personnel
(Formerly: Aerospace Supplier Quality: Common Training for Self-Release Delegates)

3 Days
I.D.# C1501

In the aerospace industry, delegated product release is a process whereby a supplier has been provided the authority to act on behalf of a delegating organization to verify and release products without additional oversight from that delegating organization. Currently, each of these delegating organizations manages and conducts a unique training program for individuals responsible for their product release overcheck process. For suppliers producing products for multiple delegating organizations, each must then manage the multiple training requirements. The delegating organizations, recognizing there is commonality among the various training programs, have come together to consolidate their training into a single, common training standard.

This three-day course will provide product release delegates with a comprehensive and standardized set of requirements for the self-release process. This course is designed to cover the key elements of the process along with a detailed explanation of product-release overcheck activities. Beginning with the role and responsibility of the product release delegate and its importance to flight safety, the instructors will guide participants through the various product release activities including a review of documentation, visual inspection, dimensional overcheck, part marking and serialization, and release documentation requirements. In addition to attending and participating in the full three days, attendees must take and pass a comprehensive learning assessment to successfully complete this course.

When the AS13001: Common Training for DPRV Personnel standard is imposed from a delegating organization as a requirement, this foundations course is recognized as satisfying the respective customer training requirement for initial self-release delegate qualification. Upon successful completion of this course and while the qualification remains valid, a product release delegate’s personal qualification is recognized by all participating delegating organizations and is transferable between supplier organizations. The initial qualification is valid for a duration of three years, at which time the individual must then complete the necessary recertification training in order to maintain the qualification. This course also aligns with the requirements of the AS9117: Delegated Product Release Verification standard.

In addition to this delegated product release foundations course, delegating organizations may also require the completion of

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
SAFETY AND QUALITY

customer process and/or part specific training prior to beginning self-release activities.

Learning Objectives
By attending this seminar, participants will be able to identify and explain:
• The role of the product release delegate
• Legal, ethics, and code of conduct
• Applicable airworthiness regulations and standards
• History of quality in the aerospace industry
• Human Factors and the importance of effective communication
• Customer requirements, flowdown, and compliance with material definition
• Key characteristics
• First article inspection reporting
• Dimensional over-inspection
• Visual inspection
• Part marking and serialization
• Nonconformance control and concession
• Subtier control
• Counterfeit, suspect, and unapproved parts awareness
• Packaging, labeling, preservation, handling, and storage
• Required documentation

Who Should Attend
This credentialing course is intended, as stated in AS13001, to meet the initial training requirements for designated personnel within aerospace supplier organizations that have been identified and approved as operating a product release process as a delegated activity. This course also meets the training requirement of the AS9117: Delegated Product Release Verification standard.

Topical Outline
DAY ONE
• Role of the Product-Release Delegate
  • Duties
  • Responsibilities
• Airworthiness Regulations and Standards
  • Industry oversight
  • Self-release oversight
  • Quality standards
  • Government source inspection
• Legal, Ethics, and Code of Conduct
  • Industry expectations
  • Legal obligations
  • Ethical behavior
  • Code of Conduct
• Human Factors and the Importance of Effective Communication
  • Human factors concepts
  • Internal and external factors
  • Communication
• Delegate’s role
• Quality History
  • Importance of supplier quality
• Aerospace Products
  • Our Industry: We make more than just engines
  • Aircraft engine technology
• Flight Safety
  • Defining flight safety
  • Delegate’s role
  • Potential impact
• Key Characteristics
  • Definition
  • Identifying key characteristics and how they originate
  • Key characteristics and your responsibilities
  • Relationship between key characteristics and critical items
• Customer Requirements, Flowdown, and Compliance with Material Definition
  • Definition of customer requirements and where they originate
  • Types of customer requirements
  • Tracking and implementation of requirements
  • Definition of flowdown, where they originate, and expectations
  • Flowdown activities and potential risk
  • Definition of compliance with material definition
  • Importance of materials compliance management

DAY TWO
• Subtier Control
  • Activities related to flowdown of sub-tier control at every level
  • Approved sources
  • “Certs” and common requirements
  • Receiving inspection
• Review Router/Traveler, OPS Complete
  • Purpose and requirements of Review Router / Traveler
  • Relationship to traceability
  • Scope of OPS Complete and requirements
  • Certificates of Conformance
• First Article Inspection Reporting
  • Definition and when it is required
  • Applicability
  • Core components of FAIR activity
  • Delegate’s responsibilities
• Dimensional Over-Inspection
  • Definition of dimensional over-inspection
  • Independence of inspection
  • Customer specific requirements
  • Key activities of measurement systems analysis
  • Additional safety related requirements
  • Critical features
  • Hidden characteristics
  • Sampling requirements
• Visual Inspection
SAFETY AND QUALITY

- Visual inspection best practices
- Inspection techniques
- Influence of environmental factors
- Foreign object debris/damage (FOD)
- Visual compliance verification
- Workmanship examples
- Suspect, Unapproved, and Counterfeit Parts Awareness
  - Terms and definitions in counterfeit parts risk mitigation
  - Proliferation of counterfeit/fraudulent parts
  - Supply chain
- Nonconformance Control and Concession
  - Definition of nonconformance
  - Responding to unplanned nonconformances
  - Waivers and deviations
  - Required documentation
  - Escaped product disposition
- Packaging, Labeling, Preservation, Handling, and Storage
  - Applicable regulations and standards
  - Packaging and labeling best practices
  - Product preservation
  - Product handling, storage, and accepted practices
  - Documentation requirements
- Learning Assessment

*The order in which the topics are presented is subject to change.

<table>
<thead>
<tr>
<th>Instructor:</th>
<th>Contact SAE Corporate Learning Solutions for Information on Instructors for this course.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fee</td>
<td>$1095 2.0 CEUs</td>
</tr>
</tbody>
</table>

AS9100D Internal Auditor Training

3 Days
I.D.# C1634

Internal audits (a requirement of the AS9100 Rev D Standard) are intended to verify the compliance and effectiveness of the organization’s quality management system. Internal auditors must be knowledgeable of these requirements and the expectations as identified in the standard. In addition, the audit requirements outlined in the AS9101 Standard have significantly changed the way auditors are expected to conduct audits in the aviation, space and defense industries.

This three-day internal auditor training program is designed to provide potential and existing internal auditors with the knowledge necessary to understand and successfully audit an organization against AS9100 Rev. D: Quality Management Systems - Requirements for Aviation, Space and Defense Organizations. Additionally, attendees will participate in a detailed examination of the requirements of AS9101 Rev E: Quality Management Systems Audit Requirements for Aviation, Space, and Defense Organizations. An overview of the Standards will also be provided to identify the effect this standard has on the way internal audits should be conducted. Case studies and classroom exercises will be presented in this class to provide participants the comprehensive knowledge and practical skills necessary to be an effective internal auditor.

Learning Objectives

By attending this training program, participants will be able to:
- Summarize the impact ISO 9000:2015 has on the application of other Standards
- Identify and explain the requirements of AS9100 Rev D including process approach, project planning, risk management, configuration management, and work transfer
- Identify and explain the key requirements of AS9101 Rev E Auditing a QMS
- Identify the basic elements of a quality management system
- Identify the tools and techniques necessary for carrying out an effective audit
- Demonstrate the knowledge and skills required to independently perform a quality management system audit
- Document the outcomes of an audit

Who Should Attend

This training program is designed for quality professionals in the aviation, space and defense industries who are involved in the internal audit program and/or management of quality systems seeking compliance to the AS9100D and AS9101E Standards.
SAFETY AND QUALITY

Topical Outline

DAY ONE
• Agenda and Introductions
• Introduction to the Basics of Quality Management Systems
• ISO-9000 Terms and Vocabulary Overview
  • Terms and Definitions
• AS9100 Rev D Overview
  • Quality Management System with emphasis on the process approach
  • Management responsibility with emphasis on customer focus
  • Resource management
  • Product realization, with emphasis on project, risk, and configuration management, and work transfer
  • Measurement, analysis and improvement

DAY TWO
• AS9101 Rev D Overview
  • Quality Management System with emphasis on the process approach
  • Management responsibility with emphasis on customer focus
  • Understanding the new aviation, space & defense 3rd party auditing focus
  • Use of AS9101E audit forms
• Auditing
  • Overview of the audit life cycle
  • Audit tools & techniques
  • Preparing to conduct an audit
  • Conducting QMS audits
  • Writing effective audit documentation

DAY THREE
• Case Studies and Classroom Exercises
  • Overview of the audit life cycle
  • Preparing to conduct an audit
  • Conducting an audit (simulated)
  • Reporting on the outcome of an audit

Instructor: Paul J. Kunder, Phil Klukas, or George Ringger

Fee $2030 2.0 CEUs

Introduction to Advanced Product Quality Planning (APQP)

1 HOUR
I.D.# PD530908ON

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, Introduction to Advanced Product Quality Planning provides 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.

While the course module is approximately one hour in length, the estimated time to completion, including knowledge checks and the learning assessment, is one hour, 30 minutes.

Learning Objectives
By connecting with this course, participants will be able to:
• Explain what APQP is, including its purpose and the goals 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 can be integrated into an organization’s business management system
• Describe the contents of a ‘Master Plan’ for new product introduction, which includes an outline of the inputs and outputs of the various phases of the APQP process
• Explain how APQP leads to continual improvement for the organization and for customer satisfaction

Major topics include:
• What is APQP
• Purpose of APQP
• APQP Integration
SAFETY AND QUALITY

- Developing a Master Plan for New Products
- APQP Benefits

Is this on demand course for you?
The Weibull Solution Methods course is designed for technical personnel and engineers who want to discover the best toolset for continuous improvement at their organization or business. The course will benefit those in any industry including automotive, aerospace, electrical/electronic, transportation, design, manufacturing, test planning, warranty, reliability, quality, liability, value engineering, and management, among others. This course is appropriate for anyone who needs an awareness of Weibull’s basic premises and benefits as well as those who need this foundational knowledge as a prerequisite for additional training toward becoming an expert Weibull practitioner.

What You Will Receive
- 90 days of online single-user access (from date of purchase) to one hour presentation
- A printable summary of the key takeaways from each lesson
- Integrated knowledge checks to reinforce key concepts
- Instructor follow-up to your content questions
- 0.1 CEUs/Certificate of Achievement (with satisfactory learning assessment score)

Instructor: Larry E. Bissell
Fee $90 .1 CEUs

Introduction to Weibull Solution Methods
75 Minutes
I.D.# PD530946ON

Weibull Analysis 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 modeling and predicting variability and failure of designs, products, and systems. Instructor Wes Fulton will provide a solid overview of Weibull Solution Methods including an explanation of 16 additional Weibull Analysis capabilities, or Weibull Extensions. This introductory short course should be considered a prerequisite for participation in a Weibull project or for attending additional SAE training that covers advanced Weibull applications.

While the course module is just over 75 minutes in length, the estimated time to completion, including exercises, job aids and the learning assessment is two hours. If a more comprehensive course is needed, consider Weibull-Log Normal Workshop; see course description on page 112.

Learning Objectives
By connecting with this course, participants will be able to:
- Determine whether or not the available data is appropriate for a Weibull solution
- Discuss the background and explain the benefits of Weibull solution methods
- Create, interpret and evaluate the correctness of a Weibull plot
- Distinguish between an infant mortality failure issue and a wearout failure issue
- Forecast events under different maintenance strategies
- Determine pass/fail criteria in designing a test program
- Explain 16 additional Weibull analysis capabilities, called Weibull Extensions and locate additional resources

Major topics include:
- Introduction and Background
- Basic Plotting
- Basic Interpreting
- Case Studies
- Variations
- Extensions and Summary

Instructors Wanted...
To shape the future of mobility engineering. SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses.

We are seeking expertise in a variety of Aerospace-related topics including: Certification, Regulations, and Standards.

Contact SAE International Professional Development to explore how you can help to shape the future of industry.
Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529 • Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
SAFETY AND QUALITY

bility, value engineering, and management, among others. This course is appropriate for anyone who needs an awareness of Weibull’s basic premises and benefits as well as those who need this foundational knowledge as a prerequisite for additional training toward becoming an expert Weibull practitioner.

What You Will Receive
• 90 days of online single-user access (from date of purchase)
• to the 75 minute presentation
• Integrated knowledge checks to reinforce key concepts
• Online learning assessment (submit to SAE)
• A job aid for practical application of the topics covered
• Instructor follow up to your content questions
• .2 CEUs/Certificate of Achievement (with satisfactory learning assessment)

Instructor: Wes Fulton
Fee $160

Principles of ISO 9001, ISO/TS 16949 and AS9100
35 Minutes
I.D.# PD530824ON

Understanding the purpose and intended use of standards, directives and requirements sets the foundation for developing a functional management system. This 35-minute, online short course is intended to present ISO 9001, ISO/TS 16949 and AS9100 as purpose driven management systems that are necessary for companies to survive in our fast-moving economy.

The Principles of ISO 9001, ISO/TS 16949, and AS9100 on demand course provides those in the automotive and aerospace industries with a high-level overview of these quality management system standards. It is designed to explore the history that lead to the development of the standards. The course also highlights the need for organizations to determine the necessary competence for personnel performing work affecting product quality, provide training or take other actions to satisfy these needs, evaluate the effectiveness of the actions taken, to ensure that personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and maintain appropriate records of education, training, skills and experience.

Learning Objectives
By connecting to this on demand course, participants will be able to:

• Recognize the need for international, imposed quality management systems and standards
• Describe the history leading up to the ISO 9001
• Explain why the Automotive and Aerospace industries need specific supplements to the ISO 9001
• Identify key elements of a quality management system incorporated in the quality management standards, including configuration management and continuous improvement
• Describe the Plan, Do, Check, Act process and summarize how it can be applied to all processes to increase production and reduce waste
• Define key terms used with the quality standards and summarize key elements included in sections 1-10 of ISO 9001:2015

Major topics include:
• The Cost of Poor Quality
• History and Development of the ISO 9001, ISO/TS 16949 and AS9100
• Quality Management System Principles and the Process Approach
• Terms and Definitions
• Overview of the Sections in ISO 9001:2015

Is this on demand course for you?
In all three standards, paragraph 6.2.2 states the need for competence, awareness and training. Management and personnel in all departments from sales and marketing to engineering, purchasing, production, customer service, receiving, packaging, storage, shipping, and beyond will benefit from the purpose driven management systems that are necessary to deliver customer satisfaction and survive in the global economy.

What You Will Receive
• 90 days of online single-user access (from date of purchase) to the 35 minute presentation
• Printable summary of the key takeways from each lesson
• Integrated knowledge checks to reinforce key concepts
• Instructor follow up to your content questions
• Proof of Participation (Transcript)

Instructor: Joseph Sorrentino
Fee $60
Understanding and Supporting Aircraft Accident Investigation and Reconstruction

2 Days  
I.D.# C1143

Aircraft accident and incident investigations should be supported by all engineering disciplines and departments involved with design, manufacturing, certification, and field operations. For individuals called upon to serve as advisors or technical representatives to official aircraft accident investigation (AAI) teams, an understanding of aircraft accident investigation and reconstruction methodology and processes is critical to success in this supportive role.

This two-day seminar will begin with the basic requirements for conducting proper accident investigations, including investigative philosophies and procedures. The instructor will then guide participants through various data gathering methods and cover several specific types of accident investigations including those related to human factors, crashworthiness, in-flight breakups, and mid-air collisions. Presentations are based on actual accidents and real-life investigation experiences and accident investigation case studies are integrated throughout the course to provide participants the knowledge required to effectively support aircraft accident investigation and reconstruction.

Learning Objectives

By attending this seminar, participants will be able to:

• Identify the key requirements and steps in the AAI process.
• Identify and evaluate analytical procedures used in an AAI.
• Identify and analyze potential complications that arise during an AAI.
• Construct and contribute analysis in support of an AAI.

Who Should Attend

This course will benefit individuals seeking a fundamental understanding of the aircraft accident investigation and reconstruction process, particularly engineers within the aerospace industries that may be called upon to serve in a supportive role as a technical advisor to an official aircraft accident investigation team.

Topical Outline

DAY ONE

• Introduction
• Investigative Attitudes and Behaviors
• Approach to an Investigation
  • Simple vs complex
  • Collecting evidence
  • Reconstructing evidence
• Basic Analytical Procedures

DAY TWO

• Witness Interviews
• Photo Documentation
• In-Flight Breakups
  • Sequence
  • Radar data
  • Trajectory analysis
  • Flutter
• Crashworthiness and Survivability
  • Design aspects
  • Implementation
  • Impact analysis
• Mid-Air Collisions
  • Operational/environmental aspects
  • Wreckage evaluation
• Nine-Box Matrix Exercise
• Wreckage Reconstruction Exercise

Note: Accident investigation case studies are integrated throughout the course.

Instructor: Donald F. Knutson
Fee $1370 1.3 CEUs

Understanding the FAA Parts Manufacturer Approval Process

2 Days  
I.D.# C1324

The requirements for producing an FAA approved replacement part can be daunting. Understanding the steps required in the FAA Parts Manufacturer Approval (PMA) process can greatly streamline the approval life-cycle and reduce unnecessary costs and delays, thereby shortening the time and cost to market. This course is designed for those organizations and individuals interested in designing and manufacturing replacement parts for civil aviation aircraft.
SAFETY AND QUALITY

This two-day course covers the crucial subjects and steps of the FAA-PMA approval process. The instructor will begin with an overview of the Federal Aviation Administration (FAA) organizational structure. The instructor will then guide participants through the roles and responsibilities of the PMA applicant, Aircraft Certification Office (ACO), Manufacturing Inspection District Office (MIDO), Flight Standards District Office (FSDO), and the Aircraft Evaluation Group (AEG) as outlined in FAA policies, guidelines, and requirements leading to FAA-PMA approvals. In addition, the instructor will present the necessary topics to be covered in all PMA engineering analyses including Approval by Identicality, Licensing Agreement, and Test and Computation. Throughout this course the instructor will combine classroom lecture with real-world examples to provide participants both a formal as well as practical learning experience.

Learning Objectives

By attending this seminar, participants will be able to:
• Understand the PMA process throughout the product life-cycle
• Recognize the roles and responsibilities of the PMA applicant
• Identify the roles and responsibilities of the FAA and FAA Designees
• Manage the PMA approval process with respect to schedules and time-lines
• Identify the required content for an acceptable Engineering Design Analysis

Who Should Attend

This course is designed for engineering and manufacturing managers, design engineers, airworthiness and certification engineers, quality assurance inspectors and engineers, program managers, consultants, Federal Aviation Administration designated engineering and airworthiness representatives (DER and DAR) and other technical administrative personnel involved in FAA-PMA certification activities. The course will help both newcomers to civil aircraft parts certification as well as experienced attendees better understand the PMA certification process.

Topical Outline

DAY ONE
• Introductions
• The purpose of this Course
• The FAA / Design & Production Approvals
• The Purpose for FAA-PMA
  • Who Needs a PMA?
  • What are the Exceptions to PMA?
  • Fabrication Inspection System
  • PMA and Older Products
  • The Roles of the FAA and Applicant
  • Project Specific Certification Plans (PSCP)
• What to Expect From Applicants
  • Who Gets Application Letter?
  • Content of Application Letter
  • Basis for Design Approval
  • Draft PMA Supplements
  • Applicant’s Data Package
  • Special Requirements for Test and Computation Applications
  • Identicality by Other Than Licensing Agreement
  • Part Marking Requirements
  • Use of Designees
  • Establishment of the Fabrication Inspection System (FIS)
  • Responsibilities of PMA Holders After Approval
  • Deviations

DAY TWO
• Aircraft Certification Office (ACO) Responsibilities
  • General Responsibilities
  • Applicant Approaches
  • Review of Applicant’s Abilities
  • Coordination with Certificate Management ACO (CMACO)
  • Verification of Installation Eligibility
  • Service History Considerations
  • Life-Limited Parts
  • Special Considerations—Identicality Without a License Agreement
  • Special Considerations—Test and Computation
  • Evaluating the Drawing Package
  • Conformity Inspections
  • Design Approval
  • Revising the PMA Supplement
  • Non-Compliance
• Manufacturing Inspection District Office (MIDO) Responsibilities
  • PMA Activities
  • Designated Engineering Representatives (DER) and Organization
  • Designation Authorization (ODA)
  • DER Roles in the PMA Process
  • Test and Computation
  • Identicality Provisions
  • Findings of Identicality
  • ODA Role in PMA
• Engineering Analysis Tools
• Material Analysis Tools

Instructor: George J. Ringger

Fee $1370 1.3 CEUs
SAFETY AND QUALITY

Weibull-Log Normal Analysis Workshop

3 Days
I.D.# 86034

RMS (Reliability-Maintainability-Safety-Supportability) engineering is emerging as the newest discipline in product development due to new credible, accurate, quantitative methods. Weibull Analysis is foremost among these new tools. New and advanced Weibull techniques are a significant improvement over the original Weibull approach. This workshop, originally developed by Dr. Bob Abernethy, presents special methods developed for these data problems, such as Weibayes, with actual case studies in addition to the latest techniques in SuperSMITH® Weibull for risk forecasts with renewal and optimal component replacement. Class work is used to reinforce key concepts, lectures are based on actual case studies, and personal computers and hands-on experiments are used to analyze dozens of Weibull & Log Normal problems. Students will be fully capable of performing basic and advanced RMS Engineering analysis with their own software on completion of the workshop.


Optional Weibull Introduction—to accelerate your learning in this Workshop, you may want to complete the SAE on demand course, Introduction to Weibull Solution Methods (I.D.# PD530946ON). This highly recommended overview of Weibull engineering can improve your retention prior to taking the workshop or provide a great review afterwards.

Learning Objectives
By attending this seminar, participants will be able to:
• Analyze design, development, production, and service failures
• Model product lifetime and reliability
• Evaluate calibration and maintainability plans
• Analyze inspection data
• Reduce test substantiation, time and costs

Who Should Attend
An engineering undergraduate degree in any discipline would be beneficial. Engineers responsible for reliability, safety, supportability, maintainability, materials, warranties, life cycle cost, design, structures, instrumentation and logistics will find these Weibull techniques extremely useful.

Topical Outline
DAY ONE - Undergraduate Weibull Analysis
• Background, Development & Introduction - 23-Minute Video Short Course
• How to do Weibull Analysis
• Interpretation of Good Weibulls - 2 & 3 Parameter
• Are two Weibull datasets significantly different?
• Interpretation of Bad Weibulls
• Risk and Failure Forecasting Case Studies
• Weibull Experiments (Wire Rupture, Torsion, LCF, Accelerated Testing), Classwork Problems and Solutions
• Log Normal Analysis
• Optimal Replacement Intervals, Block Replacement

DAY TWO - Postgraduate Weibull Analysis
• Maximum Likelihood Weibull Theory and Application
• Weibayes Analysis
• Dauser Shift, Warranty Analysis
• Rank Regression vs. Maximum Likelihood
• Extremely Small Samples Analysis
• One Failure Weibull Case Study
• An Introduction to SuperSMITH® Software, Features, Input, Analysis, Output
• Summary of Weibull Methods
• Class Work Problems
• Experimental Wire Data Distribution Analysis
• Playtime With SuperSMITH® Tutorial

DAY THREE - Confidence Intervals and System Models
• Confidence Intervals, “The Good, The Bad and The Complicated”
• Comparing Designs
• The Binomial & Poisson
• Crow-AMSAA Reliability Growth Modeling - Useful Technology for Tracking Development Testing and Any Significant Event to be Managed
• The Exponential Related to the Poisson and the Weibull
• Kaplan-Meier Survival Analysis
• Crow-AMSAA Employed for Analyzing Renewal-Reparable Systems
• System Models
• Classwork
• Complete Playtime With SuperSMITH®
• Ph.D. Oral Examination

Instructor: Wes Fulton
Fee $2275 2.0 CEUs

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529 • Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
Good Laboratory Practices (GLP) Training – CALISO On Demand 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.

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.

Fee: $185.95 0.8 CEU

ISO 9001 Overview – CALISO On Demand Course

4 Hours
I.D.# ISO9001OVERVIEW

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. 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.

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.

Fee: $159.95 0.4 CEUs
ISO 9001:2008 Training – CALISO
On Demand Course

8 Hours
I.D.# ISO9001TRAINING

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.

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.

Fee: $229.95 0.8 CEUs

ISO 9001:2008 Auditor Training – CALISO
On Demand Course

8 Hours
I.D.# ISO9001AUDITOR

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 eight-hour (.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.

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.

Fee: $229.95 0.8 CEUs
SAFETY AND QUALITY

ISO 9001:2008 Lead Auditor – CALISO
On Demand Course

22 Hours
I.D.# ISO9001LEADAUDITOR

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.

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

Fee: $355.95 2.2 CEUs

ISO 9001 Business Strategy – CALISO
On Demand 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 knowledgeably 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.
SAFETY AND QUALITY

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.

ISO 9001:2015 Overview – CALISO
On Demand Course

4 Hours
I.D.# ISO-9001-2015-OVERVIEW

ISO 9001:2015 is a quality management standard developed by the International Organization for Standardization (ISO). The ISO 9001:2015 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 9001:2015 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.

**Major topics include:**
- Process Approach
- Risk-based Thinking
- General Requirements of ISO 9001:2015
- Context of the organization
- Leadership
- Planning
- Support
- Performance Evaluation
- Improvement

This SAE/CALISO course is for you if you:
- Want to quickly and efficiently get a comprehensive overview of ISO 9001:2015
- Want to improve your CV and career opportunities with qualifications in ISO 9001
- Want to upgrade your expertise from auditing ISO 9001:2008 to ISO 9001:2015
- Do NOT have time to allocate a full day to take an ISO 9001:2015 overview 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 at certain stages of the course delivery, and on-going quizzes are incorporated throughout the course to reinforce learning and retention and gauge your understanding of a topic before you move forward. Convenient and portable, this course provides instruction without the expense of travel and time away from the workplace. 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, or in a final exam provided for trainees with a score inferior of 70%. You can take this course using a laptop or PC with an internet connection, at your own pace, and at times convenient to you.

Fee: $219.95 1.2 CEUs

ISO 9001:2015 Training – CALISO
On Demand Course

10 Hours
I.D.# ISO-9001-2015-TRAINING

ISO 9001:2015 is a quality management standard developed by the International Organization for Standardization (ISO). The ISO 9001:2015 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 9001:2015 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.

**Major topics include:**
- Process Approach
- Risk-based Thinking
- General Requirements of ISO 9001:2015
- Section 4. Context of the organization
- Section 5. Leadership
- Section 6. Planning
- Section 7. Support
- Section 9. Performance Evaluation
- Section 10. Improvement

This SAE/CALISO course is for you if you:
- Want to quickly and efficiently get a comprehensive training of ISO 9001:2015
- Want to improve your CV and career opportunities with qualifications in quality assurance
- Want to upgrade your expertise from ISO 9001:2008 to ISO 9001:2015

Fee: $199.95 0.4 CEUs

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
SAFETY AND QUALITY

- Do NOT have time to allocate a 2 full days to take an ISO 9001:2015 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 at certain stages of the course delivery, and on-going quizzes are incorporated throughout the course to reinforce learning and retention and gauge your understanding of a topic before you move forward. Convenient and portable, this course provides instruction without the expense of travel and time away from the workplace. 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, or in a final exam provided for trainees with a score inferior of 70%. You can take this course using a laptop or PC with an internet connection, at your own pace, and at times convenient to you.

**ISO 9001:2015 Auditor Training – CALISO**

**On Demand Course**

1.8 Hours  
I.D.# ISO-9001-2015-AUDITOR  
fee: $269.95 0.8 CEUs

ISO 9001:2015 is a quality management standard developed by the International Organization for Standardization (ISO). The ISO 9001:2015 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 9001:2015 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.

**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 9001:2015 audit
- Want to quickly and efficiently be trained on ISO 9001:2015 (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 first part audits
- Want to upgrade your expertise from auditing ISO 9001:2008 to ISO 9001:2015
- Want to upgrade your expertise from auditing with ISO 10011-1 to ISO 19011:2011
- Do NOT have time to allocate 2 days to take an ISO 9001:2015 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 at certain stages of the course delivery, and on-going quizzes are incorporated throughout the course to reinforce learning and retention and gauge your understanding of a topic before you move forward. Convenient and portable, this course provides instruction without the expense of travel and time away from the workplace. 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, or in a final exam provided for trainees with a score inferior of 70%. You can take this course using a laptop or PC with an internet connection, at your own pace, and at times convenient to you.

**ISO 9001:2015 Lead Auditor – CALISO**

**On Demand Course**

32 Hours  
I.D.# ISO-9001-2015-LEAD-AUDITOR-TRAINING  
fee: $299.95 0.8 CEUs

ISO 9001:2015 is a quality management standard developed by the International Organization for Standardization (ISO). The ISO 9001:2015 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 9001:2015 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.

**Major topics include:**
- General Requirements of ISO 9001:2015  
- Management Responsibility  
- Resource Management  
- Product Realization  
- Measurement, Analysis and Improvement
SAFETY AND QUALITY

- 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 9001:2015 audit
- Want to quickly and efficiently be trained on ISO 9001:2015 (the standard), and ISO 9000 (the vocabulary for the standard)
- Want to conduct internal audits and supplier audits for your company
- Want improve your CV and career opportunities with qualifications in quality assurance and leading 1st part audits
- Do NOT have time to allocate a 2-5 days to take an ISO 9001:2015 Lead 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 at certain stages of the course delivery, and on-going quizzes are incorporated throughout the course to reinforce learning and retention and gauge your understanding of a topic before you move forward. Convenient and portable, this course provides instruction without the expense of travel and time away from the workplace. 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, or in a final exam provided for trainees with a score inferior of 70%. You can take this course using a laptop or PC with an internet connection, at your own pace, and at times convenient to you.

**Fee:** $399.95  
**2.2 CEUs**

---

**ISO 14001:2004 Training – CALISO On Demand 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.

**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.

**Fee:** $219.95  
**0.8 CEUs**

---

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529  
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
SAFETY AND QUALITY

ISO 14001:2004 Auditor Training – CALISO

On Demand 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 audits and supplier audits using ISO 19011, the guideline standard on how to audit management systems.

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.

Fee: $229.95 0.8 CEUs

ISO 14001:2004 Lead Auditor – CALISO

On Demand 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.

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 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
• 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.

Fee: $319.95 2.2 CEUs
ISO 14001:2015 Overview – CALISO
On Demand Course

4 Hours
I.D.# ISO14001-2015-OVERVIEW

ISO 14001:2015 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.

Major topics include:
- General Requirements of ISO 14001
- Section 4. Context of the organization
- Section 5. Leadership
- Section 6. Planning
- Section 7. Support
- Section 9. Performance Evaluation
- Section 10. Improvement

This SAE/CALISO course is for you if you:
- Want to quickly and efficiently get a comprehensive overview of ISO 14001:2015
- Want to improve your CV and career opportunities with qualifications in ISO 14001
- Want to upgrade your expertise from auditing ISO 14001:2008 to ISO 14001:2015
- Do NOT have time to allocate a full day to take an ISO 14001:2015 overview 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 at certain stages of the course delivery, and on-going quizzes are incorporated throughout the course to reinforce learning and retention and gauge your understanding of a topic before you move forward. Convenient and portable, this course provides instruction without the expense of travel and time away from the workplace. 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, or in a final exam provided for trainees with a score inferior of 70%. You can take this course using a laptop or PC with an internet connection, at your own pace, and at times convenient to you.

Fee: $189.95 0.4 CEUs

ISO 14001:2015 Training – CALISO
On Demand Course

10 Hours
I.D.# ISO14001TRAINING

ISO 14001:2015 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.

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 14001:2015
- 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 at certain stages of the course delivery, and on-going quizzes are incorporated throughout the course to reinforce learning and retention and gauge your understanding of a topic before you move forward. Convenient and portable, this course provides instruction without the expense of travel and time away from the workplace. 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, or in a final exam provided for trainees with a score inferior of 70%. You can take this course using a laptop or PC with an internet connection, at your own pace, and at times convenient to you.

Fee: $269.95 1.0 CEUs
SAFETY AND QUALITY

ISO 14001:2015 Auditor Training – CALISO

On Demand Course

12 Hours
I.D.# ISO14001-2015-AUDITOR

This SAE/CALISO course is for you if you:

• Want to quickly and efficiently learn how to lead an ISO 14001:2015 audit
• Want to upgrade your expertise from auditing with ISO 19011:2002 to ISO 19011:2011
• Do NOT have time to allocate two 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

ISO 14001:2015 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

Major topics include:
• General Requirements of ISO 114001
• Auditing techniques
• EMS Auditing Case Studies

Fee: $269.95 1.2 CEUs

ISO 14001:2015 Lead Auditor – CALISO

On Demand Course

32 Hours
I.D.# ISO14001-2015-LEAD-AUDITOR-TRAINING

This SAE/CALISO course is for you if you:

• Want to quickly and efficiently learn how to lead an ISO 14001:2015 audit
• Want to upgrade your expertise from auditing with ISO 19011:2002 to ISO 19011:2011
• Do NOT have time to allocate four days to take an ISO 14001 Lead 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

ISO 14001:2015 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.

Major topics include:
• General Requirements of ISO 14001:2015
• ISO 14001 Vocabulary
• Environmental Policy
• Planning
• Implementation and Operation
• Checking
• Management Review
• General Requirements of ISO 19011
• Auditing Techniques

Fee: $1047.95 4.8 CEUs
SAFETY AND QUALITY

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org

ISO/TS 16949:2009 Training – CALISO On Demand Course

8 Hours
I.D.# ISO16949

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. This 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.

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.

Fee: $239.95 0.8 CEUs

Fee: $229.95 0.8 CEUs

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.

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 QS 9000 to ISO/TS 16949
- 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.

Fee: $369.95 2.2 CEUs


4 Hours
I.D.# ISO19

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, health 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.

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 19011:2011
- Want to upgrade your expertise from auditing with ISO 19011:2011 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.

Fee: $169.95 0.4 CEUs
SAFETY AND QUALITY

Sarbanes-Oxley (SOX) Training – CALISO
On Demand 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.

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.

Fee: $269.95 0.4 CEUs

Six Sigma Overview – CALISO
On Demand 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.

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.

Fee: $159.95 0.8 CEUs

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529 • Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
NEW COURSES COMING SOON

• FAA Part 21 Certification Procedures for Products and Parts
• FAA Certification, Operations & Maintenance Orientation
• Aviation Safety Engineer Job Functions
• Understanding the AS9120:2016 Standard: Quality
• Management Systems – Requirements for Aviation, Space and Defense Distributors

These courses will be available soon. Contact SAE International Corporate Learning Solutions for more information on these courses. +1.724.772.8529 or corplearn@sae.org

GET DEFINITIVE INDUSTRY AUTHENTICATION

Probitas Authentication provides unparalleled customer service through the AS9100 AQMS and training provider approval processes in accordance with aerospace certification scheme requirements. Recognized by the Americas Aerospace Quality Group (AAQG) as an Auditor Authentication Body (AAB) and Training Provider Approval Body (TPAB), Probitas Authentication is committed to:

• Customer Service – timely and attentive service
• Thoroughness and Accuracy
• Integrity – providing equal opportunities for success
• Compliance with industry standards and approved practices
• Continual Improvement

For more information visit sae-itc.org/probitas
NEED TO TRAIN YOUR WHOLE TEAM?

Bring SAE education and training to your location. Get variety, customization, quality and convenience. SAE International Corporate Learning advisors work with you to determine the best options to meet YOUR specific training challenge AND develop solutions to fit your budget and your schedule.

Through SAE Corporate Learning Solutions you can:

• Select a SAE course for delivery at your site
• Purchase a corporate subscription for a few courses or the entire library of over 50 online courses (350+ hours of content available)

Contact SAE Corporate Learning Solutions today to discuss how SAE can best meet your training needs.

TRAINING.SAE.ORG/CORPLEARNING
Accelerated Test Methods for Ground and Aerospace Vehicle Development

2 Days  
I.D.# C0316

A similar course is available on demand — Accelerated Test Methods for Ground and Aerospace Vehicle Development — see course info below.

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). A combination of hands-on exercises, team activities, discussion, and lecture are used throughout the course. Participants will also receive a copy of the instructor’s book, Accelerated Testing and Validation Management, which includes numerous hands-on exercises and a CD with analytical spreadsheets. Attendees are requested to bring a calculator to the seminar.

Learning Objectives

By attending this seminar, participants will be able to:
• Choose the accelerated test method for a given application
• Analyze accelerated testing results
• Explain how to accelerate one’s current test methods
• Explain how to accelerate one’s validation program
• Adjust accelerated test programs for business situations

• Describe how product development cycles can be reduced from 18 to 6 months

Who Should Attend

This 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. Individuals who need to achieve shorter time to market or higher quality through custom test plans will find this course to be especially valuable. Purchasers or users 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.

Topical Outline

• Statistical model for reliability testing
  • Fundamentals of a statistical reliability test
  • Effects of automotive supply chain on sample size and duration
  • Common pitfalls
  • Examine and solve two or three real life statistical data set problems
• Key Accelerated Tests, Terms, and Methods
  • Definitions: Information Goal, Basic Method, Limitations
  • Full System Life Test (FSLT)
  • Step Stress
  • Accelerated Reliability Highly Accelerated Life Test (HALT)
  • Failure Mode Verification Test (FMVT) — Development; Warranty; Life Prediction
• Test Acceleration vs. Program Acceleration
  • Advantages of accelerating a full validation program compared to an individual test
  • Examples of time/cost saved on individual test acceleration
  • Examples of time/cost saved on program acceleration
TESTS AND TESTING

• Hybrid Acceleration Methods
  • Using information goals of individual test methods to combine and leverage tests
  • Hands-on team exercise: combine test methods to solve a particular information need
• Decision and selection process
  • How to choose which method
  • Considering position in supply chain
  • Considering business model and product type
  • Considering development phase
  • Considering component, subsystem, and system level testing
  • Hands on team exercise: selecting optimal testing solution for several scenarios

Instructor: Alexander (Alex) J. Porter
Fee $1405 1.3 CEUs

Accelerated Test Methods for Ground and Aerospace Vehicle Development

10 Hours I.D.#PD130624ON

This course offers more than 10 hours of instruction divided into fourteen modules; a coordinated handbook; and a copy of the instructor’s book, *Accelerated Testing and Validation Management*, which includes numerous hands-on exercises and a CD with analytical spreadsheets. Convenient, portable, and with core content from the instructor-led seminar (view description for classroom seminar just above), the e-seminar program option offers new and alternative ways to receive the same instruction as the live classroom learning without the expense of travel and time away from the workplace.

View the complete course description and a video demo at training.sae.org/eseminars/pd130624on/

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 (self-test, immediate results)
• Online Post-test (self-test, immediate results)
• CEUs/Certificate of Achievement (with satisfactory post-test score)

Instructor: Alexander (Alex) J. Porter
Fee $595 1.0 CEU

Practical NVH Signal Processing Methods

2 Days I.D.# C0431

Signal processing has become a critical tool in optimizing vehicle noise. This seminar will help you to understand the foundation common to all NVH data acquisition equipment including digitizing, windows, aliasing, averaging techniques, and common analysis functions such as the power spectrum, transfer function and coherence. Fundamental concepts such as filtering, modulation, convolution, and correlation, as well as specialized techniques used in rotating machinery such as adaptive re-sampling and order tracking, will be covered. The seminar will also cover multi-input multi-output (MIMO) signal processing, array based solutions for force identification, source and path characterization and data visualization. Brief introductions to emerging concepts will also be explored and computer demonstrations, physical experiments and case studies will be used to illustrate applied, real-world problems.

Learning Objectives
By attending this seminar, participants will be able to:
• Explain the fundamental controls typical in modern spectrum analysis tools
• Interpret NVH data and judge its relevance to physical phenomena
• Extract new types of useful information from NVH data
• Implement new signal processing techniques

Who Should Attend
NVH technicians, engineers and managers who want to understand how NVH data is produced and interpreted will find this seminar valuable. The material is presented at a level suitable for beginners, but offers the more experienced practitioners new insight into the concepts presented through the illustrations and demonstrations that are included.

Topical Outline
• Properties of the FFT
  • Sampling and digitizing
  • Aliasing and filters
  • Leakage and windows
  • Averaging techniques
  • Autopower, crosspower and coherence
  • Transmissibility and isolation
  • Measuring and interpreting the transfer function
• Rotating Machinery Basics
  • What is an order?
  • Rotation synchronous data acquisition methods
  • AM and FM modulation effects
  • FIR, IIR and re-sampling filters
  • Up-sampling down-sampling and adaptive re-sampling

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at sae.org/corplearning • Email us at Corplearn@sae.org
TESTS AND TESTING

• Time Frequency Methods
  • Short time Fourier transform
  • Gabor expansion and Gabor transform
  • Orthogonality, invertability and the dual function relationship
  • Gabor order tracking
  • Introduction to wavelets
• Fundamentals of Multi-Input-Multi-Output (MIMO) System Analysis
  • Review of Single-Input-Single-Output (SISO) systems
  • Introduction to Single-Input-Multiple-Output (SIMO) systems
  • Partial correlation concepts
  • Coherent output power
  • Statistical errors in basic estimates
  • Conditioned spectral analysis
• Forces and Sources in MIMO Systems
  • Least squares solution techniques
  • Force estimation technique Conditioned Source Analysis (CSA)
  • Case history: transfer path analysis
  • Case history: model correlation and updating
• Introduction to Data Classification and Pattern Recognition
  • Techniques for building and analyzing feature vectors
  • Recognition engines: neural networks and hidden Markov models
  • Applications: machine noise recognition, vision based gear mesh quality

Instructor: Michael F. Albright
Fee $1370 1.3 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

Many courses are available in multiple formats. See page VII to get more information on the learning formats offered by SAE. In addition to finding courses that fit your technology need, look for courses with icons that fit the way you want to learn.

- Classroom – indicates the course is an instructor-led seminar or workshop offered in a classroom setting
- Live, Online – indicates the course is an instructor-led web seminar offered live and online via telephone and internet connection
- 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 XI
INSTRUCTOR INDEX

Albright, Michael F .............................................................................. 128
Bardasz, Ewa ...................................................................................... 77
Belanger, Jean-Paul ................................................................. 28, 29, 30, 31
Bissell, Larry E .............................................................................. 107
Breneman, Jim ............................................................................. 20
Bullen, George ........................................................................ 6, 83, 86
Chehroudi, Bruce ........................................................................ 99
Chesneau, Howard .................................................................. 100
Cressionnie, L.L. “Buddy” ...................................................... 103
Dawson, Lee D ............................................................................. 23
Dickey, Jeffrey C ........................................................................ 97
Dobrusin, Eric ............................................................................. 69
Dodson, Bryan ......................................................................... 25
Doyle, Joseph ........................................................................... 65, 75
English, Ed .................................................................................. 100
Farsi, Ken ................................................................................. 78, 102
Fulton, Wes ............................................................................... 109, 112
Haughey, Bill ............................................................................... 22
Hilderman, Vance ....................................................................... 4
Jeffery, Jon R ............................................................................... 98
Knutson, Donald F ....................................................................... 110
Klukas, Philip F .......................................................................... 106
Kunder, Paul J ............................................................................. 106
Kurowski, Paul ........................................................................... 16, 27
Li, Canghuai ............................................................................... 81, 82
Mago, Angelo E ......................................................................... 9, 14, 15, 19
Manzanares, David ................................................................... 3
Masiak, James .......................................................................... 71
Nazri, Gholam-Abbas ................................................................ 91
Peterson, Eric M ......................................................................... 1, 2
Pfeifer, Michael ........................................................................... 93
Porter, Alexander (Alex) J ....................................................... 7, 127
Ringger, George J ....................................................................... 106, 110
Roslund, Jerry L .......................................................................... 26
Ross, Phillip J ............................................................................... 8, 13, 21, 26
Rutledge, Drexel L ..................................................................... 62, 63
Saha, Prenab ............................................................................... 94
Schofield, Alan ......................................................................... 101
Seyboldt, Charles F .................................................................. 72, 78
Sittsamer, Murray ...................................................................... 66, 73
Sorrentino, Joseph ...................................................................... 109
Spence, William Cory ................................................................ 68
Stillinger, Jeffrey ....................................................................... 97
Stricker, Peter A ......................................................................... 96
Timmis, Eric ............................................................................... 67, 70
Todeschi, Michel ......................................................................... 5
Walker, R. W. (Bill) ................................................................... 64
Wang, Wego ............................................................................... 24
Woodside, Kenneth B ................................................................... 66
Zielinski, Kevin ......................................................................... 10, 11, 12

Instructors Wanted...

To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses; we are seeking expertise in a variety of topics including:

Aerospace

• Certification
• Regulations
• Standards
• Technologies

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup
Frank.Shoup@sae.org
+1.724.772.8568

3 ways to get a no-obligation price quote to bring a course to your company • Call SAE Corporate Learning at +1.724.772.8529
• Fill out the online quote request at www.sae.org/corplearning • Email us at Corplearn@sae.org
Albright, Michael F.

Michael F. Albright is co-founder and General Manager of Signal.X Technologies LLC, a firm specializing in NVH engineering and custom test &amp; measurement application development. His past positions include Business Development Manager for the NVH consulting group of LMS North America, Management and Project Engineering positions at the Roush Anatrol Division of Roush Industries, Inc, and Civilian engineering for the U.S. Navy. With experience predominantly in the automotive industry, Mr. Albright has addressed a very diverse range of noise and vibration control issues including powertrain NVH, vehicle NVH, brake noise, engine accessory noise, driveline NVH, test procedure and facility development, test/CAE hybrid simulation methods, as well as a host of manufacturing quality issues. Mr. Albright holds a B.S. in mechanical engineering from University of Cincinnati and an M.S. in mechanical engineering from Purdue University.

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.

Bardasz, Ewa

Dr. Ewa A. Bardasz is a Fellow at The Lubrizol Corporation, where she is currently responsible for overseeing technical activities related to lubricating novel combustion hardware, aftertreatment systems and emissions. She is experienced in the areas of crankcase lubrication, corrosion inhibition, engine testing and exhaust emissions control. Dr. Bardasz holds over 25 patents, has published multiple technical and scientific papers, authored chapters for technical books and is a frequent invited speaker at conferences throughout the U.S. and Europe. She is the recipient of the SAE International 2002 Award for Research on Automotive Lubricants, and 2009 SAE International Environmental Excellence in Transportation Award. Dr. Bardasz is an SAE International Fellow and a Fellow of the Society of Tribologists and Lubrication Engineers (STLE) where she is also on the Board of Directors. Dr. Bardasz obtained a M.Sc. in Chemical Engineering from Warsaw Technical University and a PhD in Chemical Engineering from Case Institute of Technology.

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.

Breneman, Jim

Jim Breneman is currently a Statistical and Reliability consultant and instructor in the Mathematics Department at the Tri-County Technical College (South Carolina). Prior to that, Mr. Breneman held various technical and managerial positions with Pratt & Whitney (P&W) Division of United Technologies including: Supervisor of Applied Mathematics and Statistics Group; Manager of Reliability and Design Review Group; Safety, Reliability, Maintainability & Quality Assurance (SRM&amp;QA) Manager for Rocket Programs; Manager of Reliability, Maintainability & Safety Engineering; Manager of Engineering Integrity for all P&amp;W products; founder and leader of P&amp;W’s Engineering Technical University; Manager of P&amp;W’s University R&amp;D programs; and ACE Mentor (equivalent to Master Black Belt). Mr. Breneman has an extensive background in reliability, as both a P&amp;W Fellow in Reliability Statistics and Risk Analysis, and an SAE International Fellow. He has presented papers on reliability topics at various conferences. Mr. Breneman holds a B.S. in Mathematics from the University of North Carolina (Chapel Hill) and an M.S. in Applied Mathematics/Statistics from N.C State University.

Bullen, George (Nick)

Mr. Nick Bullen is the President and CEO of Smart Blades, Inc. Located in Oxnard, California, Smart Blades designs and develops highly efficient wind turbine blades and modular facilities for in-situ wind turbine blade manufacturing. Previously, Mr. Bullen was Principal Engineer, Technical Fellow, and Technical Expert for Advanced Manufacturing Technology and Advanced Programs for Northrop Grumman Corporation. His expertise includes inhabited and uninhabited aerial vehicles, space vehicle design and manufacture, laser weapon system design and manufacture, and Lean processes and applications. Mr. Bullen has been awarded 16...
INSTRUCTOR BIOGRAPHIES

US and International patents for technology innovations related to manufacturing, mechanization, robotics, robotics control software and nuclear testing/quality devices that are the basis for all current automated systems used for the assembly of airframes in the US and Europe. Mr. Bullen is a Fellow in the Society of Manufacturing Engineers and is certified in Production and Inventory Control Management. He actively serves and maintains membership on academic boards of several major universities, is a member of the steering committees of professional societies including SAE International and SME, and is founder of the International Aerospace Automation Consortium. He also is a board member of the RFID supply chain governing body, EPC Global. A widely published author in magazines, proceedings, journals and peer review journals, he received the AIAA Design Engineering Award in 2000 for Significant Advances in Aerospace Engineering. Mr. Bullen received his BSMG degree from Pepperdine University, an MBA from Loyola Marymount University, and is currently finishing his PhD in Decision Sciences, Engineering Research.

Chehroudi, Bruce
Dr. Chehroudi is Chief Scientist and Group Leader at Advanced Technology Consultants. His previous positions include: Principal Scientist at Air Force Research Laboratory (AFRL/ERC), Chief Scientist at Raytheon STX (formerly Hughes Aircraft STX), Professor of Mechanical Engineering, and Research Staff Member at Princeton University. He specializes in Micro/Nano sensors, actuators, internal combustion engine, gas turbine and rocket engines, structure of sprays, gas turbine engines, combustion, fuel injection issues and emission of pollutants. Dr. Chehroudi is an AIAA Associate Fellow, a member of Ta Beta Pi and the recipient of several SAE International awards including the Arch T. Colwell Merit Award, the Ralph R. Teetor Award, the SAE International Recognition Award and the SAE International Forest R. McFarland Award in recognition of his efforts and leadership in contributions to the Continuing Professional Development Seminars. He has taught courses in the areas of internal combustion engines, thermodynamics, thermophysics of gas flows, combustion, and measurement system, and has more than 150 publications and over 200 presentations in conferences, national and international journals. Dr. Chehroudi has a Ph.D from Princeton University.

Chesneau, Howard
Mr. Chesneau is the President of Fuel Quality Services, Inc. A recognized expert on fuel-related issues, he has over thirty years of experience in fuel additives, distillate fuel problems, fuel filtration, and tank remediation. Additionally, Mr. Chesneau has extensive knowledge and field experience in the area of microbial contamination and detection. Mr. Chesneau is on the IASH Board of Directors and is the past Chairman of the SAE International Atlanta Section. He is an active member of other professional organizations including SAE International, IATA, and ASTM. He currently serves on the IATA Working Group on Microbial Contamination, the ASTM Committee dealing with fuel from middle distillates to heavy oils, the ASTM Committee establishing specifications for biodiesel, and the ASTM Committee on jet fuel. In addition to his committee and working group activities, Mr. Chesneau has authored and co-authored many articles on the subject of fuel storage and handling that have been published in various trade magazines. Mr. Chesneau served as a commissioned officer in the US Army and holds a B.S. degree from the University of Florida.

Cressionnie, L. L. “Buddy”
Mr. Cressionnie is currently the International and Americas IAQG 9100 Team Lead responsible for maintenance, revision, and clarification of the AS9100 standard. He is active in standards development as a voting member of the US Technical Advisory Group (TAG) to ISO/TC 176 which writes ISO Quality Management System standards. He serves on the US TAG Interpretations Committee and is the Aerospace Sector Liaison to the US TAG. Mr. Cressionnie represents Lockheed Martin in these roles where he works in the Aeronautics Business Unit, a 31,000 employee operation across nine sites. He led the implementation of AS9100/ISO 9001:2000 standards and quality process area for Capability Maturity Model Integration (CMMI®) at Lockheed Martin Aeronautics into a centralized, integrated quality system. Buddy Cressionnie is an ASQ senior member with quality manager and quality auditor certifications. He is a certified RABQSA aerospace experienced auditor and International Register of Certified Auditors (IRCA) lead auditor for ISO 9001 and ISO 14001. Buddy Cressionnie received his MBA degree from Texas Christian University and Bachelor of Science in Engineering from the University of Florida.

Dawson, Lee D.
Mr. Dawson has over 35 years of experience in Quality and Reliability engineering. President and CEO of Quality-One International since 1986, Mr. Dawson had previously held engineering and training positions at Ford Motor Company, and Wickes Manufacturing. As CEO of Quality-One, Mr. Dawson has consulted with hundreds of companies and trained thousands of quality and engineering professionals in Failure Mode and Effects and Analysis (FMEA) and Advanced Product Quality Planning (APQP). He periodically teaches these and other related quality and reliability courses for several colleges and universities in the US, Canada, and Australia and speaks at engineering related functions. Mr. Dawson has written and collaborated on several technical books and manuals including Murphy’s Law Overruled (FMEA in Design, Process and Service), Ford Design Institute FMEA Handbook and AIAG Effective Error Proofing CQI-1B. He has participated, written and presented numerous technical papers at ASQ, ASM and other professional organizations. Mr. Dawson has a B.S. in Metallurgical Engineering from Penn State University and is a Certified Quality Engineer (CQE), Certified Reliability Engineer (CRE) and is a Master Black Belt in the practice of Six Sigma.

Dickey, Jeffrey C.
Jeffrey C. Dickey is Executive Vice President - Hydraulics for The Lee Company, a manufacturer of high precision miniature hydraulics components used in the aerospace, medical, and industrial industries. He is responsible for seven business units, overseeing both engineering and manufacturing. Mr. Dickey has been designing hydraulic components for the past 32 years, starting as a project engineer and working his way up to his current position. He has designed and developed an array of proprietary hydraulic component designs for plugs, restrictors, check valves, pressure relief valves, flow regulating valves, pressure regulating valves, pilot operated valves, shuttle valves, bypass valves, solenoid valves, etc. His designs have helped solve issues within hydraulic systems for aerospace, medical implants, military vehicles, missiles, satellites, submarines, down-hole oil tools, formula 1 race cars, etc. He has Patents on a High-Pressure Pin Plug (Patent 4867333) and Expansion Sealing Device (Patent 5121947). He is an active member of the SAE International - A6 Fluid Power, Actuation and Control Technology Committee. He is currently the Panel Chairman of the A6CS Components Panel, and Co-Author of SAE International Paper 912134 “Total Flexibility in Cartridge Valve Porting Through Innovative Sealing Technology”. Mr. Dickey received his B.S. in Mechanical Engineering from the University of Connecticut.

Dobrusin, Eric
Eric M. Dobrusin is a shareholder in the Dobrusin Law Firm, PC in metropolitan area of Detroit, Michigan, where he concentrates his practice in intellectual property law. He is a member of the Michigan Bar and is registered to practice before the United States Patent and Trademark Office. Mr. Dobrusin previously served as the Executive Director of the National Patent Board, and he has served as an ADR Neutral and a Special Master in IP litigation disputes. Mr. Dobrusin has presented talks and authored articles on a variety of intellectual

**Dodson, Bryan**

Dr. Dodson is currently the Executive Engineer for SKF. Prior to joining SKF, Dr. Dodson held the positions of Senior Director Corporate Quality & Continuous Improvement for Collins & Aikman and Associate Director of Quality & Reliability Engineering with global responsibility for Visteon. Dr. Dodson has authored several books including: The Reliability Engineering Handbook, Practical Accelerated Testing, and Weibull Analysis: with Software. Dr. Dodson has also developed several software packages including; the Training Pro Interactive Study Guides, the Reliability & Maintenance Analyst, and Measurement Assurance. Dr. Dodson served as Chair of the committee that created the International Quality Federation’s Six Sigma Exam and also developed the software that delivers this state of the art exam. Dr. Dodson has published numerous articles in technical journals and teaches several courses for technical societies and as an adjunct faculty member at universities. A Fellow of SAE International and ASQ, Dr. Dodson holds a B.S. in Petroleum Engineering, an M.S. in Industrial Engineering, an M.B.A., and a Doctor of Business Administration. In addition, he is a Certified Quality Engineer (CQE), a Certified Reliability Engineer (CRE), a Six Sigma Master Black Belt, and a licensed Professional Engineer in Michigan."

**Doyle, Joseph**

Joseph Doyle is the principal of Strategic Insights, a Michigan-based consulting firm, specializing in executive leadership. He completed a 30-year career with General Motors Corporation, where he held a variety of management positions including: Internal Business Consultant with General Motors University, Senior Research Manager with the Corporate Organization Research and Development Activity, Manager of the Corporate Executive Development Activity, and Lead Consultant with the Corporate Strategy and Decision Support Activity. While at GM, he facilitated Global Task Teams in India, Indonesia, Thailand, England and Australia and served as the Corporate Liaison on Leadership and Strategy to the US Army War College and the National Defense University. Prior to joining General Motors, Mr. Doyle held positions with the U.S. Public Health Service, Ford Motor Company and the Management and Organization Development Department of General Motors Institute (now Kettering University). Dr. Doyle served as a teaching fellow for the Hartwick Leadership Institute and was a member of the advisory council for the Academy of Management Executive Magazine. He was a member of the Advisory Board for the Institute for Management Studies as well as member of the National Research Committee for the American Society for Training and Development. Dr. Doyle has served as an adjunct professor and lecturer at the University of Michigan Dearborn’s School of Business, taught Engineering Administration at the University of Detroit’s Graduate School of Engineering and Business Strategy at Oakland University’s School of Business Administration. He holds a B.S. in Mathematics and Physical Science from Eastern Michigan University, a M.Ed. in Educational Evaluation and Research from Wayne State University and a Ph.D. in Organizational Behavior from the University of Michigan.

**English, Ed**

Mr. English is currently Vice President & Technical Director for Fuel Quality Services, Inc. where he oversees all aspects directly related to the research, development, and deployment of chemicals, antimicrobials and detection equipment for use in the various stages of the petroleum and biomass fuels industry from the refinery to the end user. He is also responsible for evaluating regulatory and industry issues, compliance with federal and state regulations, formulating policy and implementing programs to address regulatory and industry issues, and performing technical reviews and program audits. Mr. English previously worked in the nuclear power industry. He is nationally recognized for his knowledge and expertise in the area of microbial contamination of fuels, alternative fuels, and materials compatibility and has been an invited speaker for such organizations as the EPA, FAA, CALCUPA, NEIWPC, PEL, NIST, and SAE International, DuPont, and Biofuels Americas. Mr. English is also an active member of numerous professional organizations including SAE International, IASH, IATA, and ASTM. He has a B.S. in Chemistry from the University of Florida and two years post-baccalaureate work from the University of Miami.

**Farsi, Ken**

Mr. Farsi is currently the VP of Engineering and ODA Administrator for Dassault Aircraft Services in Wilmington, DE, where his responsibilities include oversight of engineering groups and practices at all Dassault Aircraft Services locations. He has over 27 years experience in aircraft certification and operations and has worked for aircraft manufacturers, airlines and modification centers conducting certification work on small and large transport category aircraft. He is a FAA Designated Engineering Representative (DER) with Interior Arrangement and Compliance Inspection, as well as Aircraft Loading Document approval authority on Part 23 and 25 aircraft. Mr. Farsi has taught aircraft certification and Federal Aviation Regulations as an Adjunct Instructor at Northrop-Rice Aviation Institute of Technology in Los Angeles, and Aircraft Systems at San Mateo Community College in San Mateo, California. He has participated in and managed FAA certification programs for major U.S., European, Chinese, and Australian airlines as a consultant. He is a life time member of Tau Alpha Pi, the honor society for Engineering Technologies. Along with a Bachelor of Science in Aircraft Maintenance Engineering Technology from Northrop University, Mr. Farsi has participated in graduate studies in Aerospace and Aviation Operations and Management at Embry-Riddle Aeronautical University. He holds FAA Airframe and Powerplant as well as Private Pilot Certificates.

**Fulton, Wes**

Mr. Wes Fulton is the Founder and CEO of Fulton Findings. Prior, he was a program engineer/manager for AllResearch 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 George Tech and his M.S.M.E. from California State University at Long Beach.

**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 GD&T methodologies. He is a current member of
INSTRUCTOR BIOGRAPHIES

Mr. Donald F. Knutson

Mr. Knutson is President of Knutson Aviation Services (KAS), a consulting firm specializing in aircraft accident and incident investigations, wreckage reconstruction, airframe and powerplant system failure analysis, crashworthiness analysis, and air safety education and research. He has conducted a multitude of field investigations on domestic and foreign accidents involving various models of civilian and military aircraft. Mr. Knutson taught graduate and continuing education courses on aircraft accident investigation for the Wichita State University (Wichita, KS) Aerospace Engineering program and Lewis University Aviation programs (Romeoville, IL). For Boeing’s military operations in Wichita, he instructed engineers in basic and advanced topics on supporting U.S. Air Force crash investigations. Prior to starting KAS, Mr. Knutson was with The Boeing Company as a Flight Test Engineer where he evaluated fuel system designs and remote aerial refueling operations for the 767 Tanker program. Mr. Knutson also served as Director of Aviation for a forensics engineering firm where he provided aircraft accident investigation consulting and business development. He served as a Designated NTSB Representative for several international accidents and helped train new air safety investigators during field investigations. He also performed airframe and powerplant (turbine and piston) system inspections, wreckage reconstruction, metallurgical examinations, and crashworthiness analysis involving survivability issues. Mr. Knutson is a member of the Experimental Aircraft Association and the International Society of Air Safety Investigators. He is an FAA-certified pilot and Airframe and Powerplant mechanic. He received his B.S. in Mechanical Engineering from the University of Southwestern Louisiana (Lafayette, LA).

Mr. Philip F. Klukas

Mr. Klukas is Vice President of Quality Systems International, a company specializing in aerospace quality management systems where he serves as a trainer and consultant. Mr. Klukas is a certified AS9100C Aerospace Industry Experienced Auditor (AIEA), Quality Management System Lead Auditor, ANSI-ASQ National Accreditation Board (ANAB) Accreditation Witness Auditor, as well as an approved instructor for the IAQG Sanctioned AS9100C Aerospace Auditor Transition Training course. In addition, Mr. Klukas serves as a member of the RABQSA Aerospace Technical Advisory Group (TAG). Mr. Klukas was previously with United Registrar Services/TUV USA as Director ASD Technical Services, ASD Trainer, and ASD Lead Auditor. He has also served as the Western Regional Manager, Aerospace Business Development for RWTUV USA where he was an AS9100 trainer and assessor. His previous experience also includes TUV Rheinland of North America and Stat-A-Matrix where he served as a quality consultant and trainer

Mr. Jon R. Jeffery

Jon Jeffery is currently working for Parker Aerospace as Director of Innovation and Marketing for the Hydraulic System Division in Kalamazoo, MI, and is the current Chairman for SAE International A-6, the Aerospace Actuation, Control and Fluid Power Systems standards committee. Mr. Jeffery has been employed at Parker Aerospace for 20 years primarily in the development of aircraft hydraulic systems and associated hydraulic equipment. Mr. Jeffery started the hydraulic system product line at Parker in 1994 and has been involved with more than a dozen aircraft hydraulic system designs since that time. Prior to joining Parker, Mr. Jeffery worked at McDonnell Aircraft Company (now Boeing), St. Louis, Missouri for 12 years. He started as a hydraulic system design engineer during the early phase of the F/A-18 aircraft. He then spent 5 years working on hydraulic system research and development in the area of 8000 psi hydraulic system design, low energy consumption hydraulic techniques, enhanced dynamic stiffness for flight control actuators and variable pressure pumps. He published several technical papers on these subjects and was awarded a patent in 1986 for an energy recovery concept entitled “Flow Augmented Servovalve Technology (FAST) Actuator”. Mr. Jeffery later held the position of hydraulic team leader for the A-12 program and then as Unit Chief, Flight Controls & Hydraulic Systems for the F/A-18 programs. Mr. Jeffery received a Bachelor Degree in Mechanical Engineering from the University of Michigan and a Masters Degree in Engineering Management from Washington University in St. Louis, MO.

Mr. Paul J. Kunder

Mr. Kunder is the President of Amera-Veritas, Inc., a provider of quality, safety, and risk management. Mr. Kunder is a lead instructor for the Aerospace Auditor Transition Training and is currently an International/ Americas Quality Group and RABQSA AS9100 Aerospace Auditor and Quality System Lead Auditor (ref. #1834). He is active in standards development as a voting member of the US Technical Advisory Group (TAG) to ISO Technical Committee 176 which is responsible for development of the ISO 9001 Standard. He serves as the Vice Chair of the National ANSI/ASQ Z1A Committee on Auditing (ISO 19011) and on the US TAG Interpretations Committee. He has performed more than five hundred audits and has assisted more than eighty organizations with the development and certification of their quality management systems including the Federal Aviation Administration Office of Aviation Safety. Prior to his current position, Mr. Kunder was involved in the accreditation of several 3rd party registrars, acted as an administrator for the first RAB accredited registrar in the United States and works as a subcontract auditor for a number of registrars. Mr. Kunder is an ASQ senior member and holds a B.S. in Mechanical Engineering.
INSTRUCTOR BIOGRAPHIES

Kuwowski, Paul
Dr. Kuwowski is a professor in the Department of Mechanical and Materials Engineering at the University of Western Ontario in London, 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. Kuwowski has published multiple technical papers and taught professional development seminars for SAE, ASME, the Association of Professional Engineers of Ontario, the Parametric Technology Corp. (PTC), Rand Worldwide, SolidWorks Corp. and other companies and professional organizations. He contributes to several engineering publications focusing on the implementation of CAE methods into the product development process. He is a member of SAE and the Association of Professional Engineers of Ontario. Dr. Kuwowski obtained his M.Sc. and Ph.D. in Applied Mechanics from Warsaw Technical University and completed postdoctoral work at Kyoto University.

Masiak, James
James Masiak has more than 25 years of experience in the implementation of business processes for General Motors. Mr. Masiak’s most recent activities include the implementation of an enhanced engineering product cost management process within GM North America, the alignment of cross functional organizational initiatives, and development of an engineering resource allocation plan for GM Regions. Mr. Masiak was also responsible for the development and implementation of Global Engineering and Business Strategies across all of General Motors International Operations. Mr. Masiak received his B.S. in Mechanical Engineering from Wayne State University, his M.S. in Mechanical Engineering from Massachusetts Institute of Technology, and his M.B.A. from Michigan State University Executive Management Program.

Li, Canghui
Mr. Canghui Li is currently Manager of Engineering, Inspection, and Forging Operations at Xian Airfoil Technology Co., LTD (XAT) in China. XAT is a joint venture company established by Xian Aero-Engine (XAE), Pratt and Whitney (P&W), and Blades Technology International (BTI Israel). XAT manufactures compressor blades and vanes, fan blades, and medical implants using advanced precision forging and machining processes for such customers XAE, P & W, Honeywell, Dongan, Stryker, Biomet, Depuy, and Smith and Nephew, among others. Mr. Li previously served as Quality Manager at XAT where he was responsible for all quality related aspects of production and systems. Prior to that, he was a senior professional forging engineer and supervisor at XAT. Mr. Li received a BS Engineering from Northwest Poly-Technology University, with a focus on metal forming and materials engineering.

Mago, Angelo E.
Angelo Mago is senior consultant and owner of ATM Consulting, Inc., which provides customized training and consulting services to a varied design and manufacturing 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 working in DOD in the M1 Abrams and Bradley Program Management offices and as the Senior Supplier Quality Engineer for GM Truck Group responsible for NAO and off-shore supplier ISO qualification, product development, and PPAP qualification and approval. Through ATM Consulting, Mr. Mago has played a lead role in establishing a PM and APQP environment for both large and small companies. He 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.

Manzanares, David
David Manzanares has been employed at Moog Inc. for eighteen years, mostly in the aircraft flight control arena. He is presently Manager of Primary Flight Controls Engineering in Moog Aircraft Group’s Commercial Sector. During his career, Mr. Manzanares has led multiple engineering development activities for cockpit controls and electromechanical actuators including the design and development of the 787 spoiler EMA and horizontal stabilizer trim actuator. His present activities include technical oversight for engineering development programs, employee development, customer technical interface, and technology road mapping for Moog’s actuation product lines. He received his B.S. degree in Mechanical and Aerospace Engineering from Cornell University and his M.S. degree in Mechanical Engineering from the University of Utah.

Nazri, Gholam-Abbas
Dr. Nazri is the technical director of new technologies at Frontier Applied Sciences and Technologies, LLC. and an adjunct professor of Physics and Chemistry at Wayne State University, Oakland University, and University of Windsor, Canada. Dr. Nazri began his career as a Research Scientist at General Motors Global Research and Development Center after two years of postdoctoral fellowships at the Lawrence Berkeley National Laboratory. He also served as a visiting Professor at the University of Pierre and Marie Curie, Paris France, Institute of Condense Matter Chemistry at Bordeaux France, and Institute of Materials at Nantes, France. He is an active organizer of Symposia on advanced batteries and is on the International Science Advisory Board of several Lithium Battery Meetings and Conferences. Dr. Nazri has published over 100 scientific papers, 12 proceedings volumes, two text books on science and technology of lithium batteries, and is the holder of 15 U.S. patents. His research interests are in the area of materials for advance batteries for transportation applications, supercapacitors, solid-state hydrogen storage materials, electrochemical catalysis, synthesis of novel materials, and advanced analytical techniques for real time study of electrochemical systems. Dr. Nazri received his Ph.D. in Physical Chemistry from the Center for Electrochemical Sciences, Case Western Reserve University.

Pfeifer, Michael
Michael Pfeifer is President of Industrial Metallurgists, LLC and is a consultant in failure analysis and metallurgy. Previously, he worked for 13 years at Motorola as a manufacturing engineer in an integrated circuit factory and as a design/quality/cost reduction engineer for automotive electronics. At Motorola, Mike learned and applied the engineering techniques required to design and manufacture great products. He is author of the book, Materials Enabled Designs: The Materials Engineering Perspective to Product Design and Manufacturing, which discusses how to make design and manufacturing decisions in order to optimize the materials used in a product so that the product meets performance,
INSTRUCTOR BIOGRAPHIES

reliability, and cost requirements. Mike received a B.S. and M.S. in Metallurgical Engineering from University of Illinois and a Ph.D. in Materials Science and Engineering from Northwestern 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 Dryden Flight Research Facility. Alex is a member of SAE and IEEE. He holds a B.S. in aircraft engineering and an M.S. in mechanical engineering, both from Western Michigan University.

Ringsler, George J.
Mr. Ringsler has over 30 years of experience in the commercial aviation and US defense industries. As an Adjunct Instructor of Aeronautics at Embry-Riddle Aeronautical University, Mr. Ringsler teaches graduate and undergraduate courses in Mechanical/Structural Factors; Aerodynamics; Aviation Human Factors; Aviation System Safety Management; Aviation/Aero Industrial Safety Management; and Aviation Safety Program Management (SMS). Mr. Ringsler held executive positions in engineering and quality assurance for top defense and aviation manufacturers, FAA repair stations, and aftermarket distributors. His responsibilities included company-wide quality system training and liaison related to compliance with all applicable ISO, AGMS, FAA, C.A.S.E., EASA, and International CAA regulations and air-carrier domestic and international regulatory issues. As a design engineer, he specialized in structural analysis, testing, and flammability performance of aircraft interior structures. Mr. Ringsler holds a Masters of Aeronautical Science degree in Aerospace/Aviation Safety Systems, is a Board Licensed Professional Engineer in the field of Mechanical Engineering, and holds FAA-DER authorizations in both Aircraft Structures and Flammability. He holds certifications as both a FAA Manufacturing DAR (Airworthiness) and FAA Maintenance DAR (Export). In addition, he is HAZMAT and Six-Sigma Black Belt (Phase I & II) Certified, and is a certified ISO 9001, AS9120, and AS9100 Internal Auditor. He holds various patents and applications, has authored numerous technical reports and presentations, and is a contract writer/speaker for various trade organizations.

Roslund, Jerry L.
Dr. Jerry Roslund is an independent consultant specializing in the Design of Experiments (DOE) and Reliability Methods. In his 24-years with GM, he provided leadership as a GM Technical Fellow for Statistical Methods and Reliability and as a Validation Technical Integration Engineer at GM North America Vehicle Engineering. Specifically, Dr. Roslund conducted seminars on the Key Aspects of Quality, Reliability and Durability (QRD), Weibull Analysis, and Design of Experiments (DOE) for leaders and engineers within both GM and GM Suppliers. He also developed numerous course textbooks and conducted over 200 seminars providing a wealth of experience and a vast number of case studies. Dr. Roslund is a member of SAE International, ASQ, and the Society of Reliability Engineers. He received his B.S. degree in Mechanical Engineering from the University of Nebraska, M.S.M.E. from Cleveland State University, and Ph.D. in Systems Engineering from Oakland University.

Ross, Phillip J.
Phillip J. Ross is President of Quality Services International, Inc., a consulting firm specializing in quality and statistical training. He has accumulated over 4500 hours of classroom instruction teaching courses in quality, design tools, and manufacturing processes and problem solving in the United States, Great Britain, Holland, Japan, and Singapore. Prior to his consulting business, Mr. Ross worked for General Motors in automotive powertrain design and development and automobile manufacturing and assembly. He first worked with Allison Transmission Division in product design/development and then with Saturn Corporation in the manufacturing and assembly aspects. Mr. Ross was involved in the design phase of many transmission components and systems, developed statistical/quality methods and training, and performed process development. He also performed process development for lost foam casting, painting, molding, and others while at Saturn. Mr. Ross is the author of the book Taguchi Techniques for Quality Engineering which has sold over 35,000 copies worldwide, has had articles published in Quality Progress by ASQC and in Target by AME and is the holder of three patents on product design. Mr. Ross received a B.S. in aircraft engineering from General Motors Institute, and is an ASQ Fellow and Certified Quality Engineer.

Rutledge, Drexel L.
Mr. Rutledge is an Aerospace Consultant with Integrity Engineering, Inc. where he works with several aerospace companies in the area of Product Support and Sustainment. His principal areas of expertise are in project management, technical information development and delivery, and proposal development activities. Prior to joining Integrity Engineering, Inc, Mr. Rutledge was the Systems Engineering Director at Lockheed Martin Aeronautics Company responsible for developing and delivering the technical information needed to operate and maintain all aircraft manufactured or supported by Lockheed Martin Aeronautics by all US and foreign operators. Mr. Rutledge is a Certified Professional Manager, a Past Chairman of the Product Support Executive Board of Directors of the Aerospace Industries Association, a Past President and Chairman of the Board of Directors of the General Dynamics Management Association, a member of the Air Force Association, and an Honorary Lifetime Member of the International Office and Professional Employees Industrial Union. He has served as the Industry Representative and co-chair of multiple Department of Defense and Industry project teams. He is the recipient of the 2006 Leonard Ross Memorial Award for Outstanding Contributions in the field of Logistics. Mr. Rutledge has a Bachelor of Science in Business Management as well as a Master of Business Administration from LeTourneau University in Texas.

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 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 Engineering Meetings Board, a Professional Development Instructor, and the Lead Faculty Member of the SAE Vehicle Noise Control Engineering Academy. He is also a 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, and a contributing editor of Sound and Vibration publication. He has presented technical papers, organized and chaired numerous technical sessions developed by SAE and other professional organizations. Dr. Saha has also won several awards presented by SAE 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.
Began his career as a quality management professional in the U.S. Navy, quality assurance specialist, Sorrentino is certified as a level III examiner through the corporate sector and has successfully worked with more than 25 companies, military and aerospace contractors, and government agencies throughout the U.S. As president and CEO of Lean Quality Systems, Inc., Sorrentino specializes in implementing new standard methods for the corporate sector and has successfully worked with more than 25 corporations in the southern California area alone. A retired U.S. Navy quality assurance specialist, Sorrentino is certified as a level III examiner for visual, magnetic particle, dye penetrant, and ultrasonic inspections. He began his career as a quality management professional in the U.S. Navy, initially as chief petty officer, level III NAVSEA examiner/quality assurance division officer and spent eight years as a GS1910 quality specialist.

Schofield, Alan

Alan Schofield is an active consultant for Greene, Tweed & Co., where he recently retired as Global Director of Engineering. With global responsibility for the engineering function of the organization’s five business groups, as well as the Central Engineering function, Mr. Schofield was in charge of the management of all aspects of engineering design, product and material development covering applications engineering, R&D, validation, and in-service engineering support of all products. Mr. Schofield was also Aerospace Engineering Manager prior to his appointment as Global Director. Prior to that he was with CoorsTek as Director of Engineering Sales and Marketing, at Fluorocarbon Co. (now St. Gobain) as Seals Product Manager, at Shamban Intl. as Engineering Manager, and at W. S. Shamban & Co. (now Trelleborg) as Sales Engineer. The holder of three U.S. patents involving seal design and application, Mr. Schofield presently serves on the Steering Council for the SAE A6 Fluid Power, Actuation and Control Technology Committee. Additionally, he also represented Airbus on the SAE A6C2 Seals Panel, serving as Panel Chair and Secretary. He has also served as a member of the SAE AMS Committee P (Polymers) and the AMS Committee CE (Elastomers). Mr. Schofield has acted as sponsor for twenty-two document reviews and sponsor for the publication of six new documents while in his roles on SAE Standards Committees. Mr. Schofield received his B.S. in Mechanical Engineering in the UK.

Seyboldt, Charles F.

Mr. Charles Seyboldt has degrees in Mechanical Engineering and Law. He has over 15 years of experience in the transportation industry, having engineering responsibilities covering a broad range of product and manufacturing technologies. He is a registered Professional Engineer and a registered patent agent.

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, 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.

Sorrentino, Joseph

For nearly three decades, Joseph Sorrentino has been instrumental in implementing successful quality management systems for commercial companies, military and aerospace contractors, and government agencies throughout the U.S. As president and CEO of Lean Quality Systems, Inc., Sorrentino specializes in implementing new standard methods for the corporate sector and has successfully worked with more than 25 corporations in the southern California area alone. A retired U.S. Navy quality assurance specialist, Sorrentino is certified as a level III examiner for visual, magnetic particle, dye penetrant, and ultrasonic inspections. He began his career as a quality management professional in the U.S. Navy, initially as chief petty officer, level III NAVSEA examiner/quality assurance division officer and spent eight years as a GS1910 quality specialist.

Spence, William Cory

As a partner in the Litigation and Intellectual Property departments at Ungaretti and Harris, Cory assists individual and business clients in obtaining their best possible outcome in contentious legal matters. A registered patent attorney, Cory has extensive experience in litigation, arbitration, and mediation involving all areas of Intellectual Property law in the U.S., as well as international patent litigation involving multiple parties and jurisdictions, including Asia. He is a published author and frequent speaker on intellectual property issues, and has been repeatedly recognized as an “Illinois Rising Star”. Prior to joining Ungaretti & Harris, Cory spent twelve years practicing law at Kirkland & Ellis LLP. Cory is a graduate of the University of Notre Dame, where he obtained separate Bachelor of Science Degrees in Chemical Engineering and Biophysics. Upon graduation, he received his commission as a Second Lieutenant in the United States Air Force, Medical Service Corps. After completing his military service, he worked for several years in the chemical industry before pursuing his legal education at the University of Houston Law Center.

Stillinger, Jeffrey

Mr. Stillinger has over 20 years experience in the gas turbine industry and is currently a Critical Parts Lifting consultant working at Rolls-Royce Corporation in Indianapolis, Indiana. The role requires a broad background with analytical models, rotor grade materials, manufacturing, design, safety & reliability, certification, and testing. Mr. Stillinger has a focus in rotating structures analysis, and has more recently been involved in developing probabilistic methods for systems. Mr. Stillinger is currently active on the Aerospace Industries Association’s Rotor Integrity Subcommittee (RISC) working with the FAA and EASA on issues related to damage tolerance for gas turbine engines. RISC represents a multi-OEM effort to quantify and recommend best practice. In his current role, Jeff works with the FAA on a regular basis. Jeff serves on the Industrial Advisory Board at Indiana University Purdue University at Indianapolis (IUPUI).

Stricker, Peter A.

Mr. Stricker has 35 years’ experience in the aerospace industry, working on hydraulic systems and components for Vickers, which was later acquired by Eaton Corporation. During the first twenty years, he was engaged in the engineering design and development of hydraulic pumps, motors and integrated systems for commercial, military fixed and rotor wing aircraft, as well as ground defense vehicles. During the last fifteen years, Mr. Stricker has been involved in the Sales and Marketing side of the business, providing technical sales and marketing support and financial modeling for commercial and military aircraft hydraulic systems. Beginning during the spring of 2014, he will be “semi-retired”, working on selected engineering projects. Mr. Stricker is currently Vice Chairman of the Power Sources Panel of SAE International Committee A6, Aerospace Actuation, Control and Fluid Power Systems. He has authored two recent SAE International documents, AIR5872 Aerospace Hydraulic Pump Controls and ARP4940 Application Guide for Aerospace Hydraulic Motors. Mr. Stricker holds a B.S. Mechanical Engineering from McGill University, a M.S. Mechanical Engineering from the University of British Columbia, and an M.B.A. from Millsaps College. He has been a registered Professional Engineer in the State of Mississippi since 1980.

Timmis, Eric

Eric Timmis is the owner of BusinessIsAContactSport.com, a training and consulting company dedicated to business process improvement, focusing on value and quality management implementation, program/ project management training, and the integration of strategic partnership relationships between departments and organizations. Mr. Timmis has over thirty years of diversified experience across several industries, which includes the delivery of value engineering facilitation services to Ford Motor Co. and its supplier community and training for Eaton Corporation’s, Product Development Group. He is also a
recognized speaker at various national conferences. Eric received a B.Sc. in Civil Engineering from the University of Birmingham in England and is a member of the Institution of Civil Engineers.

**Todeschi, Michel**
Michel Todeschi is currently Head of the Electromechanical Actuation and THSA group within the Airbus Group. He was appointed to his current position in 2008 and is in charge of the management of R&T, design, development, validation and in-service engineering support of the Electromechanical Actuation and THSA for all Airbus models from A320 to A380, A400M and A350. In addition, Mr. Todeschi holds the Senior Expert position in Electrical Actuation and Power Electronics within the Airbus Group. He started as a development engineer for the A330/A340 program and research programs. In 2001, He was appointed to the A380 program as Task Leader where he led the team in charge of the development of the A380 Primary Flight Control Actuation. In particular, he was responsible for the introduction into service of Electrohydrotastic Actuators (EHAs) and associated Power Electronics Modules in Commercial Aircraft applications. Mr. Todeschi contributes to the SAE International-A6 Aerospace Actuation, Control and Fluid Power Systems as a member of the Flight Control Systems, EMA and EHA/IAP panels. He received his M.S. in Electronic Engineering from ENSEEIHT, Toulouse.

**Walker, R.W. (Bill)**
Bill Walker is the owner and principal engineer at Walker Technical Services where he provides consulting services in design, testing, and certification for manufacturers and operators of aerospace and mobile equipment throughout North America, Europe, and Asia. Mr. Walker has almost four decades of experience in test engineering, regulatory compliance engineering, and product safety engineering. Mr. Walker previously held the position of Manager of Safety and Compliance at John Deere Forestry, Inc., where he oversaw safety engineering, regulatory compliance, product liability management, intellectual property management, and standards development activities for the world-wide manufacturer of advanced forestry equipment. Additionally, Mr. Walker held the positions of Manager of Testing at Diamond Aircraft Industries, Director of Engineering, Manager of Flight Testing, and Test Engineer at Eurocopter Canada, Ltd. He is currently a member of SAE International MTCA (forestry machinery), ISO TC23/SC15 (Forestry Machinery), TC23/SC3 (Safety and comfort of the operator), and TC23/SC14 (Operator Controls, Operations Symbols and other displays, and Operator Manuals). He has also served on Canadian Standards Association Technical Committees on Mobile Forestry Machines and Roller Protective Structures. Mr. Walker received a B.Sc. in Aerospace Engineering from Northrop University and M.A.Sc. in Aerospace Engineering from the University of Toronto Institute for Aerospace Studies.

**Wang, Wego**
Dr. Wang is currently an aerospace engineer in the Engine Certification Office of the Federal Aviation Administration, where he serves as the focal point for Parts Manufacturer Approval. He has been a technical instructor and a researcher in mechanical engineering and materials science for more than twenty years. Dr. Wang taught at Northeastern University and is currently an adjunct faculty at Boston University and the University of Massachusetts - Lowell. He received many awards, commendations and recognitions from the Army Research Laboratory, the FAA and other institutions. Dr. Wang authored or co-authored over 40 technical/professional articles, and presented lectures/reports at numerous seminars/conferences. Active with professional societies, he is on the executive committee of ASM International Boston Chapter and was the 2005-06 Chairman of the Chapter. He also served on the executive committee of TMS Boston Section, where he was president from 1993-95. Dr. Wang has a B.S. in Mechanical Engineering from National Cheng - Kung University, a M.S. in Mechanical Engineering from National Taiwan University, and a M.S. and Sc.D. in Materials Science and Engineering from Massachusetts Institute of Technology.

**Woodside, Kenneth B.**
Ken Woodside is a senior consultant with The Luminous Group. His consulting experience has focused on assisting organizations improve their ability to operate more effectively and efficiently while meeting customer needs and expectations. He is particularly experienced in designing and implementing interventions that focus on developing creative bottom line strategies, increase productivity and improve production effectiveness. These interventions have included senior management and line personnel in the process of developing and implementing change strategies including restructuring, lean manufacturing, quality improvement, and customer / supplier relations. Ken was part of a long term consulting experience to install process control at a major metal stamping and assembly plant that provided the foundation for QS-9000 certification. As a part of this consultation 26 production teams were launched and trained using process control, lean manufacturing and quality improvement processes resulting in a 200% improvement in line transition, significant up-time improvement, product quality and lowest inventory cost in the division. One of these teams reduced inventory by 60%, had only three quality issues in two million parts and no quality problems for 18 months. This effort had the full support of both Management and UAW leadership. Ken has a Bachelors Degree in Finance and a Masters Degree in Social Psychology, both from Boston University. He earned his Doctorate Degree in Organization Development and Psychology from United University in Dayton Ohio.

**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.

---

**Instructors Wanted...**
To shape the future of mobility engineering, SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses; we are seeking expertise in a variety of topics including:

**Aerospace**
- Certification
- Regulations
- Standards
- Technologies

Contact SAE International Professional Development to explore how you can help to shape the future of industry.

Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568
**2017 SAE PROFESSIONAL DEVELOPMENT COURSE SCHEDULE – AEROSPACE**  
**MARCH - DECEMBER 2017**

<table>
<thead>
<tr>
<th>Location</th>
<th>Event Description</th>
<th>Date</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indianapolis, IN, USA - Crowne Plaza Indianapolis - Airport</td>
<td>Common Training for DPRV Personnel</td>
<td>Mar 28-30</td>
<td>I.D.# C1501</td>
</tr>
<tr>
<td>Farmington, CT, USA - Homewood Suites by Hilton Hartford-Farmington</td>
<td>Common Training for DPRV Personnel</td>
<td>Mar 21-23</td>
<td>I.D.# C1501</td>
</tr>
<tr>
<td>Livonia, MI, USA - Effective Training Inc.</td>
<td>New! Engineering Drawing Requirements 1-day Workshop</td>
<td>Mar 16</td>
<td>I.D.# ETY100</td>
</tr>
<tr>
<td></td>
<td>New! Fundamentals of GD&amp;T 2009 - 3-day Public Workshop</td>
<td>Mar 21-23</td>
<td>I.D.# ETY611</td>
</tr>
<tr>
<td>Tysons, VA, USA - LMI (Logistics Management Institute)</td>
<td>Understanding the FAA Aircraft Certification Process</td>
<td>Mar 21-22</td>
<td>I.D.# C0821</td>
</tr>
<tr>
<td></td>
<td>Aircraft Cabin Safety and Interior Crashworthiness</td>
<td>Mar 23-24</td>
<td>I.D.# C0926</td>
</tr>
<tr>
<td></td>
<td>Advanced GD&amp;T Competencies: Datum Usage</td>
<td>Mar 27</td>
<td>I.D.# WB1319</td>
</tr>
<tr>
<td></td>
<td>Advanced GD&amp;T Competencies: Profile of a Surface</td>
<td>Mar 29</td>
<td>I.D.# WB1320</td>
</tr>
<tr>
<td></td>
<td>Advanced GD&amp;T Competencies: Composite Positioning</td>
<td>Mar 31</td>
<td>I.D.# WB1321</td>
</tr>
<tr>
<td>APRIL 2017</td>
<td>Common Training for DPRV Personnel</td>
<td>Apr 4-6</td>
<td>I.D.# C1501</td>
</tr>
<tr>
<td>Norwalk, CA, USA - Cerritos College (SCCTT)</td>
<td>Common Training for DPRV Personnel</td>
<td>Apr 4-6</td>
<td>I.D.# C1501</td>
</tr>
</tbody>
</table>

For the most up-to-date live learning schedule visit training.sae.org/calendar
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 3-4</td>
<td>New! Effective Writing for Engineering and Technical Professionals</td>
<td></td>
<td>I.D.# C1605</td>
</tr>
<tr>
<td>Apr 3-4</td>
<td>Corrosion Engineering and Prevention</td>
<td></td>
<td>I.D.# C1217</td>
</tr>
<tr>
<td>Apr 3-4</td>
<td>Engineering Project Management</td>
<td></td>
<td>I.D.# 99003</td>
</tr>
<tr>
<td>Apr 3-5</td>
<td>Weibull-Log Normal Analysis Workshop</td>
<td></td>
<td>I.D.# 86034</td>
</tr>
<tr>
<td>Apr 4-6</td>
<td>Managing Engineering &amp; Technical Professionals</td>
<td></td>
<td>I.D.# C0608</td>
</tr>
<tr>
<td>Apr 6-7</td>
<td>Product Liability and The Engineer</td>
<td></td>
<td>I.D.# 82001</td>
</tr>
<tr>
<td>Apr 6-7</td>
<td>New! Critical Concepts of Tolerance Stacks</td>
<td></td>
<td>I.D.# ET1701</td>
</tr>
<tr>
<td>Apr 7</td>
<td>New! Principled Negotiations</td>
<td></td>
<td>I.D.# C1602</td>
</tr>
<tr>
<td>Live Online</td>
<td>Root Cause Problem Solving: Methods and Tools</td>
<td></td>
<td>I.D.# WB0931</td>
</tr>
<tr>
<td>Live Online</td>
<td>Acoustic Fundamentals for Solving Noise and Vibration Problems</td>
<td></td>
<td>I.D.# WB1309</td>
</tr>
<tr>
<td>Shanghai, CA</td>
<td>SAE International Troy Office</td>
<td></td>
<td>Applications of GD&amp;T 2-Day Workshop - I.D.# ETY140</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAY 2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norwalk, CA</td>
<td>Cerritos College (SCCTT)</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phoenix, AZ</td>
<td>Courtyard Phoenix North Happy Valley</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmington, CT</td>
<td>Homewood Suites by Hilton Hartford-Farmington</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Chester, OH</td>
<td>Indiana Wesleyan University</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Diego, CA</td>
<td>Homewood Suites-San Diego Airport-Liberty Station</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warrendale, PA</td>
<td>SAE International World Headquarters</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA</td>
<td>SAE International Troy Office</td>
<td></td>
<td>Strategic Leadership - I.D.# C0620</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Introduction to Failure Mode and Effects Analysis for Product and Process - I.D.# C1201</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JUNE 2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hamburg, Germany</td>
<td>THE VENUE</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td>Indianapolis, IN, USA</td>
<td>Crowne Plaza Indianapolis - Airport</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td>San Diego, CA</td>
<td>Homewood Suites-San Diego Airport-Liberty Station</td>
<td></td>
<td>Common Training for DPRV Personnel - I.D.# C1501</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA</td>
<td>SAE International Troy Office</td>
<td></td>
<td>Design Review Workshop - I.D.# C1306</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Material Selection and Testing for Plastics - I.D.# C0134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Introduction to Advanced High Strength Steel Applications and Manufacturing - I.D.# C1416</td>
</tr>
</tbody>
</table>

*For the most up-to-date live learning schedule visit training.sae.org/calendar*
## PROFESSIONAL DEVELOPMENT SCHEDULE

### West Chester, OH, USA - Indiana Wesleyan University
- **Jun 6-8** Common Training for DPRV Personnel – I.D.# C1501
- **Jun 13-15** Common Training for DPRV Personnel – I.D.# C1501

### Troy, MI, USA - SAE International Troy Office
- **Jun 26-27** Engineering Project Management – I.D.# 99003
- **Jun 28-29** Leading High Performance Teams – I.D.# C0410
- **Jun 29** Effective Decision-Making: A Methodology Approach – I.D.# C1354

### Warrendale, PA, USA – SAE International Warrendale Office
- **Jun 6-8** Common Training for DPRV Personnel – I.D.# C1501
- **Jun 28-30** New! AS9100D Internal Auditor Training – I.D.# C1633

### Livonia, MI, USA - Effective Training Inc.
- **Jun 27-29** New! Fundamentals of GD&T 2009 - 3-day Public Workshop – I.D.# ETY611

### Cleveland, OH, USA - Ohio Aerospace Institute
- **Jun 1-2** Introduction to DO-178C – I.D.# C1410
- **Jun 13-14** Understanding the FAA Aircraft Certification Process – I.D.# C0821
- **Jun 15-16** Aircraft Cabin Safety and Interior Crashworthiness – I.D.# C0926

### Grand Rapids, MI, USA - DeVos Place Convention Center—In Conjunction with the SAE 2017 Noise and Vibration Conference and Exhibition
- **Jun 15-16** Sound Package Materials for Vehicle Noise Control – I.D.# 92032
- **Jun 15-16** Practical NVH Signal Processing Methods – I.D.# C0431

### Live Online
- **Jun 5-16** Vibration Analysis Using Finite Element Analysis (FEA) – I.D.# WB1401
- **Jun 26-30** Introduction to Design Review Based on Failure Modes (DRBFM) – I.D.# WB1047

### Shanghai, China - SAE International Troy Office
- **Jun 5-6** ARP4754A and the Guidelines for Development of Civil Aircraft and Systems – I.D.# C1118
- **Jun 5-6** Introduction to DO-178C – I.D.# C1410
- **Jun 8-9** ARP4761 and the Safety Assessment Process for Civil Airborne Systems – I.D.# C1245

### JULY 2017
- **Norwalk, CA, USA - Cerritos College (SCCTT)**
  - **Jul 11-13** Common Training for DPRV Personnel – I.D.# C1501

### Farmington, CT, USA - Homewood Suites by Hilton Hartford-Farmington
- **Jul 11-13** Common Training for DPRV Personnel – I.D.# C1501
- **Jul 25-27** Common Training for DPRV Personnel – I.D.# C1501

### West Chester, OH, USA - Indiana Wesleyan University
- **Jul 11-13** Common Training for DPRV Personnel – I.D.# C1501
- **Jul 18-20** Common Training for DPRV Personnel – I.D.# C1501

### Troy, MI, USA - SAE International Troy Office
- **Jul 17-18** Managing Programs and Associated Risks – I.D.# C0409
- **Jul 17-18** Robust Design – I.D.# C1231
- **Jul 26-27** Understanding the FAA Parts Manufacturer Approval Process – I.D.# C1234

### Livonia, MI, USA - Effective Training Inc.
- **Jul 11-12** New! Critical Concepts of Tolerance Stacks – I.D.# ET1701
- **Jul 11-12** Tolerance Stacks Using GD&T 1994 2-Day Workshop – I.D.# ETY310
- **Jul 25-26** Fundamentals of GD&T for Inspectors 2-day Workshop – I.D.# ETY125

### Munich, Germany - MTU Aero Engine AG
- **Jul 18-20** Common Training for DPRV Personnel – I.D.# C1501

### San Diego, CA, USA - Homewood Suites-San Diego Airport-Liberty Station
- **Jul 4-6** Common Training for DPRV Personnel – I.D.# C1501

### Live Online

### AUGUST 2017
- **Norwalk, CA, USA - Cerritos College (SCCTT)**
  - **Aug 1-3** Common Training for DPRV Personnel – I.D.# C1501

### Farmington, CT, USA - Homewood Suites by Hilton Hartford-Farmington
- **Aug 1-3** Common Training for DPRV Personnel – I.D.# C1501
- **Aug 15-17** Common Training for DPRV Personnel – I.D.# C1501

### West Chester, OH, USA - Indiana Wesleyan University
- **Aug 8-10** Common Training for DPRV Personnel – I.D.# C1501
- **Aug 22-24** Common Training for DPRV Personnel – I.D.# C1501

---

For the most up-to-date live learning schedule, visit training.sae.org/calendar

141
# Professional Development Schedule

<table>
<thead>
<tr>
<th>Location</th>
<th>Event Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saint-Hubert, QC, Canada</td>
<td>École nationale d’aérotechnique (ÉNA)</td>
</tr>
<tr>
<td>Aug 29-31</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Troy, MI, USA</td>
<td>SAE International Troy Office</td>
</tr>
<tr>
<td>Aug 2-4</td>
<td>Principles of Cost and Finance for Engineers – I.D.# C0828</td>
</tr>
<tr>
<td>Aug 14-15</td>
<td>Design of Experiments (DOE) for Engineers – I.D.# C0406</td>
</tr>
<tr>
<td>Aug 16-18</td>
<td>Weibull-Log Normal Analysis Workshop – I.D.# 86034</td>
</tr>
<tr>
<td>Aug 17-18</td>
<td>Design for Manufacture and Assembly (DFM/DFA) – I.D.# C0418</td>
</tr>
<tr>
<td>Aug 22-24</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Aug 28-30</td>
<td>Managing Engineering &amp; Technical Professionals – I.D.# C0608</td>
</tr>
<tr>
<td>Aug 31</td>
<td>New! Principled Negotiation – I.D.# C1602</td>
</tr>
<tr>
<td>Livonia, MI, USA</td>
<td>Effective Training Inc.</td>
</tr>
<tr>
<td>Aug 29-30</td>
<td>Fundamentals of GD&amp;T 1994 2-day Workshop – I.D.# ETY120</td>
</tr>
<tr>
<td>Tysons, VA, USA</td>
<td>LMI (Logistics Management Institute)</td>
</tr>
<tr>
<td>San Diego, CA, USA</td>
<td>Homewood Suites–San Diego Airport–Liberty Station</td>
</tr>
<tr>
<td>Aug 8-10</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>SEPTEMBER 2017</td>
<td></td>
</tr>
<tr>
<td>Norwalk, CA, USA</td>
<td>Cerritos College (SCCTT)</td>
</tr>
<tr>
<td>Sep 12-14</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Phoenix, AZ</td>
<td>Courtyard Phoenix North Happy Valley</td>
</tr>
<tr>
<td>Sep 19-21</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Farmington, CT</td>
<td>Homewood Suites by Hilton Hartford–Farmington</td>
</tr>
<tr>
<td>Sep 12-14</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Sep 26-28</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>West Chester, OH, USA</td>
<td>Indiana Wesleyan University</td>
</tr>
<tr>
<td>Sep 5-7</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Troy, MI, USA</td>
<td>SAE International Troy Office</td>
</tr>
<tr>
<td>Sep 7-8</td>
<td>The Role of the Expert Witness in Product Liability Litigation – I.D.# 92054</td>
</tr>
<tr>
<td>Sep 21-22</td>
<td>Accelerated Test Methods for Ground and Aerospace Vehicle Development – I.D.# C0316</td>
</tr>
<tr>
<td>Warrendale, PA, USA</td>
<td>SAE International Warrendale Office</td>
</tr>
<tr>
<td>Sep 12-14</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Ft. Worth, TX, USA</td>
<td>Ft. Worth Convention Center—in conjunction with the SAE 2017 AeroTech Congress &amp; Exhibition</td>
</tr>
<tr>
<td>Oct 3-5</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>San Diego, CA, USA</td>
<td>Homewood Suites–San Diego Airport–Liberty Station</td>
</tr>
<tr>
<td>Oct 3-5</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Oct 31-Nov 2</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Farmington, CT, USA</td>
<td>Homewood Suites by Hilton Hartford–Farmington</td>
</tr>
<tr>
<td>Oct 3-5</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Oct 16-17</td>
<td>ARP4754A and the Guidelines for Development of Civil Aircraft and Systems – I.D.# C1118</td>
</tr>
<tr>
<td>Oct 17-19</td>
<td>Common Training for DPRV Personnel – I.D.# C1501</td>
</tr>
<tr>
<td>Oct 19-20</td>
<td>ARP4761 and the Safety Assessment Process for Civil Airborne Systems – I.D.# C1245</td>
</tr>
<tr>
<td>Oct 24-25</td>
<td>Understanding the FAA Aircraft Certification Process – I.D.# C0821</td>
</tr>
</tbody>
</table>

For the most up-to-date live learning schedule visit training.sae.org/calendar
## Professional Development Schedule

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
<th>Dates</th>
<th>Institute/Company</th>
<th>I.D.#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Cabin Safety and Interior Crashworthiness</td>
<td>Homewood Suites-San Diego</td>
<td>Oct 26-27</td>
<td>I.D.# C0926</td>
<td></td>
</tr>
<tr>
<td>Introduction to DO-178C</td>
<td>Airport - Liberty Station</td>
<td>Oct 30-31</td>
<td>I.D.# C1410</td>
<td></td>
</tr>
<tr>
<td><strong>San Diego, CA, USA - Homewood Suites-San Diego Airport – Liberty Station</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Training for DPRV Personnel</td>
<td>Oct 17-19</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Chester, OH, USA - Indiana Wesleyan University</td>
<td>Oct 10-12</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct 24-26</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleveland, OH, USA - Ohio Aerospace Institute</td>
<td>Oct 24-26</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Indianapolis, IN, USA - Crowne Plaza Indianapolis - Airport</td>
<td>Oct 31-Nov 2</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Munich, Germany - MTU Aero Engine AG</td>
<td>Oct 24-26</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA - SAE International Troy Office</td>
<td>Oct 5-6</td>
<td>Leading High Performance Teams</td>
<td>I.D.# C0410</td>
<td></td>
</tr>
<tr>
<td>Oct 10-11</td>
<td>Introduction to Advanced High Strength Steel Applications and Manufacturing</td>
<td>I.D.# C1416</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct 12-13</td>
<td>Corrosion Engineering and Prevention</td>
<td>I.D.# C1217</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct 19-20</td>
<td>Design Review Workshop</td>
<td>I.D.# C1306</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct 30-Nov 1</td>
<td>Strategic Leadership</td>
<td>I.D.# C0620</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Livonia, MI, USA - Effective Training Inc.</strong></td>
<td>Oct 25-27</td>
<td>New! Fundamentals of GD&amp;T 2009 - 3-day Public Workshop</td>
<td>I.D.# ETY611</td>
<td></td>
</tr>
<tr>
<td>Oct 30-31</td>
<td>Applications of GD&amp;T 2-Day Workshop</td>
<td>I.D.# ETY140</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Live Online</strong></td>
<td>Oct 16-27</td>
<td>Finite Element Analysis (FEA) for Design Engineers</td>
<td>I.D.# WB1241</td>
<td></td>
</tr>
<tr>
<td>Oct 17-26</td>
<td>Root Cause Problem Solving: Methods and Tools</td>
<td>I.D.# WB0931</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct 30-Nov 1</td>
<td>Design of Experiments (DOE) for Engineers</td>
<td>I.D.# WB0932</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>November 2017</strong></td>
<td>Miami, FL, USA - Cambria Hotel and Suites Miami Airport</td>
<td>Nov 14-16</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
</tr>
<tr>
<td>Indianapolis, IN, USA - Crowne Plaza Indianapolis - Airport</td>
<td>Nov 28-30</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Irving, TX, USA - Holiday Inn Express and Suites Dallas</td>
<td>Nov 28-30</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Farmington, CT, USA - Homewood Suites by Hilton Hartford-Farmington</td>
<td>Nov 7-9</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Nov 14-16</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Chester, OH, USA - Indiana Wesleyan University</td>
<td>Nov 7-9</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Nov 28-30</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Diego, CA, USA - Homewood Suites-San Diego Airport – Liberty Station</td>
<td>Nov 7-9</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Munich, Germany - MTU Aero Engine AG</td>
<td>Nov 28-30</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA - SAE International Troy Office</td>
<td>Nov 15-17</td>
<td>Principles of Cost and Finance for Engineers</td>
<td>I.D.# C0828</td>
<td></td>
</tr>
<tr>
<td>Nov 29-30</td>
<td>Engineering Project Management</td>
<td>I.D.# 99003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov 16</td>
<td>Introduction to Statistical Tolerance Stacks 1-Day Workshop</td>
<td>I.D.# ETY130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tysons, VA, USA - LMI (Logistics Management Institute)</td>
<td>Nov 14-15</td>
<td>Product Liability and The Engineer</td>
<td>I.D.# 82001</td>
<td></td>
</tr>
<tr>
<td>Nov 28-30</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA - SAE International Troy Office</td>
<td>Nov 13-17</td>
<td>Engineering Management Academy</td>
<td>I.D.# ACAD09</td>
<td></td>
</tr>
<tr>
<td>Nov 14-15</td>
<td>Product Liability and The Engineer</td>
<td>I.D.# 82001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov 28-30</td>
<td>Common Training for DPRV Personnel</td>
<td>I.D.# C1501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA - SAE International Troy Office</td>
<td>Nov 15-17</td>
<td>Principles of Cost and Finance for Engineers</td>
<td>I.D.# C0828</td>
<td></td>
</tr>
<tr>
<td>Nov 29-30</td>
<td>Engineering Project Management</td>
<td>I.D.# 99003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov 16</td>
<td>Introduction to Statistical Tolerance Stacks 1-Day Workshop</td>
<td>I.D.# ETY130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tysons, VA, USA - LMI (Logistics Management Institute)</td>
<td>Nov 15-17</td>
<td>Principles of Cost and Finance for Engineers</td>
<td>I.D.# C0828</td>
<td></td>
</tr>
<tr>
<td>Nov 29-30</td>
<td>Engineering Project Management</td>
<td>I.D.# 99003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troy, MI, USA - SAE International Troy Office</td>
<td>Nov 13-17</td>
<td>Engineering Management Academy</td>
<td>I.D.# ACAD09</td>
<td></td>
</tr>
</tbody>
</table>

*For the most up-to-date live learning schedule visit training.sae.org/calendar*
PROFESSIONAL DEVELOPMENT SCHEDULE

Farmington, CT, USA - Homewood Suites by Hilton Hartford-Farmington
Dec 5-7 Common Training for DPRV Personnel – I.D.# C1501
Dec 12-14 Common Training for DPRV Personnel – I.D.# C1501

West Chester, OH, USA - Indiana Wesleyan University
Dec 12-14 Common Training for DPRV Personnel – I.D.# C1501
Dec 19-21 Common Training for DPRV Personnel – I.D.# C1501

Troy, MI, USA - SAE International Troy Office
Dec 7-8 Design of Experiments (DOE) for Engineers – I.D.# C0406
Dec 11-13 Managing Engineering & Technical Professionals – I.D.# C0608
Dec 12-14 Common Training for DPRV Personnel – I.D.# C1501
Dec 13-15 Weibull-Log Normal Analysis Workshop – I.D.# 86034
Dec 14 New! Principled Negotiation – I.D.# C1602

Puyallup, WA, USA - Best Western Premier Hotel - Puyallup
Dec 4-5 Understanding the FAA Parts Manufacturer Approval Process – I.D.# C1234

Taiwan, Taiwan – SAE International Office
Dec 13-15 Common Training for DPRV Personnel – I.D.# C1501

Livonia, MI, USA - Effective Training Inc.
Dec 5-7 New! Fundamentals of GD&T 2009 - 3-day Public Workshop – I.D.# ETY611

Live Online
Dec 4-15 Vibration Analysis Using Finite Element Analysis (FEA) – I.D.# WB1401
Dec 4-7 Introduction to Design Review Based on Failure Modes (DRBFM) – I.D.# WB1047
Dec 5-14 Tolerance Stack-up Fundamentals – I.D.# C0842

Instructors Wanted...
To shape the future of mobility engineering. SAE International Professional Development is seeking experienced engineering professionals with industry and/or academic backgrounds to develop and teach live classroom or online courses; we are seeking expertise in a variety of topics including:

Aerospace
• Certification
• Standards
• Regulations
• Technologies

Contact SAE International Professional Development to explore how you can help to shape the future of industry.
Frank Shoup: Frank.Shoup@sae.org, +1.724.772.8568

For the most up-to-date live learning schedule visit training.sae.org/calendar
The Member Connection is your one-stop shop to engage with other mobility engineering professionals like you:

- Join the conversation about SAE standards and leverage timely technical discussions and topics that affect you on the job
- Build your professional network, and seek and share advice among industry experts
- And more...

The Member Connection is available exclusively to SAE members only at connection.sae.org. Not a member? Visit connection.sae.org for a taste of the Member Connection, and to join for complete access.