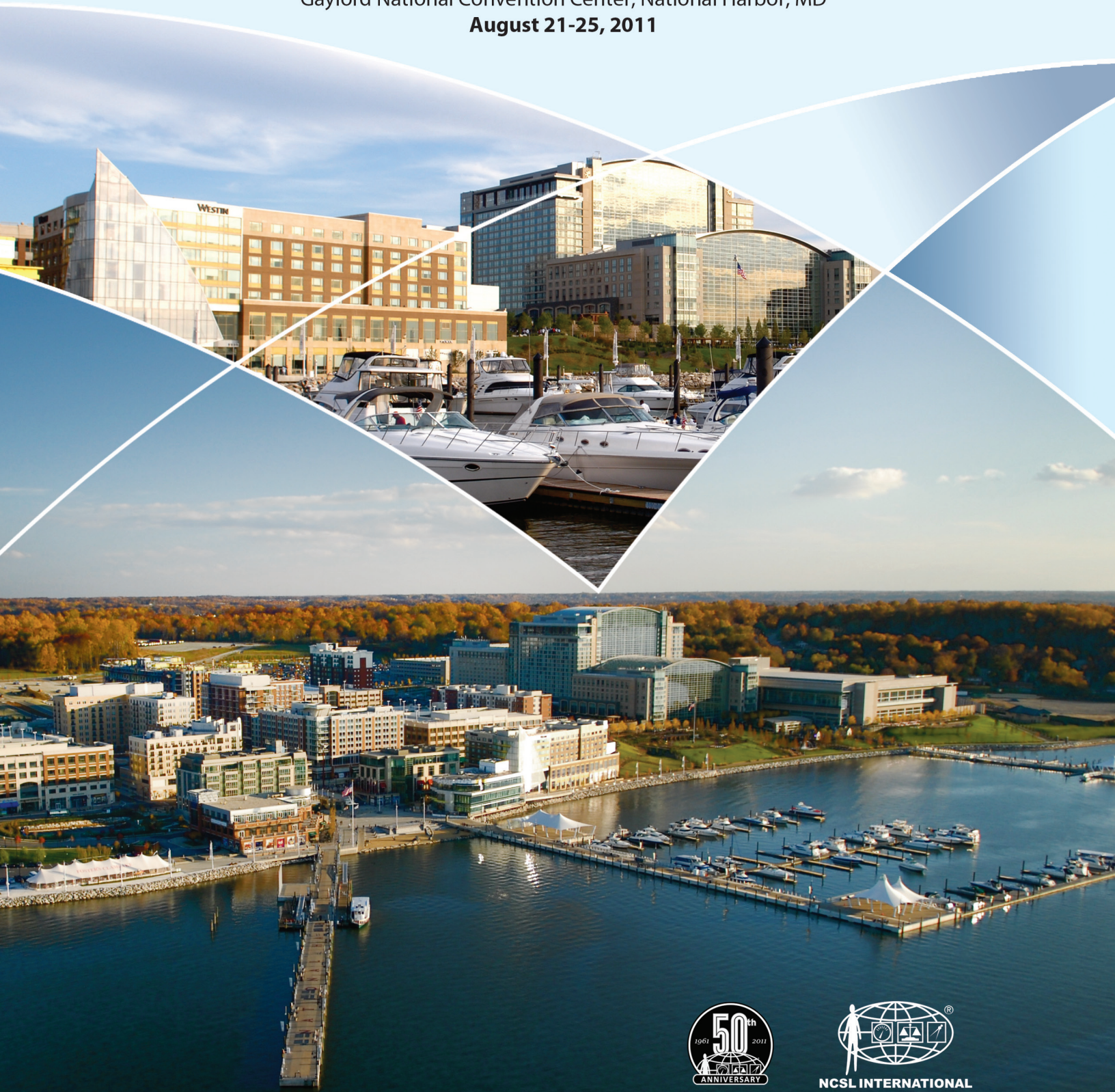


NCSL INTERNATIONAL WORKSHOP & SYMPOSIUM

REFLECTING ON THE PAST - LOOKING TO THE FUTURE

Gaylord National Convention Center, National Harbor, MD
August 21-25, 2011



NCSL INTERNATIONAL
Serving the World of Measurement

ncsli.org | info@ncsli.org | 303.440.3339

KENOTE ADDRESS



Dr. Patrick D. Gallagher, Director
National Institute of Standards and
Technology (NIST)

NIST and NCSLI Working Together to Support the Nation's Measurement System

The National Bureau of Standards (NBS) sponsored the founding of the National Conference of Standards Laboratories to address a number of problems in the measurement science community. Key scientists from industry and national laboratories saw the need for a formal organization, outside of government or industry that would bring people together to reduce overarching barriers to advances in measurement science. Back then, these challenges included the need for standardization of procedures, traceability, training requirements, and calibration lab design requirements. Since then NBS/NIST and NCSL/NCSLI have

worked in complementary ways to advance and strengthen the measurement infrastructure of the U.S. As we look to the future, the collaborative relationship between NIST and NCSLI can continue to provide the catalyst needed to solve the many new, complex problems emerging in measurement science. Additionally, opportunities for partnership have never been greater for NIST and NCSLI to work together to provide measurement support, training, and opportunities of interactions to the extremely broad audience of organizations that require demanding measurements to achieve their mission and goals.

JOIN US FOR A NIST TOUR Tuesday, August 23, 2011 1 PM to 5 PM

There will be four themed tours with 36 participants in each. Cost is \$35 per person. Visit our website at ncsl.org for tour descriptions and information.

Tour A – Electrical Metrology

Tour B – Optical Metrology

Tour C – Mass and Dimensional Metrology

Tour D – Pressure, Temperature, and Flow Metrology

TECHNICAL SESSIONS

Learning and Development

Inspiring the Next Generation
Measuring the Impact of Metrology
Laboratory Operations
Knowledge Management and Transfer

Technician/Bench Applications

Dimensional Metrology
Mass Metrology
Electrical Metrology
Thermometry
Pressure
Humidity Measurements
Torque

Management/Quality

Panel Discussion:
ANSI/NCSLI Z540.3-2006
Panel Discussion:
RP-8 and Procurement
Equipment Evaluation
Panel Discussion:
Metrological Traceability in
Pure Water Testing
Healthcare Metrology
Calibration Automation
Panel Discussion:
Delay Dating Merits and Risks
Proficiency Testing
Calibration Intervals

Global Perspectives

Legal Metrology
Panel Discussion:
Global Issues from a Regional
Metrology Perspective
Making the Case for Metrology
The Future of Metrology
History and Future of Measurement
Metrology and Innovation
Plenary: The New SI

Concepts/Theory

Uncertainty
Traceability
Physical Metrology



This year's Workshop & Symposium will be held in beautiful National Harbor, Maryland. Located just eight miles due south of Washington, DC, with convenient access to three major airports. NCSLI's headquarters hotel is the Gaylord National Resort & Convention Center, which is the largest combined hotel and convention center on the East Coast.

Register Now!

ncsli.org/conference
For registration questions and answers,
please call the NCSLI business office

303-440-3339

Gaylord National Resort & Convention Center
201 Waterfront Street
National Harbor, MD 20745

Group Rate:
Single/Double \$184
Triple \$204
Quad \$224
Executive Suite \$599
301-965-4000

FULL* REGISTRATION RATES	Regular Rate Ends June 30 th	Late Rate Begins July 1 st
Member Rate	\$1,015	\$1,115
Non-Member Rate	\$1,215	\$1,315
One Day Pass	\$400	\$400

*Full registration rate will receive a \$65 discount for staying at the conference hotel.

TUTORIAL & TRAIN THE TRAINER RATES	Regular Rate Ends June 30 th	Late Rate Begins July 1 st
HALF DAY SESSION RATE		
Member Rate	\$ 200	\$ 225
Non-Member Rate	\$ 250	\$275
FULL DAY SESSION RATE		
Member Rate	\$ 350	\$ 375
Non-Member Rate	\$ 400	\$ 425
2 DAY SESSION RATE		
Member Rate	\$ 650	\$ 700
Non-Member Rate	\$ 750	\$ 775

All Attendees and Guests who are attending any NCSLI International function must be registered, even if they are only participating in the Sunday evening reception. **BADGES ARE REQUIRED** for all events.

Full and Speaker Registration includes: Exhibitors' reception, entrance into the paper sessions, entrance into the exhibit hall, lunches (Monday - Thursday), workshop materials, including the proceedings.

Full and Speaker Registration **DOES NOT INCLUDE**: NCSLI Tutorials, guest program tours, or any travel expenses.

One Day Pass Registration includes: Entrance into the Paper Sessions, entrance into the exhibit hall, lunch for the day of attendance.

One Day Pass Registration **DOES NOT INCLUDE**: Workshop materials, including the proceeding, guest program tours, or any travel expenses.

Exhibit Only Registration: **DOES NOT INCLUDE**: Any Workshop & Symposium privileges except entrance to the exhibit hall and exhibitors' reception, tickets for lunches and banquet may be purchased separately.

Join us on the Spirit of Washington Dinner Cruise, Tuesday, August 23, 2011.

Let the *Spirit* move you!

NCSLI Attendees and guests will cruise the Potomac on the Spirit of Washington the city's most vibrant and unique combination of dining, dancing, entertainment and up-close views of the Potomac River and Washington DC's most historic sights.

For more information visit ncsli.org or call the business office at 303-440-3339.

Attendee \$35 Guest \$90

Limited seating 550



TUTORIAL PROGRAM

Friday, August 19, 2011 (full day)
8:00 AM – 5:00 PM

TT1 - Make Training Stick: A Systematic Approach to the Transfer of Learning
Jovie Masters

How to use a 9-part strategy to transfer learning to the organization by increasing an instructor's skills, involving managers and trainees, actively before, during and after the training events are addressed. Techniques to develop a manager's feedback and coaching skills are included with post-training. By the end of the session, the trainer will: Identify techniques to use a nine-part transfer of learning strategy to transfer learning in the organization; Create a 10-part classroom instructor skill development plan to increase the transfer of learning; Use post training performance analysis as a tool to identify what hinders the transfer of learning; Identify how to develop coaching and feedback skills used by managers to improve the transfer of learning; Identify specific techniques to involve managers in transferring learning; Identify how a learner's active role during training influences transferring learning; Select appropriate formats for four types of learner action plans to improve transferring learning; and Use a tool to measure the transfer of learning. These objectives will be covered in four units: 1) Overview; 2) The trainer's role in the transfer of learning; 3) The manager's role in the transfer of learning; and 4) The learner's role in transfer of learning.

Saturday and Sunday, August 20-21, 2011
8:00 AM – 5:00 PM (2 days)

T1 - Balance Calibration and Use in an Analytical Environment

Val Miller, NIST

Mark Ruefenacht, Heusser Neweigh

This NIST Seminar will discuss the sources of weighing errors in analytical environments, methodologies for quantifying the errors, and computation of balance calibration uncertainty. The concepts and materials previously used in a one-day NCSLI tutorial will be expanded. Attention will be given to error sources, selection of standards, and various calibration and testing procedures used in the balance industry. Time will be spent in hands-on exercises calibrating a variety of balances, accumulating data, and developing uncertainty budgets. The focus will then move to use of balances in an analytical environment where compliance with pharmaceutical (FDA/ USP) and international requirements will be discussed and practiced. Methodologies for process measurement assurance techniques in analytical weighing will also be covered. Participants should leave with a working knowledge of balance calibration methods, uncertainty estimation, measurement assurance concepts & minimum balance load computations that can be applied directly to their applications. This NIST Seminar is designed for beginner to advanced users of balances or calibration managers wanting a better understanding of balances and associated uncertainties in organizations where analytical weighing is an integral part of operations. Limited to 30 participants. (Laptop with spreadsheet capability and/ or scientific calculator strongly encouraged.)

Saturday, August 20, 2011
8:00 AM – 5:00 PM (full day)

T2 - Running an Effective Laboratory – Measuring Performance

Dr. Malcolm Smith, Wescan Calibration

Jesse Morse, Morse Metrology

This "How To" tutorial will be of interest to owners, managers, and supervisors of calibration laboratories, both in-house and commercial. The tutorial will cover five areas where performance measurement is important in the running of a laboratory: (1) productivity, (2) quality, (3) finance, (4) service levels, and (5) customer satisfaction. The range of measures and associated tools that can be used to establish goals and monitor performance in each of these areas will be explained and discussed. Suggestions on how these tools might be used in practice will be reviewed. Examples of measurements needed for effective process improvement projects will also be given.

T3 - Statistical Analysis of Metrology Data for Laboratory Managers and Technicians

Dilip Shah, E=mc3 Solutions

This full-day tutorial covers metrology data generation and statistical analysis techniques for laboratories that are either ISO 17025 accredited, are in the process of getting their ISO 17025 accreditation or for those laboratories that just want to apply sound data analysis techniques. Learning objectives for this full day workshop include:

Introduce metrology definitions per ISO Guide 99:2007 (VIM) for consistent application (conversing using metrology vocabulary for consistency).

Develop methods and techniques for data generation.

Introduce and apply basic statistics.

Analyze data by appropriate statistical methods.

Introduce Statistical Process Control (SPC) techniques and its application in calibration interval analysis, trend analysis. Applying data for Measurement Uncertainty, Proficiency Testing and other ISO 17025 requirements (Clauses 5.3.2, 5.4.6, 5.5.2, 5.5.9, 5.5.10, 5.6.3.3, 5.7, 5.9).

The workshop is targeted for laboratory managers and technicians who are involved in test and calibration activities. Practical examples are demonstrated using a Microsoft Excel® spreadsheet. Participants are provided a copy of the spreadsheet template for their own use. Attendees may bring a laptop computer with Microsoft Excel® spreadsheet pre-loaded on it to the workshop. However, it is not a requirement. Attendees should plan on bringing a scientific calculator for hands-on problem solving exercises for comprehension.

Saturday, August 20, 2011
8:00 AM – 12:00 PM (half day)

T4 - Fundamentals of Calibration in Dimensional Metrology

Amosh Kumar and Jim Salsbury,

Mitutoyo America Corporation

This tutorial provides an overview of calibration techniques and key issues in dimensional metrology. New for the 2011 NCSLI conference, this tutorial will include a variety of hands-on practical calibration exercises. All the major types of dimensional calibrations will be discussed. We will start by studying the calibration, use, and traceability issues of the standards used in the field, such as gage blocks, ring gages, optical flats, thread wires, and length standards. We will then discuss the calibration of common small measuring tools such as micrometers, calipers, dial indicators, and height gages. Hands-on exercises in the calibration of small tools will include procedures, worksheets, and certificates. In addition to presenting specific calibration methods, the bigger goal of the tutorial is on developing understanding of the principles behind the dimensional calibration

methods thereby giving the attendee the necessary tools to extend the tutorial concepts to other types of calibrations. With that goal in mind, not only will recommended procedures be presented, but also optional methods, sources of errors and methods to reduce them, and techniques for estimating the uncertainty of measurement.

T5 - My Measurements are Traceable Right? Demonstrating the Chain of Traceability

Dana Leaman, NIST-NVLAP

This half-day tutorial examines the requirements to demonstrate the traceability chain for our measurement and test equipment. Topics will include the concept of traceability from several levels, including the International Bureau of Weights and Measures (BIPM), National Metrology Institutes, and Accreditation Bodies. Within those discussions, we will cover the Key Comparisons Data Base (KCDB), accreditation and the associated scopes, how to demonstrate your traceability and the misconceptions associated with traceability. At the end of discussions, the participant will be able to use the concepts covered regarding traceability and apply them to the measurements made in their laboratories to determine their traceability chains.

T6 - Pressure Metrology

Anil Agarwal, NRC Canada

Mike Bair, Fluke Calibration

The half day Pressure Metrology tutorial will cover pressure measurement concepts and terminology, standards used in pressure metrology, measuring and calibration methods, sources and calculation of uncertainty and other practical considerations.

T7 - Measurement Uncertainty Made Easy

Georgette Macdonald and Alan Steele, NRC Canada

Why is it important to express the uncertainty in measurement? Quite simply, there is no traceability in measurements that lack statements of uncertainty at every link of the traceability chain. For this and other reasons, ISO/IEC 17025 requires calibration laboratories, in particular, to provide estimates of uncertainty of their measurements using accepted practices. The instructor will discuss the basics for preparing uncertainty estimates for typical uncomplicated measurement processes. This approach is consistent with the GUM but it dispenses, wherever possible, with the algebraic notations, statistical jargon, arithmetic modeling, and differential calculus operations found in the GUM that perhaps encumber a person who requires no more than a simple, conservative estimate of the uncertainty in the result of a simple measurement process. For these situations, it will be shown that the mathematics is quite straightforward and that the actual challenge, if any, to estimating uncertainty in measurement is in defining the factors that affect the measurement; namely, in understanding the metrology. Participants will receive an example Excel spreadsheet for making simplified uncertainty calculations. The tutorial will include a group exercise. Participants should bring stationary and pocket calculators.

EXHIBITORS

A.K.O. Inc., Torque Specialties Division
Acucal, Inc.
Agilent Technologies
American Assoc. for Laboratory Accreditation, (A2LA)
Ametek
Andeen-Hagerling, Inc.
ANSI-ASQ National Accreditation Board, ACLASS
ASL U.S.
ASQ-MQD
B&W Y-12, LLC
Bionetics Corporation
Bios International Corporation

Blue Mountain Quality Resources, Inc.
Brother Mobile Solutions, Inc.
Bruel & Kjaer Instruments, Inc.
Burns Engineering, Inc.
Calibrate, Inc.
Clarke-Hess Communications Research
Colorado Engineering Experiment Station Inc., (CEESI)
CONDEC
Conference on Precision Electromagnetic Measurements, (CPEM)
Crystal Engineering Corporation
Custom Calibration Solutions
Data Proof

Dewetron, Inc.
DH-Budenberg, Inc.
Dynamic Technology, Inc.
East Hills Instruments
Ectron Corporation
Edison ESI/So. Calif. Edison
Electronic Development Labs, Inc.
Essco Calibration Laboratory
EURAMET e.V.
Exelon Powerlabs
FasTest, Inc.
Fluke Calibration
GE Sensing

TUTORIAL PROGRAM

Saturday, August 20, 2011

1:00 PM – 5:00 PM (half day)

T8 - Modern Calibration Concepts: Radical Rethinking of Measurement Uncertainty, Decision Rules, and Proficiency Testing

Jim Salsbury, Mitutoyo America Corporation

Recent research and international standardization in measurement uncertainty has brought forward new and fundamental concepts that are challenging the status quo in the calibration field. The resulting changes are most apparent in the calibration and performance verification of measuring instruments, which is the focus of this tutorial. While the concepts in this tutorial are advanced in nature, the treatment is at a fundamental level and anybody with at least a basic understanding of calibration and measurement uncertainty will benefit from attending. This tutorial will address three key areas: measurement uncertainty, conformance decision rules, and proficiency testing. The measurand in the calibration of measuring instruments will be carefully considered, along with the myth of “resolution” and “repeatability” in measurement uncertainty. The use of measurement uncertainty in decision rules will then be addressed from both a risk management and uncertainty management perspective. Novel approaches to proficiency testing will also be presented to support the new, and much lower, measurement uncertainty estimates in the calibration of measuring instruments. This tutorial is most suitable for quality and technical representatives from ISO/IEC 17025 accredited calibration laboratories, but anyone involved with calibration or testing will benefit.

T9 - Information Technology (IT) Testing Accreditation as it Relates to Producers and Users of Calibration Software
Robert Knake, A2LA

This half-day tutorial will go over the new program for ISO/IEC 17025:2005 accreditation of Information Technology (IT) Testing Laboratories that specifically test software that generates Calibration and Measurement Capability (CMC) values required to be stated on the scope of accreditation. The tutorial will discuss why this program has been established, the requirements for the IT Testing lab, and lastly the requirements for organizations who wish to utilize the software to support the CMC claims on their scope in lieu of creating a traditional “uncertainty budget.”

As the metrology world moves more towards automation of calibration processes there is a need to look at the measurement uncertainty generation process from a different perspective. This tutorial will cover the program being implemented as a way to evaluate CMC generation in a software supported calibration process and what it means for you as an accredited organization.

(Some of the specific requirements to be discussed will be accreditation body specific in order to provide clarity.)

T10 - Monte Carlo: Uncertainty Made Easy

Alan Steele and Georgette Macdonald,
NRC Canada

A new era is dawning in uncertainty analysis. A new tool is emerging to bypass many of its difficulties that have troubled practical metrologists. The new tool can harness experience from the laboratory to help analyze the uncertainty of any practical measurement equation. Starting from the uncertainties claimed for input quantities

(which can still be tough to evaluate), Monte Carlo simulation can simplify the rest.

The new Supplement-1 to the ISO-GUM gives formal recognition to building, exploring and validating metrological uncertainty budgets using Monte Carlo methods. In this tutorial, you will use Monte Carlo simulation for uncertainty analysis, using Excel macros for this purpose. You will get an open-source Excel Toolkit that converts difficult uncertainty analysis into an easy Monte Carlo exercise that will feel much like doing a real experiment. You will learn the fundamentals of Monte Carlo uncertainty analysis, and how to enter your own measurement equation (or equations) into the Toolkit, using Excel's version of Visual Basic.

Some familiarity with uncertainty analysis, MS Excel and BASIC is essential to getting the most from this course, but students from all backgrounds and with all levels of experience are welcome and encouraged to attend.

Attendees should bring their own laptop with Excel installed, including full permission to access Excel's Visual Basic programming environment. Excel from Office 2007 has a new user interface, and is not recommended for this Tutorial, since our demonstrations will be using earlier versions of Excel (all other versions, from Excel 97 on, are OK).

T11 - Fundamentals of Gas Flow Measurement

Robert DeRemer, CSA International

The main thrust of the Fundamentals of Gas Flow Measurement tutorial will be the comparison of volumetric flow meters and mass flow meters used in gas flow measurement applications. Specific topics that will be covered will include principles of operation of various types of flow meters, factors that influence when to choose a mass flow meter or a volumetric flow meter, how to interpret performance specifications, how the various types of meters are calibrated, and an example of measurement uncertainty.

Sunday, August 21, 2011

8:00 AM – 5:00 PM (full day)

T12 - Collecting Objective Evidence: The Internal Audit Process in Preparation for the Onsite Assessment

Thomas Hettenhouser,
NIST-NVLAP

This tutorial will be of interest to managers and staff of laboratories with new or mature quality systems. It will cover what constitutes objective evidence by stepping through the internal audit process, including skills that an auditor needs to have to be effective. The tutorial will emphasize the importance of records for all aspects of the management system including reference documents, method validation and their interdependency with metrological traceability and reporting results. Using the described internal audit process prior to an on-site assessment companies new to the accreditation process as well those with mature quality systems will be able to prepare better for an upcoming on-site assessment.

T13 - Improving Cal Lab Performance: Strategies, Tactics and Tools

Dean Williams, Duke Energy

This hands-on interactive workshop provides participants with 9 insights for increasing their personal and their organization's effectiveness. First presented and

awarded the Algie Lance Best Paper Award at the 2007 Measurement Science Conference, the 3 Principles for greater effectiveness, based on Goldratt's Theory of Constraints, have been expanded to include the 3 Practices for increasing day-to-day productivity, and the 3 Pragmatics for overcoming the problems, conflicts, and resistance to change faced by individuals or organizations seeking greater effectiveness. Whether entry level technician or seasoned manager, the activities, real life Cal Lab illustrations, and accompanying discussions provide each participant an opportunity to gain and apply these Effective Focus Insights in a dynamic learning environment.

Sunday, August 21, 2011

8:00 AM – 12:00 PM (half day)

T14 - Fundamentals of Temperature Calibration

Thomas Wiandt, Fluke Calibration

This presentation is a review of the fundamentals of temperature calibration. Topics include calibration equipment, calibration techniques, curve fitting issues, and the mathematics important to thermometry. Types of thermometers covered include platinum resistance thermometers, thermistors, thermocouples, and combined thermometer/readout systems. This segment is intended for those who are new to temperature calibration, those who need to validate what they already know, or those who just have some nagging questions that need to be answered.

T15 - Applying for and Maintaining Accreditation: Common Pitfalls

Pamela Wright, A2LA

This tutorial will be of interest to managers and staff of laboratories with new or mature quality systems who are currently accredited or who plan to do so in the near future. The tutorial will cover the challenges of applying for and maintaining accreditation to ISO/IEC 17025.

Areas to be covered include information on accrediting bodies, proficiency testing planning and participation, the requirements for traceability of reference standards and reference materials, advertising, and most common deficiencies.

Organizations new to the accreditation process as well those with mature quality systems will be able to better prepare for an ISO/IEC 17025 assessment when participating in this tutorial. (Some of the specific requirements to be discussed will be accreditation body specific in order to provide clarity.)

T16 - Good, Bad, or Indeterminate: Who Makes the Call?
Jeff Gust, Fluke Calibration

When calibration data is provided on a certificate, ISO 17025 requires a statement of the measurement uncertainty. In addition, if a statement of compliance with specifications is made, the uncertainty of measurement must be taken into account. Z540.3 requires the false accept risk to be less than 2% if a TUR of greater than 4:1 cannot be maintained. This tutorial will describe some practical ways to consider uncertainties and their associated false test decision risk when making in-tolerance or out-of-tolerance declarations.

GIDEP
GRAS Sound & Vibration
Guildline Instruments, Ltd.
Heusser Neweigh
ICL Calibration Laboratories, Inc.
ID Label, Inc.
IET Labs, Inc.
INSCO Metrology
Instrulab, Inc.
Interface, Inc.
International Accreditation Japan
International Accreditation Service
Isotech North America

J M Test Systems, Inc.
Kaymont Consolidated Industries, Inc.
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Mensor Corporation

Meriam Process Technologies
Mettler-Toledo, Inc.
Michell Instruments, Inc.
Micro Motion
Minnesota Dept. of Commerce
Mitutoyo America Corporation
Morehouse Instrument Company, Inc.
National Metrology Institute of Japan, AIST
National Metrology Institute of South Africa
National Physical Laboratory, (NPL) UK
National Research Council of Canada
National Scientific Centre, Institute of Metrology
NAVAIR North Island

TUTORIAL PROGRAM

Sunday, August 21, 2011
8:00 AM – 12:00 PM (half day)

T17 - Fundamentals of Torque Calibration
Henry Zumbun and William Lane,
Morehouse Instrument Co.

This presentation is a review of the fundamentals of torque calibration. Topics include an overview of torque standards including ASTM-E2428 and BS7882, uncertainty of torque calibration standards, Type A and B uncertainty analysis, torque calibration equipment, calibration and testing of torque transducers, proper calibration techniques, error sources associated with torque calibration, and why proper torque measurement is more than just a traceable length and mass calibration.

This segment will cover torque transducers as well as proper torque wrench use. There will be a "hands on" demonstration on how to properly use a torque wrench and the errors associated with improper handling. This segment is intended for those who are involved with torque calibration, those wanting to minimize the errors associated with improper use of torque equipment, and for those who have questions that need to be answered.

T18 - Power and Energy Measurement:
Bridge the Gap Between Theory and Practice
Steve Weinzierl and Marcus Zickelsoose,
Radian Research, Inc.

New for 2011 NCSLI conference, this tutorial explores alternative methods used throughout the Electricity Energy industry to provide Watt-hour energy traceability. This tutorial will begin with a review of the traceability chain starting with the revenue meter in common use through to a National Institute of Standards. This tutorial includes analysis of measurement methods and common error sources followed by hands-on measurement transfer exercises. During the tutorial we will explore the varied results obtained from commonly used electricity meters that incorporate different measurement VAR-hr algorithms as well as the errors associated with measurements using loads that obtain high harmonic content.

This tutorial will be informative to anyone working at the highest level of standards through to personnel working in the Electricity Utility industry.

T19 - Evaluating and Documenting Test and Measuring Equipment Substitution
Graeme Payne, GK Systems, Inc.

This tutorial discusses what to do when an approved work document specifies one item of inspection, measuring and test equipment (IM&TE) but there is a need to use a different item because the original item is not available and: the specified IM&TE may be obsolete technology; or it may not be supported by the manufacturer or not economically repairable; or the original manufacturer may not exist anymore. The tutorial presents a proven methodology to evaluate the original and replacement instruments and document the results, some considerations for industries in a regulated environment, and some tips for locating data on old equipment. The basis of the evaluation process is application of simple measurement uncertainty methods, in place of older methods such as specification comparison. This methodology can be used by an organization as an effective process for evaluating and deciding equipment substitu-

tions or equivalencies. Having an effective program for this process can reduce the risk of making incorrect measurements, improve the system by documenting equipment upgrades, and set a baseline for the future when replacement of the new item is needed. The equipment substitution analysis can be integrated into the organization's overall measurement management system.

This tutorial is intended for people in any industry where there is a need to maintain or support older equipment or systems. The information is applicable to any organization where measurements are made during the process of producing goods or services, as well as calibration and test laboratories. It may also be of interest to laboratory accreditation assessors and quality system auditors. The principles are adaptable to all measurement and test disciplines. After completing the tutorial, you will understand some situations that require a substitution process; have awareness of some policy, regulatory, legal or other issues involved; know various ways of identifying the true measurement requirements; understand the importance of knowing all relevant characteristics of both the original and substitute IM&TE; know the minimum requirements for effective documentation; and be prepared to start developing a formal IM&TE substitution process in your organization. Attendees are invited to bring example cases.

Sunday, August 21, 2011
1:00 PM – 5:00 PM (half day)

T20 - Force Calibration: Methods and Uncertainties
Michael Tovey, Tovey Engineering, Inc.

Force calibration is a special discipline with many considerations not common to other areas of metrology. Often measurement uncertainties are underestimated due to the omission of significant error sources. Metrologists must consider both mechanical and electrical boundary conditions to achieve calibrations with low measurement uncertainties. Factors such as second order material responses, and interaction of undesired parasitic loading due to fixture characteristics, misalignment of load frame components, stiffness, etc. can have significant influence on the measurement result. This tutorial will cover the characteristics of force transducers, force calibration methods, force calibration standards (E74 and ISO 376) and measurement uncertainty models for primary standards, secondary standards and field transfer standards. The tutorial begins at a basic level and leads to discussion of more complex issues.

T21 - Fundamentals of Radiation Thermometry Calibration
Frank Liebmann, Fluke Calibration

This presentation is an overview of the basic knowledge necessary to perform radiation thermometer calibrations. The presentation is divided into two parts. The first part is a lecture covering the basics of radiation temperature measurement and infrared thermometry calibration. The second part is a hands-on portion which covers the steps necessary to make a calibration measurement, plus a number of tests to determine measurement uncertainty, and the computation of uncertainties following international standards. The attendee will be provided with a spreadsheet to facilitate the computation of uncertainty. The type of radiation thermometer covered in this presentation is an infrared thermometer with a thermopile detector and an 8 – 14 μm bandwidth. However, the principals taught are applicable

to other classifications of radiation thermometers to include radiation thermometers with pyroelectric detectors and thermal imagers. The presentation is geared to those who are new to radiation thermometer calibration, those who need a refresher on the subject, and to those who would like to perform better calibrations.

T22 - Microwave Network Analysis and Power Calibration
Bart Schrijver, Agilent Technologies

This tutorial will focus on an introduction to microwave measurement concepts and specifically on network analysis and RF power measurement. The measurement architecture of both types of measurements will be shown and described in detail. In addition topics like signal flow diagrams, S-parameters, network analyzer calibration, calibration techniques, uncertainty analysis and traceability for both network analysis and power measurements will be reviewed.

T23 - Estimating and Evaluating Measurement Decision Risk
Dr. Howard Castrup, Integrated Sciences Group

This tutorial presents topics relating to measurement decision risk analysis and management, including selected material from NCSLI RP-18, Estimating and Evaluating Measurement Decision Risk. Methods are provided for computing measurement decision risk and guidelines are presented for developing test guardbands that correspond to specified risk levels. Also discussed are other "measurement quality metrics," such as false reject risk, and alternative means of computing risk, such as Bayesian analysis and the development of in-tolerance confidence levels.

Included are discussions on the influence of measurement reliability and measurement uncertainty on false accept risk and on computing and interpreting the Z540.3 fallback TUR of 4:1.

This tutorial is intended for individuals with a need to develop and apply tools for the control of measurement decision risk, with special emphasis on compliance with Z540.3. Although some college level math will be employed, related concepts will be fleshed out to ensure comprehension by attendees with moderate mathematical training.

T24 - Metrology Personnel Qualification and Development
Richard Brenia, Southern California Edison

In recent years the world of Metrology has seen a decline in the availability of trained and experienced Metrologists in the job market. This is mainly due to the U.S. Armed Forces reducing the number of technicians being trained to calibrate M&TE. There is an increased demand for documented Metrologist Qualifications stemming from more stringent Quality Program requirements. Although there has been an increase in the number of public sector schools for Metrology training, there aren't enough technicians to cover the void left by the reduction of U.S. Military Metrology training.

One solution to these problems is to develop an in-house Metrology training program. A Metrologist Training Program has an added intangible effect of boosting technician morale. The technician can see a clear and concise path to becoming a trained, experienced journeyman.

Naval Surface Warfare Center
NIST Measurement Services
NIST/NVLAP
Northrop Grumman
Oak Ridge National Laboratory
Ohm-Labs, Inc.
On Time Support, Inc.
One Red X Software
Paroscientific, Inc.
PMS Systems Corporation
Pond Engineering Laboratories, Inc.
Pratt & Whitney Measurement Systems, Inc.
Precision Environments, Inc.
Quality Vision Services, Inc.

Radian Research, Inc.
Ralston Instruments
RH Systems
Rice Lake Weighing Systems
Rohde & Schwarz, Inc.
Rotronic Instrument Corporation
Sartorius Mechatronics
Scantek, Inc.
SIM
SIMCO Electronics
Standard Calibration
Standards Council of Canada
TDK-Lambda Americas
Tegam, Inc.

Tektronix Service Solutions
Test Equipment Repair Corporation
TestEquity LLC
The Modal Shop
Thunder Scientific Corporation
Tovey Engineering, Inc.
Transcat, Inc.
Transmille Calibration
Troemner, LLC
U.S. Army Primary Standards Laboratory
Vaisala, Inc.
Vishay Foil Resistors
Western Environmental Corporation
WorkPlace Training, Inc.



NCSL International 2011 Workshop and Symposium Registration

August 21-25, 2011 National Harbor, MD

Conference language: English

Conference currency: USD



REGISTRATION OPTIONS

Register on-line at www.ncsli.org

Fax or Phone Credit Card Registrations to:

Fax: 303.440.3384 – Phone: 303.440.3339

Mail Check or Credit Card Registrations to:

NCSL International
2995 Wilderness Place, Suite 107
Boulder, CO 80301-5404

REGISTRATION FEES & DEADLINES

		With Hotel discount	
		Members/Non-members	Members/Non-members
<input type="checkbox"/> Advanced	On or Before February 28, 2011	\$965/\$1,165	\$900/\$1,100
<input type="checkbox"/> Regular	March 1 to June 30, 2011	\$1,015/\$1,215	\$950/\$1,150
<input type="checkbox"/> Late	Starting July 1, 2011	\$1,115/\$1,315	\$1,050/\$1,250

☐ Full registrations will receive \$65 discount if staying at the conference hotel. Hotel confirmation number _____

☐ One day pass (does not receive hotel discount) \$400/\$400

☐ **NIST Tours \$35 each** (one tour per participant - see website for tour descriptions)

☐ **Tour A - Electrical Metrology**

☐ **Tour B - Optical Metrology**

☐ **Tour C - Mass and Dimensional Metrology**

☐ **Tour D - Pressure, Temperature, and Flow Metrology**

REGISTRANT INFORMATION (Please print or type)

☐ **Member:** NCSL International Membership Number _____ (Contact Member Delegate or NCSL International for number)

☐ **Non-Member**

First Name: _____

Zip+4 / Postal Code: _____

Last Name: _____

Country (if not USA): _____

Job Title: _____

Telephone No.: _____

Organization: _____

Fax No.: _____

Dept. / Div. / Lab.: _____

E-mail: _____

Address: _____

Job Code: _____ **Industry Code:** _____

City: _____

Special Accommodations: Please attach a written description if you require special ADA, wheelchair or dietary needs. Please note the only alternative meal option offered at this time is a vegetarian plate.

State / Province: _____

JOB CODES

(A) Administration	(P) Professor
(C) Consultant	(Q) Quality
(E) Education	(S) Senior Management
(G) Engineer	(D) Student
(M) Manager	(T) Technician
(O) Owner	

(AE) Aerospace
(AU) Automotive
(CH) Chemical Industry
(CL) Commercial Lab
(CG) Consulting
(CP) Corporate Lab

INDUSTRY CODES

(EL) Electronics
(PH) Pharmaceutical/Healthcare
(MG) Manufacturing
(G1) DOC
(G2) DOD
(G3) DOT

(G4) NASA
(G5) Other:
(C) Community College
(PC) Private College
(T) Technical College
(U) University

CREDIT CARD INFORMATION

☐ VISA ☐ Mastercard ☐ American Express ☐ Discover Card #: _____

Full name as it appears on card: _____ V-code: _____ Exp. Date: ____/____/____

Signature: _____ Date: ____/____/____

CANCELLATION POLICY

NCSLI Conference, Tutorials and Related Events: Cancellations received IN WRITING before 5:00 p.m. (Eastern) on July 18, 2011, will be subject to a service charge of \$50 per registration. No refunds will be issued for cancellations received after 5:00 p.m. (Eastern) on July 18, 2011. Registrations may be transferred from one party to another BY WRITTEN REQUEST RECEIVED through August 12, 2011.

FOR OFFICE USE ONLY

Registration Received: ____/____/____ CK # / CC App #: _____ CK / CC App Date: ____/____/____

Payment Received: ____/____/____ PO / Inv. #: _____ Amount: \$ _____ Entered: ____/____/____



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