



# NCSLI Newsletter

## NCSL International

Serving the World of Measurement Since 1961

**Come to Salt Lake City  
for the 2004 NCSLI Annual  
Workshop and Symposium**

**July 11-15, 2004**

### President's Message



*Dave Agy  
NCSLI President*

### January Board Meeting

The first Board of Directors' meeting in 2004 was held in Monterey Bay, California. We had two workshops during this Board meeting - the first on membership and the second on the Newsletter. Harry Moody has been appointed the chair of an Ad Hoc committee to look at ways to grow the membership. Working with Harry on this committee will be Tom Wunsch, Roxanne Robinson, Steve Stahley, and Doug Sugg. The charter for this committee is:

*Seek ways to increase membership for NCSL International. The committee will solicit ideas for increasing membership with the emphasis on a study of new industry groups. Feasibility studies should be conducted for each idea presented, by appropriate NCSLI personnel. Ideas will be compiled and sent to the Board of Directors for analysis and review. In addition, the Ad Hoc Committee will work with the Marketing Vice-President to coordinate their activities with the NCSLI Membership Committee. The deliverables for this committee are a list of ways to increase membership for NCSLI in a quarterly report to the NCSLI Board of Directors*

*continued on page 46*

**NCSLI Newsletter**  
**Vol 44, No. 2, April 2004**

**PUBLISHER:**

NCSL International  
 2995 Wilderness Place, Suite 107  
 Boulder, CO 80301-5404  
 (303) 440-3339, FAX (303) 440-3384  
 E-mail: <info@ncsli.org>

For clarity, the NCSLI Newsletter encloses email addresses and web site URLs in brackets <.....>.

**EDITOR:**

John L. Minck  
 642 Towle Place  
 Palo Alto, CA 94306  
 Phone and Fax (650) 493-3955  
 E-mail: <JLMinck@earthlink.net> or  
 <john\_minck@non.agilent.com>

**Associate Editor:**

Chris Franks, Agilent Technologies-Retired

**Layout and Production:**

Rebecca Johnson, Acorn Publishing  
 <acorn@best.com>

NCSL International is a non-profit Colorado corporation. It is an international association of laboratories and organizations that maintain or have an interest related to measurement standards and calibration facilities.

The NCSLI Newsletter is sent to NCSL International member organizations (3 copies) and to a special listing of activities and key personnel whose work is closely related to that of NCSL International. Send member delegate address changes to the NCSL International Business Office at 2995 Wilderness Place, Suite 107 Boulder, CO 80301-5404.

NCSLI acknowledges and thanks Agilent Technologies for sponsoring the NCSLI Newsletter Editor position.

**BOARD OF REVIEWERS**

Dave Abell	Larry Nielsen
Dave Agy	Richard Pettit
Chris Franks	Derek Porter
Jeff Gust	Ed Pritchard
Georgia Harris	Roxanne Robinson
Carol Hockert	Doug Sugg
Klaus Jaeger	Mike Suraci
Harry Moody	Terrell Wilson
	Tom Wunsch

\*\*\*Articles and other material appearing in the NCSLI Newsletter express the views of the authors and contributors, and are not necessarily those of the Editor or the NCSL International.

**Visit our website:**

<[www.ncsli.org](http://www.ncsli.org)>

**On the cover:** Is Salt Lake City a gorgeous place for a summer working vacation or what?

**TABLE OF CONTENTS**

MAKE YOUR PLANS FOR THE SALT LAKE CITY CONFERENCE ..... 3  
 BEST PAPER .....12  
 METROLOGY CALENDAR .....16  
 TRAINING INFORMATION .....17  
 REPORTS FROM THE BOARD .....19  
 SOMEONE YOU SHOULD KNOW-CAROL HOCKERT .....21  
 NCSLI WEBSITE TOUR .....22  
 REPORTS FROM THE REGIONS .....24  
 NCSLI 2003 FINANCIAL RESULTS .....28  
 REMEMBERING KENT CROW .....29  
 REMEMBERING ANTHONY ULRICH .....30  
 SCENES FROM THE MONTEREY BOARD MEETING .....31  
 COMMITTEE NEWS .....32  
 NEWS FROM THE NMIs (Previously NIST NEWS) .....36  
 NCSLI NEWSNOTES .....43  
 LIAISON NEWS .....44  
 WELCOME TO OUR NEW NCSLI MEMBERS .....48  
 NCSLI MANAGEMENT ROSTER .....49

**BUSINESS OFFICE DEDICATION**

Sunday, April 18, 5pm to 8pm

If any of you are in the Boulder area and would like to join in our celebration of the opening of our new Business Office, you are invited. Speeches, food and schmoozing.

**EDITOR'S MESSAGE**

**We never make mistakes**

Last editorial I mentioned that Mike Boothe was from Quality Lab Co., when noting his suggestion about electronic delivery of the newsletter, via .pdf Adobe formats. Seems like I transcribed his company name wrong. Mike is with Cal Lab Co., Inc, of South Holland, IL. I'll bet his boss was surprised.



*John Minck  
 NCSLI Editor*

At the Monterey Board meeting, Mike's suggestion was entertained and handed to Craig Gulka at the Business Office. Craig will study how to set up either an email broadcasting of the electronic version of the newsletter to those subscribers who want it that way, or perhaps set up a way for them to download from the website, with the appropriate security.

Stand by for some practical solution.

*Continued on page 15*

The NCSLI Newsletter (USPS 469-030) (ISSN 1536-2264) is published quarterly by NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404. (Annual subscription price; \$15, members, \$40, non-members.) The subscription price for member organizations is included in annual dues. Periodicals Postage Paid at Boulder, CO and at additional mailing office. POSTMASTER: Send address changes to NCSLI Newsletter, NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404.

# NCSL International Workshop & Symposium



**Salt Lake City, UT**

**July 11-15, 2004**

**T**he definition of metrology, from the simplest - *The science of measurement*, to the most complex - *The science of measurement for determination of conformance to technical requirements including the development of standards and systems for absolute and relative measurements*, may need to be reconsidered in light of increased responsibilities for calibration laboratories. Over the last decade, there has been a dramatic increase in the requirements applied to all levels of the international measurement system. Thanks, in large part, to national and international standards, standards and calibration laboratories in particular have had to consider becoming both registered [ISO 9000] and accredited [ISO 17025]. Even National Metrology Institutes must implement a full quality program. No longer is it enough to just concentrate on providing a good, traceable measurement, metrologists must also be concerned with training, documentation, metrics, customers, complaints, etc., as well as the political and legal aspects of metrology

It is important even with all of the new requirements that metrologists not lose sight of the primary responsibility of the laboratory - to provide good measurements to their customers. Join us in Salt Lake City for the 2004 NCSL International Workshop & Symposium to discuss this and many other issues facing the metrology community.

## **Papers, Panels & Workshops:**

The Technical program offers papers, panels, and workshops that explore this year's Conference theme, and are organized into the following five categories:

- ▶ Theoretical
- ▶ Applied
- ▶ Management & Quality
- ▶ International
- ▶ Invited

## **Exhibits:**

Meet with key executives and leading technical experts from over 120 of the top Measurement Science industry innovators and suppliers from around the world. To keep pace with rapidly changing technology, this Conference is a must.

## **Networking:**

The Workshop & Symposium affords unparalleled opportunities to meet with key individuals in the field of Metrology to collaborate and gain new information and insights that can help solve ongoing challenges with fresh perspectives, new skills and new partnerships. Examples of areas of involvement include automotive, analytical chemical, pharmaceutical, and forensics.

## **Tutorials:**

The 2004 Conference will include a series of tutorials presented before and after the conference. There will be more tutorials this year than in past years. Some of the subjects to be covered include Temperature, Accreditation, and Uncertainty, among others. Please visit the NCSLI Website, [www.ncsli.org](http://www.ncsli.org), for the titles and abstracts of all of the 2004 tutorials.

**Please join us in Salt Lake City, Utah, prepared to learn, to teach, and to develop new professional relationships with your fellow "Metrologists".**

**For more information, please visit our website at [www.ncsli.org/conference/2004/](http://www.ncsli.org/conference/2004/)**



# NCSL International 2004 Workshop and Symposium Registration

July 11-15, 2004 - Salt Lake City, Utah

Conference language: English  
Conference currency: USD



## REGISTRATION OPTIONS

Register on-line at [www.ncsli.org](http://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

		Members	Non-members	Save
<input type="checkbox"/> <b>Advanced</b>	On or Before May 3, 2004	\$650	\$850	\$200
<input type="checkbox"/> <b>Regular</b>	May 4 to June 14, 2004	\$700	\$900	\$200
<input type="checkbox"/> <b>Late</b>	After June 14, 2004	\$800	\$1000	\$200
<input type="checkbox"/> <b>International Evening</b>	July 14, 2004	\$50		
Dinner/Square Dance at This is the Place - Heritage Park				
<input type="checkbox"/> <b>Organizational Membership</b>		\$400		

## REGISTRANT INFORMATION (Please print or type)

**Member:** NCSL International Membership Number \_\_\_\_\_ (Contact Member Delegate or NCSL International for number)

**First Name:** \_\_\_\_\_ **Country (if not USA):** \_\_\_\_\_

**Last Name:** \_\_\_\_\_ **Telephone No.:** \_\_\_\_\_

**Job Title:** \_\_\_\_\_ **Fax No.:** \_\_\_\_\_

**Organization:** \_\_\_\_\_ **E-mail:** \_\_\_\_\_

**Dept. / Div. / Lab.:** \_\_\_\_\_ **Job Code:** (see below) \_\_\_\_\_

**Address:** \_\_\_\_\_ **Industry Code:** (see below) \_\_\_\_\_

**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:** \_\_\_\_\_

**Zip+4 / Postal Code:** \_\_\_\_\_

### 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	

### INDUSTRY CODES

(AE) Aerospace	(EL) Electronics	(G4) NASA
(AU) Automotive	(PH) Pharmaceutical/Healthcare	(G5) Other: _____
(CH) Chemical Industry	(MG) Manufacturing	(C) Community College
(CL) Commercial Lab	(G1) DOC	(PC) Private College
(CG) Consulting	(G2) DOD	(T) Technical College
(CP) Corporate Lab	(G3) DOT	(U) University

## CREDIT CARD INFORMATION

VISA  Mastercard  American Express  Discover Card #: \_\_\_\_\_

Full name as it appears on card: \_\_\_\_\_ Exp. Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

## CANCELLATION POLICY

Full registration fees will be refunded if written notice is received (by fax or mail) by June 11, 2004. You may transfer your paid registration to another individual from your organization to attend in your place without penalty. Written authorization for this substitution is required. Please mail or fax written notice of substitution to the NCSL International business office to arrive by June 25, 2004.

## FOR OFFICE USE ONLY

Registration Received: \_\_\_\_/\_\_\_\_/\_\_\_\_ CK # / CC App #: \_\_\_\_\_ CK / CC App Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

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

# CONFERENCE TUTORIALS

## Fundamentals of Temperature Calibration

Thomas Wiandt & Ron Ainsworth  
Hart Scientific, Inc.  
American Fork, UT

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.

## Temperature Calibration Uncertainty Analysis

Thomas Wiandt & Ron Ainsworth  
Hart Scientific, Inc.  
American Fork, UT

This presentation is a step by step review of the tools necessary to evaluate the uncertainties present in temperature calibrations. Topics include curve fitting errors, error propagation, error budgeting, TURs, and statistical process control. Also discussed will be pertinent fundamentals of uncertainty analysis as outlined in the Guide to The Expression of Uncertainty in Measurement (GUM). This segment is intended for those who are new to uncertainty analysis as well as those who are well versed but require further guidance or clarification.

## Introduction to the Evaluation of Uncertainty

Rüdiger Kessel  
Metrodata GmbH  
Germany

There are two important reasons for evaluating the uncertainty of measurements. The first, and by far most important, is that a transparent evaluation of uncertainty is, or should be, an integral part of the Quality Assurance System for measurement results. The second is that current accreditation regulations in all western countries require some quality statement or uncertainty budgeting. There are also a variety of other reasons such as being able to carry out business transactions based on measurement results and providing means for scientists to communicate effectively concerning technical matters.

Without a full uncertainty budget for the measurements, it is difficult to confirm that the measurements are proper anchored and traceable to agreed reference points, e.g. SI units. Since 1993 when the ISO Guide to the Expression of Uncertainty in Measurement ("GUM") was published for the first time, many organizations have adopted it as the standard for evaluation of the result and uncertainty of metrological experiments. The GUM approach offers a complete and consistent way to estimate the reliability of the measurement results. The lecture will give an introduction to the basic concepts of the GUM and how they can be used in practice. The different aspects of the concept will be demonstrated with small example

## Microwave Measurement Principles, Techniques and Uncertainties

Dr. Godfrey Kwan  
Kwan Research  
Santa Rosa, California.

Microwave measurements are of great interest to both the telecommunications industry and the scientific research community. Characterization of a load, a power sensor, or a radio frequency integrated circuit (RFIC) and/or its test fixtures are a few of the applications that we demand high accuracy for in our measurements. This is of extreme importance since the accuracies of many additional measurements and their interpretations need to be traced back to and rely on these "higher-level" measurements and characterization data.

In this tutorial, we shall: (1) Review transmission line theory; (2) Learn about microwave devices and their characteristics; (3) Learn the theory and limitations of scattering parameters representation; (4) Learn concepts and techniques in microwave instrumentation; (5) Learn construction and principles of microwave primary standards; (6) Review ISO guidelines to expression of measurement uncertainty; (7) Learn VNA calibration techniques and error-correction models; (8) Examine real life examples of measurement traceability.

## Laboratory Accreditation: The Process from A to Z

Dana Leaman and Tim Osborne  
American Association for Laboratory Accreditation (A2LA)  
Frederick, MD

What does one need to know regarding the accreditation process to 17025? What should be expected? Where does one start? The accreditation process can be very confusing for anyone. Knowing what to expect throughout the accreditation process can alleviate much of the confusion and make the entire process a positive learning experience.

ISO/IEC 17025, "General requirements for the competence of testing and calibration laboratories" is the internationally recognized standard for determining the competency of testing and calibration laboratories. The American Association for Laboratory Accreditation currently operates an Accreditation program to ISO/IEC 17025 within eleven major fields. This paper discusses the steps of our accreditation process from beginning to end offering insights into avoiding many of the pitfalls of the process.

## Running an Effective Laboratory - Measuring Performance

(Sponsored by the NCSLI Small Business Initiative Committee)  
Greg Powell  
The Signal Group  
Vancouver, BC Canada

Malcolm Smith  
NCS Laboratories  
Seattle, WA

This tutorial will be of interest to owners, managers, and supervisors of calibration laboratories, both in-house and commercial. The tutorial will cover four areas where performance measurement is important in the running of a laboratory: productivity, finance, marketing and customer satisfaction. The range of measures that can be used to monitor performance in each of these areas will be discussed. Suggestions on how these measures might be used in practice and in concert will be reviewed. Examples of measurements, with discussion of their effectiveness and appropriateness for process improvement, will be given.

## **Good, Bad, or Indeterminate: Using Guardbands to Help Make the Call**

David Deaver  
Fluke Corporation  
Everett, WA

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. This tutorial will describe some practical ways to consider uncertainties when making in-tolerance or out-of-tolerance declarations.

## **Introduction to Sound Measurement and Microphones**

Niels V. Boegholm  
Bruel & Kjaer  
Denmark

This tutorial will explain what sound is and the importance of sound (noise) measurements. Different sound fields like the pressure-field, free-field and random-field is explained. Sound parameters like Sound Pressure Level and Sound Power as well as different frequency weighting functions is explained. Different types of microphones are introduced, with major focus on the condenser measurement microphone. Which microphone parameters are important for different applications? Introduction to different microphone calibration methods (using primary (reciprocity) calibration, comparison, actuator and pistonphone / calibrator). The major uncertainty contribution elements in microphone calibration are defined and examined in some detail. Finally the latest trends in microphone technology, like MEMS and microphones with integrated data sheets (TEDS) are briefly explained.

## **Very Low Pressure Calibration**

Mike Bair and Karl Kurtz  
DH Instruments, Inc.  
Phoenix, AZ

This course focuses on the special challenges of very low gauge and differential pressure calibration. Topics range from the difficulty of establishing and maintaining adequate reference uncertainties to the unique practical issues encountered in hardware setups and the measurement process. The calibration uncertainties associated with influences that become dominant at very low pressure are analyzed. Participants perform hands-on measurement exercises illustrating the points discussed.

## **Who Accredits the Laboratory Accreditor?**

Roxanne M. Robinson  
A2LA  
Frederick, MD 21704

In general, it seems known and understood that quality system registrars are accredited by the Registrar Accreditation Board (RAB) that in turn is recognized by the International Accreditation Forum (IAF). Product certifiers are accredited by ANSI which is recognized by the Pacific Accreditation Cooperation (PAC), a regional cooperation under the IAF umbrella.

But the question has been raised more and more frequently, "Who accredits the Laboratory Accreditor?" There has been a proliferation

of laboratory accreditation bodies in the United States within the last few years, due in large part to the requirements of QS 9000 (1998) for accredited calibration services. Calibration laboratories pursuing accreditation are often confused about which laboratory accreditation body to choose to meet their needs. If their only client is ultimately an American Automaker, then the laboratory should be content with the services that an accreditation body recognized by the Big 3 can give them.

However, if that calibration laboratory is interested in providing services to international clients or is interested in supporting testing laboratories that are providing services at an international level, then the calibration laboratory must be accredited by an internationally recognized laboratory accreditation body. The question is then asked, "What is so special or different about the international recognition process for laboratory accreditation bodies?" The simple answer is "Confidence." There must be confidence that the accreditation bodies are competently accrediting testing and calibration laboratories for their competence to perform the tests or calibrations on their scopes of accreditation. This level of confidence is fundamental to the obligations of the MRA that each signatory accreditation body has to promote the acceptance of data from accredited laboratories of each MRA partner.

This tutorial will explain the peer evaluation process leading to this confidence and try to make some sense out of the myriad of calibration accreditation bodies in the United States and the recognitions that each of them hold.

## **Practical Modeling of Measurements for the Unertainty Evaluation**

Dr. Klaus-Dieter Sommer  
Thuringian State Bureau for Metrology and Verification (LMET)  
Ilmenau, Germany

The modeling of the measurement is a key element of the evaluation of measurement uncertainty in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). It is the aim of the modeling procedure to mathematically establish the relationship between the measurand and all input quantities, which may contribute to the uncertainty associated with the measurement result. This relationship serves as a basis for the uncertainty propagation as well as for computer-aided uncertainty determination. Since neither the GUM nor other relevant uncertainty documents provide any guidance on the modeling of measurements, the modeling of measurements appears to be the most difficult problem of uncertainty evaluation in accordance with the GUM.

With a view to overcome this problem, a straightforward and highly versatile modeling procedure has been developed which is based on the idea on the classical measuring chain. It is structured into five elementary steps, and only three types of modeling components are employed. Furthermore, it will be shown that almost all measurements and calibrations can be reduced to only a few generic model structures, which, on their part, can easily be tailored to the particular measurement procedure.

The tutorial will give an introduction to the above modeling concept with examples from various fields of measurement and calibration. On the basis of exercises and practical examples, the participants will be qualified to systematically analyze and perform the modeling of their measurement and calibration procedures with a view to mathematically establishing the so-called model equations.

## **Pipette Calibration and Use: Reducing Variability via Uncertainty**

Analysis and Bench-top Verification  
George Rodrigues, Ph.D.  
Artel  
Westbrook, Maine

This workshop combines practical advice with hands-on experience for metrology managers, engineers, and calibration technicians. Participants will learn: Practices for the creation of an uncertainty budget for your pipette calibration program, as a prerequisite for 17025 accreditation and/or for identification of the most significant error sources. Simple and cost-effective strategies for mitigating the leading sources of liquid delivery variability in the laboratory; including environmental factors, operator technique, and undetected pipette failures. The focus of the workshop is on bringing the business value of metrology from the calibration facility to the process level -- to improve quality, reduce mitigation risk and lower calibration and rework costs. By addressing calibration concerns on the bench-top, the metrologist can have a positive effect on the bottom line while actually enhancing control over laboratory processes.

## **Basics of Vibration, Shock, Accelerometers and their Calibration**

Torben R. Licht  
Bruel & Kjaer  
Denmark

This tutorial will introduce the fundamentals of vibration and shock, the various types of accelerometers used in its measurement, and accelerometer calibration. The physics of motion and the design of accelerometers will be summarized to support the discussion of calibration, with an emphasis on the parameters that are sources of uncertainties. A description will be given of comparison and absolute calibration techniques, with examples of the typical uncertainties to be expected. A brief list of calibration "Do's" and "Don'ts" is discussed.

## **Gas Flow Calibration and Uncertainties Using molbloc/molbox**

Larry Renda and Greg Secord  
DH Instruments, Inc.  
Phoenix, AZ

This tutorial covers the principles and operation of the DHI molbloc/molbox system. The focus is on the practical application of molbloc/molbox to perform a variety of typical calibration and measurement tasks and the determination of the associated uncertainties. Participants learn techniques for test setup, execution and data collection, supported by hands on experience with measurement hardware. The course also includes a review of the fundamentals of mass flow measurement, the operating theory of molbloc/molbox, the determination of uncertainty budgets, and DHI's methods for calibrating them.

## **Advanced Topics in Uncertainty Analysis**

Howard Castrup, Ph.D.  
Integrated Sciences Group  
Bakersfield, CA

This tutorial examines methods and techniques of uncertainty analysis taken from the GUM, other published work and current research. Widely used statistical uncertainty analysis tools will be derived from scratch, allowing a discussion of their utility and applicability. In addition, methodologies, such as Monte Carlo, Bayesian, ANOVA, and SPC will be discussed and an error analysis model will be developed that provides a rigorous framework for uncertainty analysis. Concepts will be illustrated using shareware and commercially available software.

## **Laboratory Data Management: "If the Data Don't Match, then the Answers Won't Hatch."**

Donald W. Wyatt, President  
Diversified Data Systems, Inc.  
Tucson, Arizona

This tutorial is intended for calibration managers, metrologists, or information technology professionals with responsibility for developing or maintaining calibration data management systems. The tutorial methodically reviews the data that needs to be captured, validation guidelines that can ensure the integrity of the data, and the analysis and reporting that can improve the efficiency and productivity of a calibration lab. The scope of the tutorial includes data required for regulatory compliance, data necessary for process control, data sought by customers of the lab, as well as data valuable for business unit management and administration. Attendees will gain valuable insights and understandings, which will benefit either the search for a new data management system or the quest to improve an existing system.

## **Methods, Traceability and Uncertainty for Hardness Testing**

Robert Ellis  
David L Ellis Company, Inc.  
Acton, MA USA

There are many methods of hardness testing used in industry throughout the world. Hardness, which was once considered a process control method, has evolved into test systems that can be sound in metrology, can be standardized and meet traceability requirements. The majority of all hardness testing includes Rockwell, Brinell, Vickers, Knoop and Durometers. All of the tests should meet the requirements of the appropriate ASTM, ISO and OMIL test methods. Systems should be in place to ensure a traceability chain can be found from the national institutes to the calibration laboratories and finally down to the end users. All hardness measurements reported should have an uncertainty value assigned to the test performed. The intent of this tutorial is to discuss how these hardness methods should be performed properly, where traceability exists to national institutes and how to determine the uncertainty of the test.



# NCSL International 2004 Workshop and Symposium

## Tutorial Registration

July 10, 11 & 16, 2004 - Salt Lake City, Utah

Conference language: English

Conference currency: USD



### REGISTRATION OPTIONS

Register on-line at [www.ncsli.org](http://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

### TUTORIAL FEES & DEADLINES

			Member/Non-member	After 6/14/04
<input type="checkbox"/> Fundamentals of Temperature Calibration	Sat. July 10	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Temperature Calibration Uncertainty Analysis	Sat. July 10	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Introduction to the Evaluation of Uncertainty	Sat. July 10	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Microwave Measurement Principles, Techniques and Uncertainties	Sun. July 11	8:00 a.m. - 5:00 p.m.	\$190/230	\$210/250
<input type="checkbox"/> Laboratory Accreditation: The Process from A to Z	Sun. July 11	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Running an Effective Laboratory - The Measurement Beyond Metrology	Sun. July 11	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Good, Bad, or Indeterminate: Using Guardbands to Help Make the Call	Sun. July 11	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Introduction to Sound Measurements and Microphones	Sun. July 11	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Very Low Pressure Calibration	Sun. July 11	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Who Accredits the Laboratory Accreditor?	Sun. July 11	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Practical Modeling of Measurements for the Uncertainty Evaluation	Sun. July 11	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Pipette Calibration and Use: Methods for Reducing Variability via Uncertainty Analysis and Bench-top Verification	Sun. July 11	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Basics of Vibration, Shock, Accelerometers and Their Calibration	Sun. July 11	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> GasFlow Calibration and Uncertainties Using MolBloc/Molbox	Sun. July 11	1:00 p.m. - 5:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Advanced Topics in Uncertainty Analysis	Fri. July 16	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Laboratory Data Management: If the Data Don't Match, Then the Answers Won't Hatch	Fri. July 16	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160
<input type="checkbox"/> Methods, Traceability and Uncertainties for Hardness Testing	Fri. July 16	8:00 a.m. - 12:00 p.m.	\$110/140	\$130/160

### REGISTRANT INFORMATION (Please print or type)

Member: NCSL International Membership Number \_\_\_\_\_ (Contact Member Delegate or NCSL International for number)

Non-Member

First Name: \_\_\_\_\_ Country (if not USA): \_\_\_\_\_

Last Name: \_\_\_\_\_ Telephone No.: \_\_\_\_\_

Job Title: \_\_\_\_\_ Fax No.: \_\_\_\_\_

Organization: \_\_\_\_\_ E-mail: \_\_\_\_\_

Dept. / Div. / Lab.: \_\_\_\_\_ Job Code: (see below) \_\_\_\_\_

Address: \_\_\_\_\_ Industry Code: (see below) \_\_\_\_\_

City: \_\_\_\_\_

State / Province: \_\_\_\_\_

Zip+4 / Postal Code: \_\_\_\_\_

**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.

### 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	

### INDUSTRY CODES

(AE) Aerospace	(EL) Electronics	(G4) NASA
(AU) Automotive	(PH) Pharmaceutical/Healthcare	(G5) Other: _____
(CH) Chemical Industry	(MG) Manufacturing	(C) Community College
(CL) Commercial Lab	(G1) DOC	(PC) Private College
(CG) Consulting	(G2) DOD	(T) Technical College
(CP) Corporate Lab	(G3) DOT	(U) University

### CREDIT CARD INFORMATION

VISA  Mastercard  American Express  Discover Card #: \_\_\_\_\_

Full name as it appears on card: \_\_\_\_\_ Exp. Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

### CANCELLATION POLICY

Full tutorial registration fees will be refunded if written notice is received (by fax or mail) by June 11, 2004. You may transfer your paid registration to another individual from your organization to attend in your place without penalty. Written authorization for this substitution is required. Please mail or fax written notice of substitution to the NCSL International business office to arrive by June 25, 2004.

### FOR OFFICE USE ONLY

Registration Received: \_\_\_\_/\_\_\_\_/\_\_\_\_ CK # / CC App #: \_\_\_\_\_ CK / CC App Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

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

## KEYNOTE SPEAKER



**Graeme Drake**

Graeme Drake is currently Head of Conformity Assessment with the International Organization for Standardization (ISO) based in Geneva. He is Secretary of the international Committee on conformity assessment (CASCO), which develops policy and produces international standards and guides on conformity assessment matters.

Previously Graeme was General Manager - International, for Standards New Zealand. In this capacity he advised private sector companies, New Zealand and foreign governments on technical barriers to trade issues, good regulatory practice, standards and conformity assessment subjects, and participated in the work of APEC, ASEAN-CER, IEC, ISO, MERCOSUR-CER, OECD, and the World Trade Organisation.

Prior to joining the standards and conformity assessment world he has held executive positions in New Zealand local government, and has been a principal environmental consultant for a large international consulting firm and operated his own consulting business.

Graeme holds a Bachelor's Degree in Regional Planning, Post Graduate Diploma in Business Administration and a Masters of Business Studies.

## SPONSOR'S PROGRAMS

NCSL International is pleased to offer a sponsorship program in conjunction with the 2004 Workshop and Symposium in Salt Lake City, Utah. This program allows interested parties to support NCSL International at the event and to receive recognition for their contribution to the program.

Sponsors may select from a variety of sponsorship opportunities, fitting any size budget, from "Platinum" sponsors to "Silver." As an alternative, a sponsor may select a specific venue, such as the sponsorship of the Cyber Café.

A number of benefits are included at each sponsorship level. Depending on the level chosen, the sponsor will receive some portion of these extended benefits. Potential sponsors can visit the following NCSLI website URL to learn exactly which benefits accrue to each level, PLATINUM naturally offering all the listed advantages, while SILVER offers less, and so forth.

<https://www.ncsli.org/conference/2004/sponsorship/>

### PLATINUM

Here are the benefits provided for Platinum Sponsors:

- Company Logo on conference sponsor website, with banner ad, listing in last minute guide sponsor page, logo on Conference Bag
- Recognition at opening keynote and closing session
- Sponsorship Signage at the Event
- Product Demonstration meeting room on Sunday, July 11
- Single-page literature or a CD insert in the Conference Bag
- Listed in the Program CD and in NCSLI Newsletters
- You will receive additional recognition in these areas:
  - Sunday Night Exhibit Reception
  - Single Luncheon
  - Single breaks (Your logo prominently displayed on table tents at refreshment areas)

**GOLD and SILVER have corresponding less benefits**

### CYBER CAFÉ

- Company Logo on conference sponsor website, in conference last minute guide sponsor page
- Recognition at opening keynote and closing sessions
- Signage at the Cyber Café

### A/V SERVICES

- Company Logo on conference sponsor website, in conference last minute guide sponsor page
- Recognition at opening keynote and closing sessions
- Signage for A/V Equipment

### SPONSORSHIP FEES

Platinum	\$5,000
Gold	\$3,500
Silver	\$2,000
Cyber Café	\$750
A/V Services	\$750

## GUEST PROGRAM

### Monday Tour:

Celebrate Salt Lake City on a tour that includes some of the city's most famous sites and buildings \$ 40 - 4 Hours

Guests will travel by motor coach to the State Capitol Building, the city's crowning jewel. The view from the front steps is magnificent. Murals lining the Georgian marble rotunda walls tell the story of the settling of the Old West.

The tour includes a drive past the elegant mansions on South Temple. Many of these homes were built with wealth derived from the Park City mining boom of the late 1800's.

Drive past Rice/Eccles Stadium, site of the opening and closing ceremonies for the 2002 Winter Olympic Games, and Old Fort Douglas, the 2002 Olympic Athlete's Village. Visit This-Is-The-Place Monument and visitors center at the mouth of Emigration Canyon. This monument stands as a tribute to the men, women and children who were instrumental in settling this area. While at the monument, guests can watch a 20 minute video on the pioneer trek from Illinois to the Salt Lake Valley.

En route back to downtown, guests will stop at Trolley Square for lunch on their own, and shopping in the upscale shops. Trolley Square is a unique shopping center built in trolley barns from the early 1900's.

### Tuesday Tour:

Visit Park City - Site of the Sundance Film Festival, and mountain hub of the 2002 Winter Olympics \$ 45 - 5 Hours

Enjoy the quaint town of Park City. Park City had its beginnings as a boomtown during the silver mining boom of the late 19th century. Learn about its colorful history as the area changed from a mining town to a world famous ski resort.

Stop at the jailhouse museum and learn more about the history of this unique town. Spend time browsing the unique shops and galleries on historic Main Street, and be sure to take time to relax and enjoy dinner or a snack at one of the many fine eateries in town.

## INTERNATIONAL EVENING

This Is The Place State Park, \$50

Wednesday, July 14, 2003 - 6:30 pm - 10:00 pm

Visit the exhibits, then join us for dinner, followed by square dancing, including a demonstration, instruction, and audience participation. This promises to be an interesting, educational, and fun evening!

Take a walk into the past at This Is The Place State Park. Old Deseret is a living historic village that recreates a typical community between 1847 and 1869. See the sights of daily pioneer life and visit adobe houses, shops, schools, churches and sites of cultural activities. Guides, dressed in period dress, conduct daily activities and share stories of pioneer lifestyles.

This Is The Place Monument, located south of Old Deseret Village, was erected in 1947. It commemorates the 100th anniversary of the arrival of Mormon pioneers to the Salt Lake Valley. Early Spanish explorers, mountain men and American Indians also are featured. A video presentation, exhibits and a museum store are available at the visitor center. This Is The Place State Park is Utah's most renowned historic park. It is on the east bench of Salt Lake City at the mouth of Emigration Canyon.



# 2003 CONFERENCE—BEST THEORETICAL PAPER

## Determining Consensus Values in Interlaboratory Comparisons and Proficiency Testing

Speaker/Author: Dr. Henrik S. Nielsen  
HN Metrology Consulting, Inc.  
Indianapolis, Indiana, USA  
<hsnielsen@HN-Metrology.com >  
Phone: (317) 849 9577; Fax: (317) 849 9578

### 1. Abstract

An important part of interlaboratory comparisons and proficiency testing is the determination of the reference value of the measurand and the associated uncertainty. It is desirable to have reference values with low uncertainty, but it is crucial that these values are reliable, i.e. they are correct within their stated uncertainty. In some cases it is possible to obtain reference values from laboratories that reliably can produce values with significantly lower uncertainty than the proficiency testing participants, but in many cases this is not possible for economical or practical reasons. In these cases a consensus value can be used as the best estimate of the measurand. A consensus value has the advantage that it often has a lower uncertainty than the value reported by the reference laboratory. There are well known and statistically sound methods available for combining results with different uncertainties, but these methods assume that the stated uncertainty of the results is correct, which is not a given. In fact, the very purpose of proficiency testing is to establish whether the participants can measure within their claimed uncertainty. The paper explores a number of methods for determining preliminary consensus values used to determine which participant values should be deemed reliable and therefore included in the calculation of the final consensus value and its uncertainty. Some values are based on impressive equations and others have curious names. The relative merits of these methods in various scenarios are discussed.

### 2. The Purpose of Proficiency Testing

As part of their quality assurance programs, accreditation bodies normally require accredited laboratories to participate in proficiency testing. There are two broad categories of proficiency testing or interlaboratory comparisons, one where a set of artifacts is sent around to all participating laboratories and one where a specimen or sample is split up and one piece is sent to each participating laboratory. HN Proficiency Testing offers the former kind of proficiency tests and this paper is based on experiences with this kind of tests. However, the techniques described herein and the conclusions are valid for either kind of tests.

The purpose of proficiency testing is to ensure that the participating laboratories can make reliable measurements. A measurement can be unreliable in two different ways. It can contain a blunder or other serious error, which makes it atypical for what would be expected from the laboratory, or the uncertainty of the measurement can be underestimated, such that the error in a correctly performed measurement is larger than the uncertainty stated by the laboratory.

A measure of the quality of the design of a proficiency test is how well it can distinguish between reliable and unreliable measurements. The width of the gray zone between reliable and unreliable measurements as judged by the proficiency test can be thought of as

the uncertainty of the proficiency test. To minimize the uncertainty of the proficiency test it is necessary to have a reference value that is reliable (per the definition above) and has a low uncertainty.

Unless a reference laboratory that can measure with a much smaller uncertainty than the test participants can be identified, a (weighted) average value will generally be more reliable, i.e. be less likely to be affected by the influence of mistakes or blunders, than a value produced by an individual laboratory. Such a value will also have a lower uncertainty than the least uncertain measurement included in the average.

Since the very purpose of proficiency testing is to identify reliable results it is unreasonable to make a priori assumptions about the reliability of the participants' results. Therefore it is necessary to have a robust algorithm for determining which results to consider reliable and therefore include in the average and which to disregard.

### 3. Algorithms for Identifying Reliable Results

For a variety of reasons HN Proficiency Testing has been using what in our opinion are reliable, accredited, commercial laboratories as reference laboratories. These laboratories do not necessarily offer an uncertainty that is significantly lower than that of the test participants. We have therefore been using weighted averages as reference values for our tests whenever we have considered it prudent to do so based on the particular measurements and the number of participants.

We have been using a weighted average rather than an arithmetic average in recognition of the fact that there is a significant variation in the capabilities of the participating laboratories, thus giving higher weights to the laboratories that claim a lower uncertainty, as long as we deem their results to be reliable.

Another advantage of using a weighted average is that the uncertainty of the weighted average is easy to calculate, if one assumes that the measurements are independent, which is generally a reasonable assumption in these types of tests, as long as there are not a large number of results from one particular laboratory or from laboratories that are related e.g. by using the same, wrong procedure.

#### 3.1 The Median Algorithm

Our first algorithm for determining reliability was fairly simple: We determined the median of all the measurement results in a test and all the results that contained the median value within their uncertainty range were deemed to be reliable and were thus included in the weighted average. We used the median rather than the mean value, as the median is more robust towards outliers.

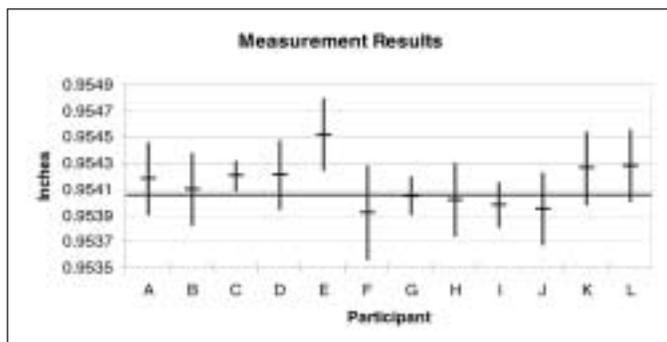


Figure 1: Measurements from 12 laboratories. The vertical lines indicate uncertainty ranges. The bold horizontal line indicates the median value. The values from participants C and E are not considered reliable for the purposes of calculating the weighted average value, as their uncertainty ranges do not include the median.

Figure 1 shows a typical set of measurements and their median value. As can be seen from the figure, the uncertainty ranges of participants C and E do not include the median value (the bold line). Therefore, the values from these to participants are not included in the weighted average.

It can be argued, that the result from participant C is probably reliable, but the criterion is designed to eliminate rather than include the results that are only probably reliable. As it turns out when the weighted average value and its associated uncertainty are calculated, the result from participant C is indeed acceptable based on the  $E_n$  calculation, but that is a different issue.

The algorithm works well on most data sets, but it turned out to have some weaknesses, see figure 2. The range of uncertainties quoted by the participants in this test is very wide with participants A, C and G quoting low but - as it turns out - realistic uncertainties and participants B, E, F and I quoting fairly high but - based on their results - also realistic uncertainties for this particular measurement. Note that the values of participants A, C and G correspond quite well to each other, given their uncertainties, but since they are in the minority in this case, their uncertainty ranges do not include the median value.

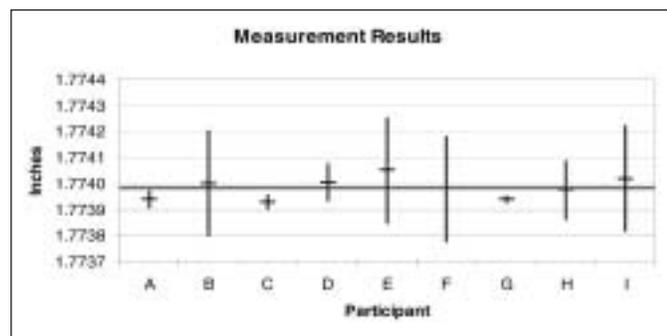


Figure 2: Measurements from 9 laboratories. The vertical lines indicate uncertainty ranges. The bold horizontal line indicates the median value. The values from participants A, C and G are not considered reliable for the purposes of calculating the weighted average value, as their uncertainty ranges do not include the median. However, although they are in the minority, these 3 results agree well with each other and their stated uncertainty is within what is reasonable for the measurement in question.

The weighted average of the values that include the median in their uncertainty range is 1.774 and the uncertainty of the weighted average is 0.00051. These particular measurements were in inches, but this is irrelevant to the analysis. When the results of the individual

participants are compared to this weighted average, the results of participants A, C and G are found to have an  $E_n$  value outside  $\pm 1$  and they are thus deemed unacceptable.

The median algorithm works well for eliminating results with unrealistically low uncertainty claims from the weighted average. It does not work well for data sets that include a few results with low, but realistic uncertainty claims amongst a majority of results was significantly higher uncertainty claims.

### 3.2 The Cumulative Probability Algorithm

Having identified this weakness in the median algorithm, it became clear that it would be necessary to develop a more robust algorithm. The median algorithm assigns the same weight to all results when determining the first estimate of the reference value (the median value). To correct for the behavior described above it would be necessary to assign a higher weight to results with low uncertainty claims when determining the first estimate of the reference value.

The cumulative probability algorithm does this by modeling each result as a normal distribution with a standard deviation equal to one half of the claimed uncertainty. This distribution represents the probability distribution for the true value, given the measured value and the claimed uncertainty. This is consistent with the assumptions in and the theory behind the ISO Guide [1], as participants are required to report their uncertainty as an expanded uncertainty using  $k=2$ .

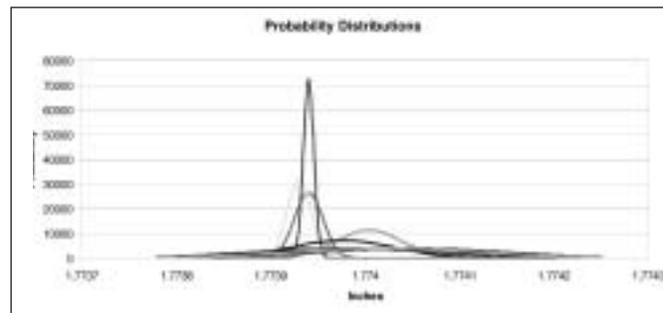


Figure 3: The same measurements as in figure 2, represented by normal distributions with a standard deviation equal to their respective combined standard uncertainty (half their expanded uncertainty). The amplitudes of the distributions are such that the area under each curve is unity.

The cumulative probability distribution based on all the measured values is calculated using the following formula:

$$f(x) = \frac{\sum_{i=1}^n \left( \frac{1}{\sqrt{2\pi}\sigma_i} e^{-\frac{(x-\mu_i)^2}{2\sigma_i^2}} \right)}{n}$$

where:

- $f(x)$  is the cumulative probability distribution
- $n$  is the number of measurements/participants
- $\mu_i$  is the value measured by the  $i$ 'th participant
- $\sigma_i$  is the standard deviation (one half of the expanded uncertainty) associated with the value measured by the  $i$ 'th participant

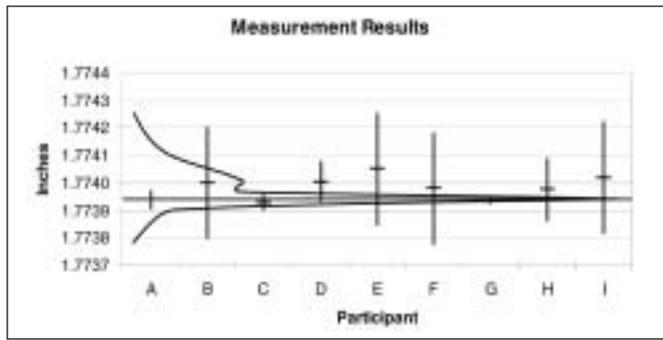


Figure 4: The same measurements as in figure 2. The curve indicates the cumulative probability distribution and the bold horizontal line indicates the value with the highest cumulative probability, the first estimate of the reference value using this algorithm. As it can be seen, the cumulative probability distribution is dominated by the values with the lowest claimed uncertainties (Participants A, C and G). The value of participant G is obscured by the cumulative probability distribution curve.

The cumulative probability algorithm works well for the data set used in figures 2, 3 and 4. However, it relies very heavily on the assumption that the measured values and the quoted uncertainties are correct, which is the very issue proficiency testing is intended to validate.

The weakness of the cumulative probability algorithm is illustrated in figure 5. The value of participant G has been changed to simulate an outlier with a very low quoted uncertainty. This is a quite common situation in proficiency testing. Because of the exponentially higher weight given to values are quoting low uncertainty, this outlier is able to "overpower" the rest of the measured values. It is clear from figure 5 that the cumulative probability algorithm is not a robust algorithm.

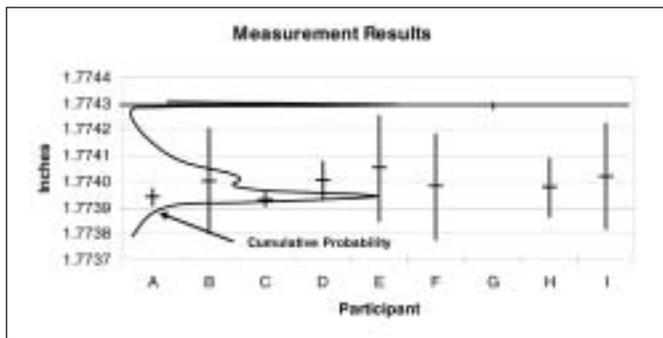


Figure 5: The same measurements as in figure 4, except the value from participant G has been altered to simulate an outlier. The curve indicates the cumulative probability distribution and the bold horizontal line indicates the value with the highest cumulative probability at about 1.7743 inches. As it can be seen, the cumulative probability distribution is dominated by the values with the lowest claimed uncertainties (Participants A, C and G). The uncertainty claimed by participant G is one half of that claimed by participants A and C, which puts the peak of the cumulative probability curve at the value of participant G. The value of participant G is obscured by the cumulative probability distribution curve and the bold horizontal line.

### 3.3 The "Value Voted Most Likely To Be Correct" Algorithm

The median algorithm does not consider the uncertainty claimed by the participants in the first estimate of the correct value. While it works well in most cases, this algorithm is not robust for data sets containing a few results with low, realistic uncertainty amongst a

higher number of results with higher uncertainty and significant deviation.

The cumulative probability algorithm assigns significant weight to the uncertainty claimed by the participants in the first estimate of the correct value. Therefore this algorithm is not robust against outliers with a low claimed uncertainty.

Given the problems with these two algorithms it would appear that an ideal algorithm would add some weight to the uncertainty claimed by the participants in the first estimate of the correct value, but not as much as the cumulative probability algorithm does. The "Value Voted Most Likely To Be Correct" algorithm is one such algorithm.

Where the cumulative probability algorithm interprets the uncertainty claimed by the participants as a normal distribution, the Value Voted Most Likely To Be Correct algorithm interprets the uncertainty range of each participant as a modified rectangular distribution. The modification is that the distribution has a height of one, regardless of its width. Conceptually this is equivalent to saying that each participant gives one vote to each value within their uncertainty range and zero votes to values outside this range. By tallying the votes one can determine which value, or range of values, the highest number of participants considers a likely correct value.

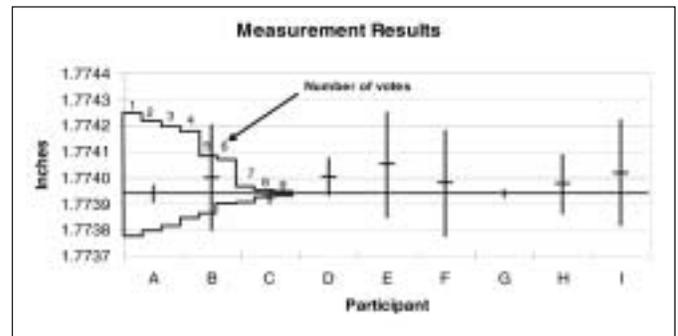


Figure 6: The same measurements as in figure 2 and 4. The stepped curve indicates number of votes for each range of values and the bold horizontal line indicates the value with most votes, the first estimate of the reference value using this algorithm. As it can be seen, the algorithm finds the value most participants can agree on.

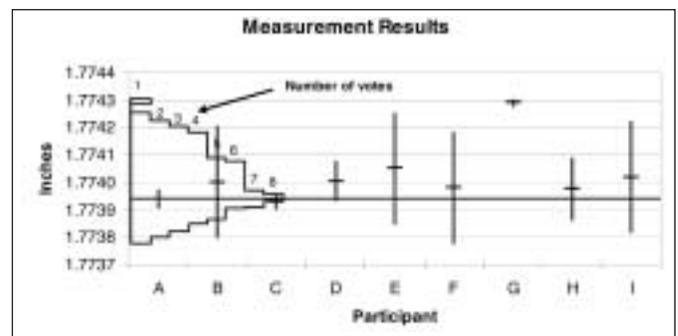


Figure 7: The same measurements as in figure 5 with the result for participant G modified to simulate an outlier. The stepped curve indicates number of votes for each range of values and the bold horizontal line indicates the value with most votes, the first estimate of the reference value using this algorithm. As it can be seen, the algorithm is robust against outliers.

Figure 6 shows how this algorithm works on the original problem data set. It finds a first estimate of the reference value that is acceptable not only according to the high uncertainty measurements but also according to the three low uncertainty measurements.

Figure 7 shows how this algorithm, contrary to the cumulative probability algorithm, is robust against outliers. Early results that include several data sets indicate that the Value Voted Most Likely To Be Correct algorithm is not only more robust than the median algorithm but also in most cases identify more participant values as reliable and therefore lead to weighted average values with lower uncertainties than the median algorithm, while at the same time finding fewer participant values unacceptable according to the  $E_n$  calculation.

#### 4. Conclusions

A weighted average value is one way to create a reference value in interlaboratory comparisons in proficiency testing. In order for the weighted average value and its associated uncertainty not to be contaminated by incorrect measurements (measurements that yield a wrong value due to a measurement error and measurements with a too low quoted uncertainty) a criterion must be established for which measurements are included in the weighted average.

A good criterion for determining which measurements to include in the weighted average is one that, while excluding all potentially incorrect measurements, includes as many measurements as possible to yield a reliable weighted average value with as low an uncertainty as possible. At the same time a good criterion must be robust against "problem data sets".

Requiring a measurement's uncertainty interval to include the median value of all the reported values for the measurand is one such criterion. This criterion is statistically well founded and generally works well, but as it is shown in this paper it may come to the wrong conclusion for data sets that include correct measurements with significantly different uncertainties.

While one new algorithm, the cumulative probability algorithm, works well on the data set where the weakness of the median algorithm was discovered, it is shown to be very sensitive to outliers and lack the required robustness.

Another new algorithm, the Value Voted Most Likely To Be Correct algorithm, is presented. It is shown how this new algorithm works better than the median algorithm on data sets with significantly different uncertainties, while at the same time exhibiting good robustness against outliers.

#### References

1. Guide to the Expression of Uncertainty in Measurement. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML., 1995

#### EDITOR'S MESSAGE (Cont. from page 2)

##### And speaking of Websites

I have to stand back in awe when I see how fast and how far the Internet has transformed the way we do business. For a globally dispersed organization like NCSLI, it is a Godsend. Instant information from the world and to the world.

I decided to ask Craig Gulka at the Business Office to overview the capabilities and breadth of information available on our website, and was stunned to find how much there is. In fact, I had to work to compress the information to just two pages in this issue. See pages 22-23. You are aware that last issue, I chose to refer some of the "overhead" pages in the rear of the newsletter, to the website, and summarize them on page 54 of the January 04 issue. Since then the Board asked me to add back several pages.

However, there are still multiple reasons for you to visit the NCSLI website and review all the different kinds of information and services that you can get with a click of the mouse. It is quite impressive, and once I found it out, I wanted all our members to share it.

##### Sad news for all

I'm late on reporting the death of Kent Crow, one of our active Committee Chairmen. From all reports, Kent was a gentleman and effective leader. His cancer came on suddenly, and was unforgiving. See Kent's remembrance on page 29.

And then, more bad news came from Canada, when we learned that Anthony Ulrich, one of our newly appointed Regional Coordinators was killed in a wintertime accident. For old guys like myself, it is very distressing to see young men taken at the height of their lives. Although my philosophy of life does cover events like that; Life is a Crapshoot, it is not very profound, and certainly not very much solace to Kent's and Anthony's families. See page 30.

##### We are family

Two NCSLI incidents hit my consciousness recently. One was that I was able to drive to the latest NCSLI Board meeting at Monterey. I only get to Board meetings now about once every 5 years, although I get to interact with members at Guy Fleming's regular regional meetings. Watching the Board meeting discussions and seeing the agenda-working just has to impress anyone with the professionalism and world-wide metrology reach of this organization. It is quite stunning.

Then came a simple comment from one of my review panel members who helps me proofread this newsletter before it goes to the printing company. He just stated that he enjoys reading the newsletter for its personal touch. It then struck me that while this global organization manages the highest of the technologies and national laboratories and organizational skills for world matters, it is at the same time, such a venue for personal friendships. The Board meetings build so many personal friendships that last a lifetime-I know that from personal experience. I have mentioned before that many of the spouses of Board members have formed lifetime connections. The regional meetings bring together local friends who work together.

Remarkable, don't you think?

John Minck  
Editor

# METROLOGY CALENDAR

0204

## NCSLI MEETINGS

July 11-15, 2004  
NCSL Workshop & Symposium  
Salt Palace, Salt Lake City, UT  
CONTACT: NCSL Business Office, (303) 440-3339  
Fax: (303) 440-3384  
e-mail: <info@ncsli.org>  
website: <www.ncsli.org/conference>

## INDUSTRY/GOVERNMENT MEETINGS

### International Dimensional Workshop

May 10-14, 2004  
Nashville, TN  
CONTACT: Ed Pritchard, (865) 574-4261  
Fax: (865) 574-2802  
e-mail: <pritchardew@y12doe.gov>  
website: <http://www.sme.org/idw/>

### IEEE Instrumentation & Measurement Technology Conference

May 18-20, 2004  
Grand Hotel di Como, Como, Italy  
CONTACT: Robert Myers, (310) 446-8280  
Fax: (310) 446-8390  
e-mail: <bob.myers@ieee.org>  
website: <www.ieee-imtc.org>

## INTERNATIONAL DIMENSIONAL WORKSHOP

Airport Marriott  
Nashville, TN  
May 10-14, 2004

Time is short for signing up for the 2004 International Dimensional Workshop.

Details are on the IDW2004 Website:

<http://www.sme.org/idw/>

Contact: Ed Pritchard  
Oak Ridge Metrology Center  
Phone: 865-574-4261, Fax: 865-574-2802  
<pritchardew@y12.doe.gov>

## REGION MEETINGS

### Uncertainty Road Show

April 1, 2004  
Lockheed Martin Metrology Lab, Sunnyvale, CA  
CONTACT: Guy Fleming, (408) 742-7857  
Fax: (408) 742-4436  
e-mail: <guy.fleming@lmco.com>

### Denver/Boulder Section Meeting

April 22, 2004  
Agilent Technologies, Englewood, CO  
CONTACT: Dale Varner, (303) 977-5523  
FAX: (303) 971-5635  
e-mail: <dale.varner@lmco.com>

### New York City Section Meeting

April 28, 2004  
Dayton T. Brown, Inc., Bohemia, NY  
CONTACT: Don Bansen, (631) 589-6300 x723  
Fax: (631) 244-6234  
e-mail: <dbansen@dtb.com>

### Madison, WI Section Meeting

May 13, 2004  
Bone Care International, Middleton, WI  
CONTACT: Keela Sniadach, (608) 298-4681

### Northwest US Region Meeting

May 21, 2004  
Museum of Flight, Seattle, WA  
CONTACT: Keith Cable, (206) 762-2515  
Fax: (206) 762-5880  
e-mail: <kcable@nwcal.com>  
website: <www.ncsli.org>

Please send Metrology Calendar additions and corrections to the NCSL International Business Office,  
(303) 440-3339 FAX:(303) 440-3384, or E-mail to <info@ncsli.org>

---

# TRAINING INFORMATION

---

## CRYOGENIC ENGINEERING TRAINING

June 7-11, 2004  
Boulder, CO

Four and one-half days, includes: Basic Principles, Properties of Cryogenic Fluids, Properties of Solids at Low Temperatures, Cryogenic Refrigeration and Liquefaction, Cryogenic Instrumentation, Cryogenic Equipment and Systems Analysis, and Cryogenic Safety.

Based on the book, "*Cryogenic Engineering*" by Dr. Thomas M. Flynn.

Contact:

Dr. Thomas Flynn  
511 North Adams Ave.  
Louisville, CO 80027  
(303) 665-8302 F (303) 665-0222  
Syllabus and registration forms at: < [www.cryoco.com](http://www.cryoco.com) >

\*\*\*\*\*

## REGULATORY ASSET MANAGEMENT TRAINING

Blue Mountain Quality Resources, Inc. and eCalibration.com have teamed up to offer informative training seminars for GMP compliance. Our courses are designed and presented by instructors who are well qualified to present particular aspects of asset management issues relating to calibration, maintenance, and qualification applications in the pharmaceutical, biotech, laboratory, R&D, and production environments. Each two-day course is \$995 per student. Group discount is available.

### Laboratory Instrument Qualification, Calibration & Maintenance

May 13-14, 2004 Location: Plymouth Meeting, PA

The analytical instrument qualification and calibration records are among the most frequently requested items in regulatory inspections. An understanding of the requirements of an effective instrument qualification and performance verification program assists in fulfilling GMP and GLP regulations. Individuals who are responsible for or involved with any aspect of the procurement, qualification, calibration or maintenance of laboratory instrumentation will enhance their job performance by attending this class.

### Calibration Fundamentals & Best Practices

June 3-4, 2004 Location: Chicago, IL

A successful calibration program within a corporation does not operate alone but rather it must interact with management, users, quality assurance departments and regulatory affairs. The development of an effective calibration program relies upon the cooperation among these groups. Whether you have experience in the calibration field or have recently acquired calibration responsibilities, this course will provide you with the knowledge and understanding of the fundamentals of an effective calibration program.

## Fundamentals of GMP Maintenance

June 17-18, 2004 Location: Plymouth Meeting, PA

Maintenance programs have long been identified as being a critical component of any efficient operation. Maintenance in FDA regulated industries takes on additional importance because of the role it plays in the validation and production processes of a quality product. Individuals who are responsible for or involved with any aspect of the maintenance, quality, calibration or compliance of assets will reinforce their job performance by attending this class.

More information: < [www.ecalibration.com](http://www.ecalibration.com) >

\*\*\*\*\*

## FIRST COURSES FOR THE NEW NCSLI TRAINING CENTER

Presented by Integrated Sciences Group

### Introduction to Uncertainty Analysis

April 19-20, 2004 and September 27-28, 2004  
\$895 - Software Included

This two-day course provides a straightforward and easy-to-understand introduction to the principles of measurement uncertainty analysis. Concepts and methods are consistent with those found in ANSI/NCSL Z540-2, the "U.S. Guide to the Expression of Uncertainty in measurement." The development of uncertainty estimates and the illustration of analysis principles are enhanced through hands-on training in the use of ISG's Uncertainty SideKick software.

### Advanced Uncertainty Analysis

April 21-22, 2004 and September 29-30, 2004  
\$1,295 - Software Included

This two-day course provides instruction in advanced principles and methods of uncertainty analysis. Topics are presented that include and extend the methods and concepts found in ANSI/NCSL Z540-2. The practical application of these principles to the analysis of direct measurements, multivariate measurements and measurement systems is illustrated through hands-on training in the use of ISG's UncertaintyAnalyzer software.

### Measurement Decision Risk Analysis and Management

June 2-4, 2004  
\$1,495 - Software Included

This three-day course provides a conceptual background in measurement risk analysis methods and techniques documented in NASA Reference Publication 1342, "Metrology - Calibration and Measurement Processes Guidelines." Topics include achieving accuracy ratios and other quality requirements through the analysis and management of false accept and false reject risks, establishing and using tolerance guardbands, and interpreting and reporting measurement decision risk.

**Interval Analysis Concepts and Methods**

June 7-8, 2004

\$895

This two-day tutorial provides an overview of calibration interval analysis concepts and methods documented in NSCLI Recommended Practice RP-1, "Establishment and Adjustment of Calibration Intervals." Students will be introduced to risk analysis concepts, measurement reliability modeling methods, statistical interval analysis techniques, calibration interval

objectives and potential ancillary interval analysis benefits such as equipment outlier identification. Concepts are illustrated using commercially available software and selected freeware.

All four courses are to be held at the new NCSLI Training Center, Boulder, CO

Integrated Sciences Group

< www.isgmax.com >

1-800-400-7866

**CENAM TRAINING COURSES**

*Editor's Note: The NCSLI Board is active in supporting and encouraging training activities for our member organizations across the world. In that spirit, we are publishing the 2004 training schedule for Mexico's CENAM below. We are publishing here in our usual English language, but of course the training modules are conducted in Spanish.*

The CENAM training is given in Spanish. For this schedule below and more information in Spanish, please log onto the NCSLI website and go to the **training information**.

---

**CENAM Courses for 2004**

Course #	Title	Dates
07/04	Introduction to the uncertainty evaluation in chemical-clinical area	April 22 & 23
08/04	Pressure metrology	May 11 to 14
09/04	Electrical measurements in DC, for calibration laboratories	19 to 21
10/04	Force metrology in tension and compression machines	26 to 28
35/04	Fundamentals for vibration metrology. Theory and practice	26to28
11/04	Introduction to metrology, evaluation and expression of uncertainty in measurement	June 2 to 4
12/04	Optical fiber metrology for telecommunications	9 to 11
13/04	Basic course of mass metrology	16 to 18
14/04	Calibration of colorimeters	24 & 25
36/04	Introduction to metrology in acoustics	July 5 to 7
15/04	Calibration of piston micropipettes and pipettes	7 to 9
16/04	Course-workshop on NMX-EC-17025-IMNC-2000 standard "General requirements for the competence of testing and calibration laboratories"	27 to 30
19/04	Electrical measurements in AC for calibration laboratories	August 11 to 13
18/04	Introduction to metrology, evaluation and expression of uncertainty in measurement	18 to 20
19/04	Course of weights calibration	25 to 27
20/04	Time and frequency metrology. Theory and practice.	30 & 31
21/04	Metrology of torque	September 1 to 3
22/04	Calibration of refractometers and polarimeters	8 to 10
38/04	Advanced techniques on vibration metrology	22 to 24
23/04	Traceability and uncertainty evaluation in chemical measurements by gravimetry and volumetry	23 & 24
24/04	Uncertainty evaluation in pH and electrolytic conductivity measurement	30 & 1 Oct.
25/04	Introduction to metrology, evaluation and expression of uncertainty in measurement	October 6 to 8
26/04	Course of metrology of large weights	13 to 15
39/04	Sound sources identification techniques and noise control	20 to 22
27/04	Hardness metrology	November 4 & 5
28/04	Theory for measurement and calibration of temperature, humidity and thermal conductivity	8
29/04	Theory and practice for measurement and calibration of temperature, humidity and thermal conductivity	9 & 10
30/04	Pressure metrology	9 to 12
31/04	Uncertainty evaluation on electrical measurements	17 to 19
32/04	Introduction to metrology, evaluation and expression of uncertainty in measurement	December 1 to 3
33/04	Vacuum Metrology	9 & 10

---

# REPORTS FROM THE BOARD

---

## ILAC/NACLA REPORT

*Anthony Anderson*

### International Laboratory Accreditation Cooperation (ILAC) Laboratory Committee (LC)

There have been no meetings of the ILAC LC since the Bratislava General Assembly in September. At the request of the Accreditation Policy Committee (APC) Chair, I reviewed and edited the rules and procedures regarding the use of the ILAC-MRA Mark, which had been presented to the General Assembly, and participated in the writing of the license and sub-license agreement documents.

I reported after Bratislava that this is the Mark that accrediting bodies will be able to use on their documentation combined with their own logo or mark. Laboratories will be able to use a similar Mark, but including their accreditation certificate number, on calibration certificates and test reports. The license documents have been submitted to ILAC's lawyers in The Netherlands for approval and conformity with Dutch Law. Following approval the worldwide registration process of the ILAC Mark will begin.

In November, Mike Peet, ILAC Chair, attended the World Trade Organization Technical Barriers to Trade (WTO-TBT) Committee's triennial review of the operation and implementation of the Agreement on Technical Barriers to Trade. Significant for ILAC was a recommendation by the TBT Committee that a work program be established to better understand member's conformity assessment systems in their implementation of the agreement. In particular, representatives from relevant international and regional accreditation fora will be invited to provide information on their operation and the participation of Members, in particular, developing country Members, in their systems.

Users, such as certification bodies, should also be invited to share their experiences in this respect, and to hold a workshop on the different approaches to conformity assessment, including the acceptance of conformity assessment results. How ILAC might assist in this activity will be discussed at the next Executive Committee Meeting in February. Gathering the information will be a long process, but by beginning early, ILAC will be in a strong position to reply to the WTO when they are approached.

### National Cooperation for Laboratory Accreditation (NACLA)

I attended the NACLA Board workshop and retreat in Scottsdale, Arizona, in November. In October I reported that this second workshop on the future of NACLA would be led by a professional facilitator. The board members were split into 5 task groups; Marketing, Recognition, Resources, Stakeholder Buy-in and Structure. Each group was asked to carry out a "STOP" process for problem solving (Situation, Target, Options, Pick a Plan).

After each step of the process the task groups presented their work to the whole board for input, and then returned to their TG's. In the final session, a priority and value system was used to come up with the actions that would be pursued by each group. The work is expected to be completed by the April 2004 Forum. Of particular

note was an action by the Resources TG to consider changing NACLA from a membership-funded organization to being funded through a "capitation fee" levied on ABs. This would be a much more secure way of establishing NACLA's long term fiscal health.

Two new lead evaluators have been appointed, which should significantly help with the backlog of recognitions in process. In addition, an action from the Recognition Task Group in Scottsdale was to hold an Evaluator Conclave in the early part of 2004 and planning is underway. Following a final evaluation of one of the AB applicants carried out in December, another AB recognition is expected very shortly.

The operation of the new NACLA corporate office in Florida has now begun and all administrative enquiries should be addressed to the new location: c/o Guildline Instruments, Inc., 103 Commerce St., Suite 160, Lake Mary, FL 32746. Phone is 407-333-3327. Fax, 407-333-3309. Email: < treasurer@nacla.net >.

NACLA's Treasurer, Tony Anderson, will be the main contact at the corporate office. All NACLA corporation inquiries, communications with the NACLA President and officers, financial matters, dues and fees, and general NACLA business will be handled from this office. NACLA's web site will continue as < www.nacla.net >.

\*\*\*\*\*

## BIPM REPORT

*Andrew Wallard*

As reported informally by the NCSLI President to the last Board Meeting, the October 2003 meeting of Member States of the Metre Convention - the General Conference on Weights and Measures (CGPM) - agreed to BIPM's budget for the years 2005-8. The new annual budget will be about 10M, which represents a "real terms" increase of nearly 5%. This will allow us to recruit a small number of new staff and launch new initiatives in organic chemistry (with an emphasis on laboratory medicine), as well as begin new projects on a "Watt" balance and a high performance calculable capacitor. The former will enable us to monitor the international kilogram at about the part in 10<sup>8</sup> level and the latter will provide a long-term calibration service and relate the electrical and mechanical units.

The CGPM also agreed on a number of Resolutions (see <www.bipm.org>). Amongst these were the CGPM's position on the relationship between calibration and conformity assessment, the use of the dot and comma as the decimal marker, the Metre Convention's relations with developing countries, and the importance of the CIPM - MRA in trade. CGPM's priorities for the BIPM focus on extending its scientific programme so as to provide a technical base in organic chemistry, on international coordination of metrology at the highest level and to relations with international and intergovernmental bodies.

In November 2003, the BIPM held a meeting of nearly 100 people interested in metrology in food. During the meeting key presentations were made by representatives of a number of international bodies concerned with cross-disciplinary issues and well as sectoral

or industry bodies (such as those concerned with olive oil and wine). The general view was that the time was ripe for an initiative to introduce a more formal approach to uncertainty and traceability in the area although other technical problems often dominate measurement uncertainty.

As a result the BIPM has applied to be an observer to the "CODEX ALIMENTARIUS" of the United Nations' Food and Agriculture Organisation. We shall also be looking to this group to advise on priority areas for international comparisons needed to develop confidence in the reference standards and methods used in food analysis, and to investigate their international equivalence.

We now believe that it is a good time to develop a strategy for the promotion of the CIPM-MRA and to highlight its relevance to the reduction of technical barriers to world trade. A number of international projects are already addressing the issues (eg. the EU's "REG-MET" project) and I shall be speaking at a meeting of US Regulators in May 2004 organised by Pete Unger of A2LA.

In laboratory medicine, we have signed a cooperation agreement with the ILAC and the International Federation of Clinical Chemistry (IFCC), which formally launches the "Joint Committee on Traceability in Laboratory Medicine." The JCTLM Executive will meet in March 2004 and will set priorities for a number of activities. In the meantime we are well on the way towards drawing up a list of "standards of a higher order" which will enable in-vitro device manufacturers to demonstrate best practice so as to meet the requirements of the European IVD Directive launched on 1 January 2004.

Finally, I have now formally taken over from Terry Quinn as Director of the BIPM. The "key handing over ceremony" took place on 1 January 2004.

We are looking forward welcoming our NCSLI Board colleagues to the BIPM during March.

\*\*\*\*\*

## **EUROPEAN COOPERATION IN METROLOGY (EUROMET)**

*Seton Bennett*

There are now 27 full members of EUROMET, with the admission of Bulgaria last year, and this number is likely to increase to 30 with the expansion of the European Union this year. In addition, there are currently 8 Corresponding Applicant NMI's (aiming at full membership), 15 Corresponding Organisations & 2 Corresponding NMIs (South Africa and Russia). The EUROMET Directory, with details of all the members, can be downloaded from the EUROMET website < <http://www.euromet.org/docs/pubs/> >.

In the October 2003 Newsletter I described the "MERA" project, which has been developing plans for strengthening the coherence of metrology research in European NMIs. The project has examined different collaboration scenarios and has consulted widely with all those stakeholders who have an interest in the development of metrology in Europe. It also examined future trends in technology which would generate demands for improved measurement capability. MERA will provide EUROMET NMIs and their policy makers with a 'roadmap' for the implementation of the EUROMET strategy with regard to a coordinated European Metrology Infrastructure (EMI).

At the EUROMET Executive Committee (EEC) meeting in January 2004, the emerging MERA conclusions & recommendations were presented and discussed. The next steps for the strategy were approved and a proposal for a possible "iMERA" (implementing MERA) project is now being developed for presentation to the EUROMET members and submission to the European Commission for financial support.

EUROMET continues to forge strong links with other European organisations with an interest in metrology. The 4E organisations (EA, EURACHEM, EUROLAB and EUROMET) have established a loose association, and the annual meeting of their Chairpersons took place on 16th January in Dublin, Ireland. The meeting addressed the strengthening of future cooperation between the 4Es and the proposals for a Memorandum of Understanding (MoU) between the organisations, in addition to a bi-lateral MoU between EA and EUROMET. The meeting also considered the issue of future measurement and testing research in the European Framework programmes and in particular how this research activity can be strengthened in the 7th Framework.

Lastly, an update from EUROMET's QS-Forum. (The committee in which the NMIs participating in the CIPM Mutual Recognition Arrangement (MRA) presented details of their quality systems). The 11th meeting of QS-Forum took place in Lisbon, Portugal on the 27th and 28th of January. Three NMIs made presentations of their quality systems, and final implementation reports were presented by a further 11 countries, representing some 22 NMIs and 'designated' institutes. Amongst other matters, the QS Forum also discussed the final EUROMET report on laboratory quality systems to the Joint Committee of the RMOs and the BIPM (JCRB), and the future role of the QS-Forum in the on-going monitoring of the quality systems of NMIs. This represents the final step in completing the transitional stage of the MRA. The next meeting of the QS-Forum will take place at the National Institute of Metrology (INM), Romania in February 2005.

---

# SOMEONE YOU SHOULD KNOW

---



**Carol Hockert**  
*NCSLI VP, Conference Management*

One of our most successful Section Coordinators in the 1990's, Carol Hockert, of the Minnesota Weights and Measures Division, is well known in the Twin Cities NCSLI community. Carol's section meetings gained national recognition by the size of the turnouts, sometimes above 100, which had been unheard of previously in the section.

Carol accomplished this by using a steering committee to assist her with meeting themes and guest speakers, a process that is still being used successfully today. After two years as section coordinator, Carol served as the Region Coordinator for the North Central region.

She joined the board of Directors in 2001, where she became the Central Division Vice President. While serving as division VP, Carol coordinated the training of section and region coordinators during the annual conference. She also assisted in revising the Handbook for Region and Section Coordinators, and lined up several of the popular Uncertainty "roadshows" at sections around the country.

Since January of 2003, Carol has served as the Vice President of Conference Management. The Tampa conference was her first big test, but if you ask her, she'll say that the team of volunteers and staff on the conference committee do most of the work in running a conference. "I try to anticipate problems and take care of them before they appear, but mostly, I'm just along for the ride." The next big event is the conference in Salt Lake City. But like Tampa, Carol is certain of the conference's success. "We'll have the best speakers, the most exhibitors and sponsors, and the best tutorials, because everyone on the committee is driven to improve upon what we've learned each year."

Carol Hockert believes anything is possible. Nine years after reentering the workforce as a temporary clerk in the Minnesota Department of Commerce, she became the state's director of Weights and Measures.

One of ten children, Carol split her childhood years between Chappaqua, NY, and St. Paul, MN. Carol and her father were close, and it was no surprise to anyone that she followed in his footsteps, pursuing a degree in chemical engineering from the University of Minnesota. (Her son, Mark, continued the tradition, earning his BSChE from the University in 2000.)

Married to a fellow chemical engineer, Eric, Carol spent the years following graduation at home caring for her three children. During this time she honed her leadership skills in a variety of volunteer roles, from managing political campaigns to coaching soccer.

Those skills served her well when it came time to rejoin the workforce. In six short years, she's gone from working in the state's NVLAP accredited metrology laboratory, to being responsible for two laboratories and a division of 34 people.

Carol's work impacts nearly every Minnesotan on a daily basis. Weights and Measures, a division of the State Commerce Department, sets the standards of measurement for any commodity or service sold by weight, volume or length in Minnesota. It's responsible for checking the accuracy of all commercial weighing and measurement equipment in the state, from gas pumps to grain elevators to grocery scales.

The division conducts more than 85,000 inspections of commercial weighing and measuring equipment each year, including gas pumps, bulk fuel meters, LPG meters, grocery store scales, truck scales, railroad scales, and a wide range of similar equipment. These devices affect over 25 billion dollars of commerce each year. In addition, Carol's staff annually inspects approximately 30,000 samples of packaged foods and agricultural commodities to assure packaging accuracy.

Seventeen field inspectors canvass the state to collect unannounced, random fuel samples at point of sale locations and terminals, to be tested for octane, cetane, oxygenates, and sulfur content in the division's Petroleum Laboratory.

Carol also oversees the Minnesota Metrology Lab, which provides Echelon I mass calibration services to those customers requiring the tightest tolerances and smallest uncertainties. The lab's clients include other state metrology laboratories, biomedical companies, defense and aerospace contractors, the nuclear power industry, and a wide range of high-tech industries. The laboratory is required by law to maintain the state's standards of mass and volume, calibrating commercial test equipment for field staff and service companies.

In her spare time, Carol serves as a technical expert to NVLAP, participating in the assessments of other metrology labs all over the country.

Carol credits the support of colleagues and supervisors for guidance and encouragement as she rose through the ranks of the Commerce Department. In addition, she says, she remembered some early advice from her father, who imparted the importance of family and a strong work ethic: "Work hard and then let your capabilities speak for themselves".

*Editor's Note: Part of the material for this profile came from an article by Jennifer Pagatchnik, in the University of Minnesota CEMS News, an alumni publication for their Chemical Engineering and Materials Science Dept.*

---

# NCSLI WEBSITE TOUR

---

*Editor's Note: The NCSLI website has become more and more useful and filled with a wealth of functions and information. From on-line membership applications to complete annual conference data and sign-ups, you should try it out.*

*In many ways, the newsletter isn't very "newsy" because being a quarterly, my editorial deadlines often cut off before some committee or conference plans are ready for publication. So then it takes a full 3 months for the information to get published. The NCSLI website takes on a very useful purpose in the interim.*

## Webpage Sidebar Titles

### Presidents' Message

- The current president gives his message here

### Membership

- Allows you to connect to link to apply for membership online
- Can download each type of application form
- Find out more about what being a member entitles you to

### Welcome

- Vision
- Mission
- Who Should Join
- History, Search for past events
- What is NCSL International Video - Download and watch
- NCSLI 40th Anniversary Video - Download and watch
- Keynote address Video - Download and watch

### Calendar

- Search for events by putting in keywords or dates
- Hit search to get a list of all upcoming events
- Submit on upcoming event

### Current Events

- Takes you back to calendar
- Also, a link under Current Events called News that takes you to any relevant news items

### Conference

- Tells the theme--Bottom of page is a link to Exhibitor Information Center
- Call For Papers 2004
  - Provides link to submit abstracts online
  - When you go to main menu under here it allows those who can log in to view:
    - Speaker Menu
    - View Abstracts
    - Program Chair Menu
    - Abstract Review Committee Menu
    - Admin Menu
- Abstract Instructions--Also has link to submit
- Abstract Submission
  - Tells requirements to submit an abstract
  - Gives link to submit or modify an abstract
- Current Sponsors---Lists the current sponsors with links to their sites
- Sponsorship Programs
  - Sponsors can login
  - Others can purchase a sponsorship
  - Lists benefits of different levels of sponsorship

### Registration Info

- Lists conferences and tutorials rates and deadlines for signing up
- Link to tutorial information with abstracts of tutorials
- Tutorials
  - Gives abstracts for tutorials and rates (see pp 5-8)
- Exhibitor Search
  - Allows you to search for an exhibitor at the upcoming conference by booth number, company name or product line
  - When you select a company you searched for has a link to their website
- Travel Planning
  - Gives list of information of companies that are working with NCSL International to give special rates for the upcoming conference
- Guest Program
  - List the guest programs for the upcoming conference with a brief description of what the programs are (see pp 10-12)
- Exhibit Sales 2004
  - Link to Contract, Terms, & Conditions & Floor Plan Documents
  - Layout of exhibit floor and current exhibitors with their locations
- 2003 Presentations
  - If have username can upload a past presentation if you were a past speaker
  - Can click on the link under presentation to view and save a past presentation
- 2003 Photo Gallery---Allows you to look at photos from the year
- Future Conferences---Tells you where the upcoming conferences will be held
- Past Conferences---Tells you where the past conferences were held

### Regions

- Gives map of world where you can click on an area to find contact information for representative in that area
- Link to international newsletter
- Coordinators under regions allows you to log in and then gives you access to: Update Calendar, Order Meeting Supplies, Find a Speaker, Update Speaker List, Coordinators Guidebook, Administrative Guidelines, Update Roster Info, Region/Section Forum and Oct 2003 Board Meeting Bullets

### Metrology News

- Take you back to news under current events

### Resources

- NCSLI position statements to download
- Acronym & Abbreviation/Glossary Search
- Measurement Comparison Program Report Database

If you click on search database it will give you a list of all or you can search by volume number or discipline

### Procedures Database

- Can search calibration procedures database by classifications, equipment name, manufacturer or model or hit search to view all
- List of other procedure sources

- Training Information Directory
- NCSLI Archive Database
  - Volunteer Database
    - Can view all by hitting search or search by position title, volunteer's last name, or search by year
  - Past Presidents
  - William A. Wildhack Award Past Recipients
- Liaison Links under Resources gives a list of different Liaison Links

### Training

- Lists links to Resources
  - Educational Institutions Offering Metrology Programs
  - NCSLI International Continuing Education Units (CEU's)--- Goes to FAQ's
  - Training Information Directory - which has links to the following and each gives you a lists and allows you to search:
    - College Programs
    - Computer-Aided Courses
    - Instructed Courses
    - Self-Study
    - Text Books
    - Video Instruction
    - List all resources
    - Add/Update allows you to log in to add or update a resource
  - Training Library under Training
    - Link to Training Aids Order Form
    - Gives links to order online
  - NMI Training Programs
    - Gives the schedules sponsored by other companies

### Training Information Directory

- Same as under training

### Publications

- Takes you to a link to order online
  - Can search for an item by product name or in a category
- Has link to download order form also

### NCSLI Surveys

- Takes you to a new page where you can select to take either the Training Need Assessment survey or the US Measurement Requirements Committee Survey

### Miscellaneous

- Shows page explaining the Royal Egyptian Cubit

### Awards

- 2003 Best Paper Awards
  - Lists papers, authors and brief description
- 2003 Wildhack Award Winners
- Wildhack Award History

### Streaming Video

- Give links to download and watch the following videos
  - What is NCSLI?
  - 40 years of Progress
  - Keynote Speaker 2003
  - Keynote Speaker 2002

### Forums

- Takes you to an independent site where you need to register to use to get a new username and password
- You can then subscribe to the many different topics that are listed

### Guestbook

- Can enter personal information and give any comments that you wish

### Chat Room

- If have a username may go in and talk to others

### Online Store

- Allows you to search for an item by product name or a category and then purchase

### Online Dues Payment

- Allows current members to renew their membership online
- Allows people to purchase the publication club or to renew it

### Metrology Jobs Board

- Has link to search jobs and can do so by: Title, Industry, State/Province, Zip Code or Country or you can hit search to see all the jobs that are posted
- Member organizations may subscribe to job posting service
- Or if already have subscribed may hit post job and log in and then they are able to enter a new job or edit an old posting

### Resume System

- Job Database--Takes you back to the Metrology Jobs Board
- Search Resumes--If you have a user name and password you may search those resumes that are posted--Can just hit search to see all resumes
- Post/Update Your Resume--Can enter personal information and then upload your resume so that it may be searched

### Website Top Bar Items

#### Directory of Standards Labs

- Allows you to search for a standards lab by: Company Name, Company City, State, Country, Capabilities, Standards, or Industries
- Or you can display all standards labs
- DSL Admin
  - Allows those who have a username and password to: Update Lab Information, Update Capabilities, Update Services, Update Standards, Update Industries/Market Sectors

#### Volunteer Roster

- Allows you to view the contact info of the volunteers in the different areas
- Also if you have a user name and password you can select organization admin and then you can do the following: Update Roster, Update My Information and Change My Password

#### Committees

- Gives list of all committees and sub committees can select one to view contact, goal & objective information and any other information
- Allows the committee personnel to edit their pages also

#### Forums

- Same as side bar

#### Join NCSLI

- Allows you to register for membership online

# REPORTS FROM THE REGIONS

## Madison Wisconsin Section (1317) Meeting

May 13, 2004  
Bone Care International  
Middleton, Wisconsin

### Topics:

- Using, calibrating, and providing specifications for balances;
- Round table discussion on dealing with, and being audited by the FDA
- The 'ins and outs' of qualifying test equipment to meet FDA requirements
- Update and refresher on taking ASQ's CCT exam
- ASQ Quality Press' The Metrology Handbook available for purchase (limited number of copies signed by the Editor)

Contact: Keela Sniadach, 608-298-4681



February 11, 2004  
3M Company  
St. Paul, MN  
Doug Evink  
Twin Cities Section Coordinator

The February 11, 2004 meeting of the Twin Cities Section of NCSLI was hosted by 3M and held at their facility in St. Paul, MN, and was attended by 74 participants from 39 companies. We thank Terry Conder and 3M for providing an excellent meeting room along with the coffee, soda, pastries, and the infamous trip to the 3M company store.

*Editor's Note: Doug, this is the first that a lot of us have heard of the 3M Company Store. Is this like all the Post-it notes you can carry in your pockets?*

**Speaker:** George Rodrigues - Artel

**Topic:** The traceability of volumes delivered by hand held pipettes.

George started by providing a little history of pipettes. George explained the different types of pipettes and what are some of the physical characteristics that may effect the performance of the pipettes. He described some of the sources of error such as environmental effects, tip design and quality, operator technique, silent failures, and calibration methods. He explained that operator technique has the largest error experience. George detailed two different methods of calibrating pipettes - Gravimetric and Photometric. He also spoke to the question of traceability of the various methods of calibration.

**Speaker:** Paul Packebush - National Instruments

**Topic:** Computer-based instruments - What users need to be concerned about from the hardware and software viewpoint.

Paul's presentation addressed four points. What are computer-based measurements systems, Understanding multifunction data acquisition (DAQ) boards, DAQ board consideration, and Software considerations. Paul explained the elements of a computer-based measurement system and why we use computer-based measurement systems. He stated that DAQ boards are designed to meet the needs of a general-purpose measurement system. They are not designed for a specific type or class of measurement. DAQ Boards provide multiple measurement modes such as analog input, analog output, digital I/O, counter/timer functionality, and external timing and triggering. He spoke to what goes into choosing a DAQ board. Lastly he explained what goes into maintaining the accuracy of the board such as hardware support, software support, and calibration services.

**Speaker:** Jeff Gust - Quametec Proficiency Testing Services

**Topic:** Improving temperature calibration processes through proficiency testing.

Jeff took us down the path of why to do proficiency tests. He explained that proficiency testing is a means to verify laboratory measurement method, technical training, traceability of standards, uncertainty budgets are correct, reporting of results is appropriate, and that the laboratory understands what measurement the customer

## Denver/Boulder Section (1323) Meeting

Thursday, April 22, 2004  
Agilent Technologies  
9780 South Meridian Boulevard  
Englewood, Colorado (northeast of I-25 and Lincoln Avenue).

The NCSLI Boulder/Denver Section Spring 2004 meeting will be hosted by Ken Kahn of Agilent Technologies. This date was selected to align with the NCSLI Board of Directors meeting, to be held on April 18-21 in Boulder, Colorado. Ball Aerospace has volunteered to host the Fall 2004 NCSLI Boulder/Denver Section meeting.



*Editor John Minck and newly designated Mid-Atlantic Region Coordinator Dana Leaman chat at the Monterey Board meeting. Dana's real job is a manager at the A2LA organization.*

wants. Jeff presented the details of a temperature proficiency test. He demonstrated the design of the test, the artifact, the scheme design, the reference laboratory, the packing and shipping of the artifact, and the technical protocol. Jeff went through the evaluation of the results and explained the common mistakes noticed. They were math blunders, not considering drift of temperature probe between calibrations, training - not making 4 wire measurements on PRT, failure to follow directions, and underestimating bath uncertainty.

**Speaker:** Dave Kreitlow - MTS

**Topic:** Featured Lab

Dave gave us a guided tour via a power point presentation of MTS's calibration department. He showed us the products that MTS manufactures and thus the calibration requirements to support this process. Dave explained the importance of the Metrologists at MTS and identified each Metrologist along with a little history about each person. Some had a little more history than others. Just ask Scott Gingerich for more details.

**Speaker:** Jeff Gust - NCSLI VP Industrial Programs

**Topic:** NCSLI Updates

Jeff Gust provided highlights of the Board of Directors Meeting that was held on January 19 - 21 via the power point presentation developed by the BOD. Special attention was directed to the 2004 NCSLI Workshop and Symposium that will be held in Salt Lake City.

**Speaker:** Doug Lynde - On Time Support

**Topic:** An alternative metrology software architecture.

Doug took us on a historical journey from the origin of computers to their start of becoming involved with the calibration system to current architecture. He provided early examples of how the metrology departments started using computers as an external aid to now becoming an integral part of a calibration system and asset management system. He showed examples of what the near future will look like from an enterprise network format of asset management and calibration systems.

**Attendees:**

Liimatta, Steve	3M Center Calibration Laboratory
Mcdonald, Mike	3M Center Calibration Laboratory
Miller, Jerry	3M Center Calibration Laboratory
Paulson, Dennis	3M Center Calibration Laboratory
Regal, Chuck	3M Center Calibration Laboratory
Reinsberg, Jim	3M Center Calibration Laboratory
Ackerman, Dennis	3M Corporate Metrology Lab
Bjerstedt, Steve	3M Corporate Metrology Lab
Conder, Terry	3M Corporate Metrology Lab
Lamin, Sema	3M Corporate Metrology Lab
Marsden, John	3M Corporate Metrology Lab
Nelson, Ross	3M Corporate Metrology Lab
Otto, Jeff	3M Corporate Metrology Lab
Riley, Pat	3M Corporate Metrology Lab
Meza, Soby	Alliant Techsystems
Muehliesen, Len	Alpha Electronics Corp of America
Killian, Jay	Andersen Corporation
Nordgren, Roger	Arrow Laboratory
Pineau, Bob	Artel
Rodrigues, George	Artel
Urban, Gregory	Computype
Zemaitis, Roger	Dytec Instruments
Wetterstrom, Ed	Emerson Process Mgmt
Erickson, Doug	General Dynamics Adv Info Sys
Drees, Julia	Guidant
Imholte, Mike	Guidant
Roden, Larry	Guidant
Satre, Vicki	Guidant
Boyles, Steve	Honeywell DSES
Hupfer, Trent	Honeywell DSES
Franzwa, Stacy	Hutchinson Technology Inc
Mcvinnie, Joel	Hutchinson Technology Inc
Snitker, Craig	Hutchinson Technology Inc
Brady, Dennis	Instrumentation Services Inc.
Meyer, Gary	J&G Technology

Brandenburg, Ralph	Kato Engineering
Enke, Rod	Lockheed Martin
Bohrer, Bob	Medtronic
Boon, Jason	Medtronic
Carpenter, Ruel	Medtronic
Morgan, Jeanne	Medtronic
Persell, Vickie	Medtronic
Peterson, Al	Medtronic
Anderson, Mike	Medtronic
Nowacin, Walter	Medtronic
Hentz, Derrick	Medtronic Profusion Systems
Scheuble, Curtis	Medtronic Profusion Systems
Jacobsen, Odell	Mentor Corp
Disrud, Scott	Minnesota Rubber
Gingerich, Scott	MTS Systems Corp
Grangroth, Julie	MTS Systems Corp
Kreitlow, Dave	MTS Systems Corp
Remer, Bob	MTS Systems Corp
Ellis, Chuck	NAPT
Mccarty, Bob	National Instruments
Packebush, Paul	National Instruments
Kenning, Karla	Northfield Acquisition Co/Sheldahl
Lynde, Doug	On Time Support
Evink, Doug	Palen Kimball Company
Mcdougall, Jane	Precision Repair & Calibration
Gust, Jeff	Quameteq
Huerta, Antonio	Ridgewater College
O'neil, Herb	Ridgewater College
Canfield, Jim	Saint Jude Medical
Martz, Gary	Saint Jude Medical
Mason, Shawn	Saint Jude Medical
Meysenbourg, Andy	Saint Jude Medical
Howard, Don	Sensor Systems Goodrich
Novak, Dan	Smith Medical-MD, Inc
Adams, Bruce	State of Minnesota
Spinks, Harry	Techtology LLC
Vossler, Kevin	Trane Company
Dolezal, Jim	United Standards
Hanssen, Paul	Workplace Training

\*\*\*\*\*



June 12, 2003  
Clean Air Engineering  
Palatine, Illinois 60067  
Tom Waltrich,  
Chicago Section Coordinator

Twenty-seven people were in attendance at the June 12, 2003, Chicago Section meeting of NCSLI. The meeting host was Mr. Bill Walker with Clean Air Engineering. Clean Air Engineering provided excellent facilities, refreshments, and lunch.

Tom Waltrich opened the meeting with introductions and a presentation of the day's agenda. Mr. Bill Walker, session host, then welcomed everyone to the Clean Air Engineering facility and provided logistics. Tom Waltrich then provided highlights of the NCSLI April 2003 board of directors meeting.

**Guest speakers included:**

- Mr. Barry Eisan of Vaisala gave a presentation on humidity measurement.
- Mr. Mike Bird of Cal One Systems did double duty by providing a talk on pressure measurement and another presentation entitled, "Measurement Uncertainty for Real People"
- Mr. Scott Evans with Clean Air Engineering gave a presentation on ASTM procedures on stack testing.

Door prizes were raffled off after the presentations. Mr. Art Dean of Clean Air Engineering ended the day with an interesting tour of the Clean Air Engineering Laboratories.

I would like to thank all in attendance for their interest and participation. Thanks go to the speakers for their time and fine presentations. Special thanks go to Mr. Bill Walker and Clean Air Engineering for all their effort and outstanding hospitality.

Reports from the Regions

**Attendees:**

Juanita Aldana	Siemens Medical Systems
Lynn Thomas	Baxter Healthcare
Lev Khodesh	JLW Instruments
Mike Bootke	Cal Lab Company
David P. Zmuda	Siemens Medical Systems
Nasim Akhtar	Northrup Grumman
Kevin Kennedy	Northrup Grumman
Ron Czischke	Underwriters Laboratories
Bill Long	Underwriters Laboratories
Andy Duchaine	JH Metrology
Rod Vanrite	JH Metrology
Rodica Caratas	Abbott Laboratories
Dan O'Donnell	Abbott Laboratories
Mike Alfred	Instrument Calibration Services Inc.
Ralph Bertermann	Lighthouse Training Group
May Huang	Organics LaGrange Inc.
Shauntea Tolliver	Salus Inc.
Mark A. Christiansen	Salus Inc.
David Katzer	Siemens Building Technologies
Bill Walker	Clean Air Engineering
Luis Solarte	Salus Inc.
Tom Waltrich	Baxter Healthcare
Mike Bird	Cal One Systems
Barry Eisan	Vaisala
Scott Evans	Clean Air Engineering
Art Deane	Clean Air Engineering
Chris Evelo	Dytec/Midwest

*Editor's Note: This is a correct meeting date. I published it to emphasize that my policy on regional meeting reports is very accommodating. My reasoning is that every regional meeting is important to our operations, and sometimes one meeting has an agenda item that can be crucial to another coordinator looking for meeting ideas. So when I found out from Tom that he still had a report which I didn't have, I asked him to send it on.*

\*\*\*\*\*



February 26, 2004  
 Transcat  
 Houston, TX  
 D. Keith Scoggins  
 South Texas Section Coordinator

The South Texas Section winter meeting was held on February 26, 2004 in Houston, Texas. Tom Dovenov from Transcat and C. R. Dendy from Fluke Corporation hosted the meeting, which was conducted by Keith Scoggins, the metrology laboratory supervisor at the South Texas Project Nuclear Operating Company.

Keith Scoggins welcomed everyone to the meeting and also requested feedback on the types of presentations attendees would like to see in future section meetings.

Chris Grachanen, South Central U. S. Region coordinator, from Hewlett-Packard, discussed the highlights of the October NCSLI Board of Directors Meeting. For only the third time in the last 12 years, the Board of Directors' meeting was held outside the United States. The Board met in Queretaro, Mexico - home of the National Metrology Institute of Mexico [CENAM].

Chris was also the first presenter of the morning. Chris provided valuable information on the American Society for Quality and the Certified Calibration Technician (CCT) program. Chris explained how the Certified Calibration Technician program provides a method for certifying personnel's technical knowledge. Additionally, Chris stated that ASQ was working on a Metrology Handbook that could be used as a study guide in preparation for the CCT test.

The second speaker was Keith Bennett, from Transcat. Keith led a discussion on the pros and cons for ISO 17025 Accreditation. There are costs associated with obtaining accreditation and each laboratory must evaluate the needs of their customers to determine the practicality of becoming accredited.

Mitch Stone, from On Time Support, presented an overview of alternative metrology software architectures. He discussed how industries are moving back to mainframe computers and how future software needs will be affected by the change. Again, the boys from On Time Support provided the attendees with a great deal of practical and useful information.

C. R. Dendy, from Fluke Corporation, presented enlightening and highly fascinating information regarding workplace safety and instruments used on high energy applications. C. R. discussed high-energy work environments and unseen electrical hazards. He also discussed transients-arc flash and what causes them to occur. C. R. described the new ANSI/ISA standards for electrical measurement equipment and gave an exceptional explanation of the different CAT ratings. (CAT I-IV) delineate IEC 1010, the power standard.)

A wonderful lunch was provided by our hosts; Transcat and Fluke. After lunch, Kirk Mosher, from Ruska Corporation, discussed percent-of-reading precision in pressure transfer standards. Kirk showed how producers of precision pressure transfer standards are capable of providing highly accurate percent-of-reading instruments. Kirk impressed everyone with his expert knowledge of this subject.

A tour of the Transcat's Houston metrology laboratory facilities was offered to all attendees. A very special thanks to Tom Dovenov and C. R. Dendy, for their support in providing for the meeting location, refreshments, and lunch.



*There was a good turnout for the South Texas NCSLI Meeting in Houston. Everyone was eager to hear what the speakers had to say and participate in open discussions.*



*The outstanding lunch was provided by our hosts, Tom Dovenov from Transcat and C. R. Dendy from Fluke Corporation. Good friends, good food and delightful discussions, what more could you ask for?*

Attendees:  
 Keith Scoggins STPNOC  
 C. R. Dendy Fluke  
 Tom Doveno Transcat  
 Chris Grachanen Hewlett-Packard  
 William Curry STPNOC  
 John Griffin STPNOC  
 Michael Berry STPNOC  
 Patrick Brauer STPNOC  
 Kirk Mosher Ruska  
 Mitch Stone On Time Support  
 Matthew Sell On Time Support  
 Keith Bennett Transcat  
 Ted Beckham Acudata  
 George Hartz Acudata  
 Dave Upton EMA  
 Chris Aguirre Motorola  
 Dan Bates Data Marketing  
 Dave Sanders Oscilloscope Services  
 James Riley Megger  
 Steve Keithley Mensor  
 Lee Graham Mensor  
 Matt Maxwell Thermo-Temp  
 Larry Houghton Thermo-Temp  
 Lito Perez PSA, Inc.  
 Eli Perez PSA, Inc.  
 Wannie McPeters Lockheed Martin  
 Greg Stiggins Lockheed Martin  
 John Cooner Lockheed Martin  
 Russ Bachtel Lockheed Martin  
 Kelly Oppliger Motorola  
 James Chandler GE Druck  
 Lesa Walker GE Druck  
 Steve Parnell RJV NASA/JSC  
 Mike Johnson RJV NASA/JSC  
 Joe Greagrey Centerpulse  
 Anthony Martinez M&M Instruments  
 Chris Kengle CarboMedics, Inc.  
 Andy Bradley CarboMedics, Inc.  
 George Kugler AC Consulting

\*\*\*\*\*



Nov. 20, 2003  
 Lockheed Martin Technical  
 Operations  
 Stennis Center, MS  
 Ken Garcia,  
 Gulf Coast Section Coordinator

The NCSLI Region 6, Gulf Coast Section held its fall meeting on November 20, 2003. The meeting was hosted by Lockheed Martin Technical Operations at their Integrated Metrology Center (IMC) located at NASA's Stennis Space Center in south Mississippi.

Twenty seven attendees represented a wide variety of government, contractor and commercial entities, with personnel from Entergy, W. A. Brown, Southern Marketing Associates, Fluke, Pearl River Community College, Northrup Grumman Ship Systems, Alabama Scale, AGT, JM Test Systems, Schlumberger, Tegam and Lockheed Martin.

The meeting opened with coffee, pastries and a welcome from Ken Garcia, IMC Metrology Engineering. Ken presented an overview of NCSLI and membership benefits. Next, Mark Hayes, IMC Manager, gave an update on the IMC status, news and capabilities. After Mark's report each participant was given a chance to update the section on any news related to their laboratory or business, such as any new accreditations.

Fluke's Bill Wightman gave an interesting presentation entitled "Precision DC-Low Frequency Measurements." Bill's presentation included some fascinating insight into the way this discipline has improved over the years.

Mike Eckert of Tegam gave a presentation on "Power Mount Calibrations." Mike is a good teacher and his talk was a very informative guide that sparked quite a bit of interest.

After a catered lunch provided by the IMC, attendees were educated about the NCSLI's training facilities and programs by Dale Varner of LMTO's Denver Laboratory. Dale was also able to describe in detail some current topics of interest to all such as the Certified Calibration Technician program offered by ASQC.

The meeting adjourned with some discussion of topics for the spring meeting tentatively set for April 2004. Some requested topics were uncertainty calculations, guardbanding, use of the GPS system, cryogenic temperature calibrations and surveys of calibration software.

Finally, attendees were provided a tour of the Integrated Metrology Center laboratories.

For information about the Gulf Coast Section please contact Ken Garcia at < Kenneth.L.Garcia@lmco.com > or 228-813-2075.

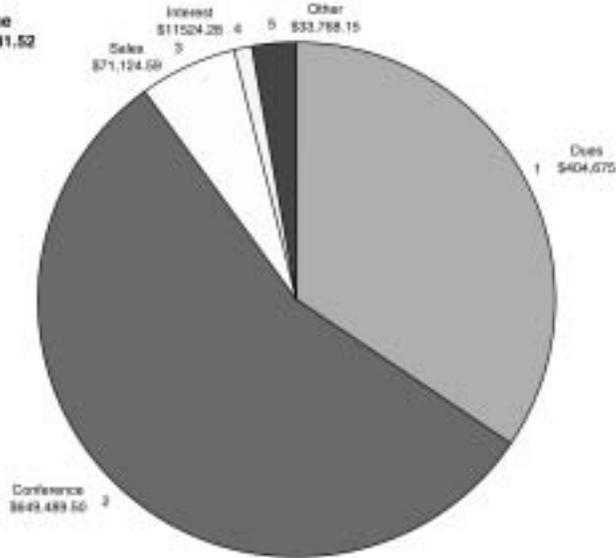


*Host Lockheed-Martin really treated these NCSLI visitors warmly, with complimentary food and break refreshments. We thank all those generous companies who welcome our global operation, and we hope that the NCSLI benefits also extend back to those member companies.*

Attendees:  
 Bill Wightman Fluke  
 David Hall Southern Marketing Associates  
 Mike Eckert Tegam  
 Clint Plant W.A. Brown  
 Ken Garcia LMTO  
 Dallas Balmer Entergy  
 James Caddy Entergy  
 Mark Hayes LMTO  
 Darrel Olivier Entergy  
 Harvey Tullier Entergy  
 Kevin Braun Northrup Grumman Ship Systems  
 Scott Morrison JM Test Systems  
 Yancy Cain JM Test Systems  
 Bill Miley JM Test Systems  
 Vince Henricks JM Test Systems  
 Dean Hotard Schlumberger  
 Craig Richardel Schlumberger  
 Lawson Hill Alabama Scale  
 Mike Comeau Pearl River Community College  
 Phil Schulze Pearl River Community College  
 Bruce Hummel AGT  
 Don Wilson AGT  
 Rick Ketzler AGT  
 Sam Brown AGT  
 Chuck Mitchell AGT  
 Brain Dafni LM Manned Space Systems, Michoud  
 Eddie Johnson LM Manned Space Systems, Michoud

# NCSLI 2003 FINANCIAL RESULTS

**Income**  
\$1,170,581.52

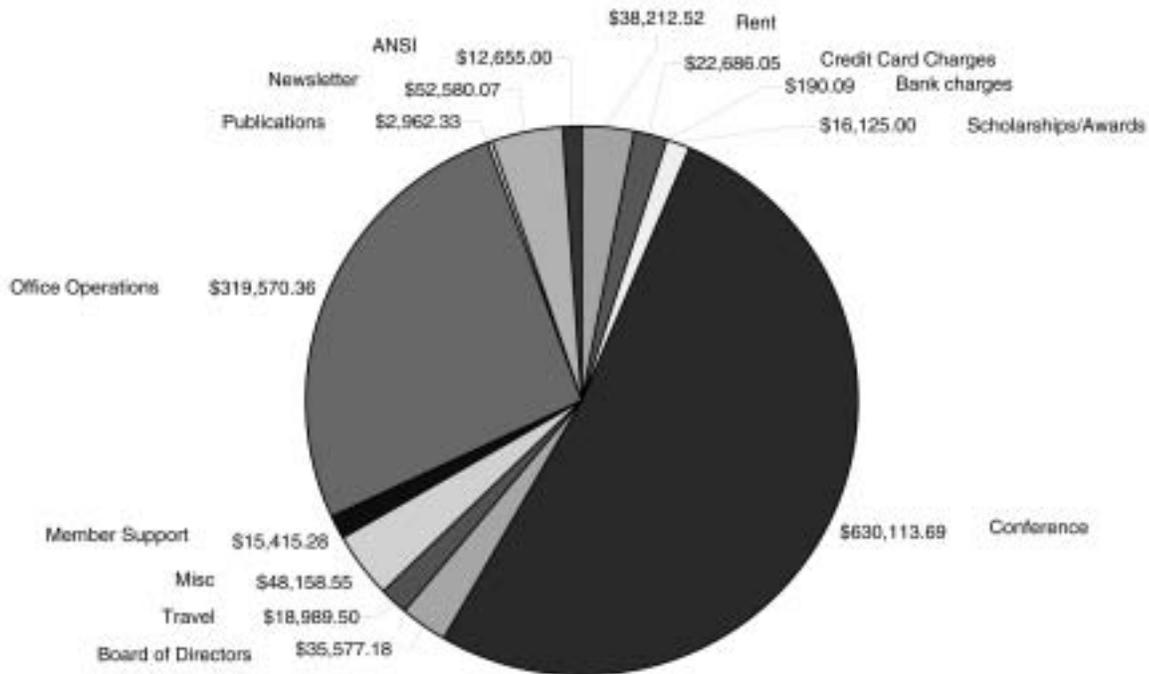


Assets	\$933,252.75
Liabilities	\$442,072.44
Equity	\$491,180.71

*Editor's Note: Each April, I used to publish a two-page, fine print report of the previous year's financial activities, and found that there was little member interest in all the line-item breakouts. However, as a member company, you have a right to see any such detail.*

*If you would like further details, please contact Jack Ferris, NCSLI Treasurer, at (231) 334 4891, < sleeping\_bear@hotmail.com >*

**EXPENSES**  
\$1,215,620.61



## REMEMBERING KENT CROW



**Kent Crow**  
Mar 9, 1953 -- Aug 20, 2003

We received word in December that Kent Crow had passed away at his home in Missouri back in August of pancreatic cancer. Kent Crow was one of our active and successful Chairmen of the Utilities Committee, while at the

Diablo Canyon nuclear power plant at San Luis Obispo, CA. He had been active as a member of the committee and then took over as a very popular leader around 1999. He was 50.

Kent took over as chairman from Ken Ralston. The committee was right in the middle of its project to revise RP-10. In mid-June he told friends that he had just been diagnosed with the cancer, and he told me he was sure he wouldn't be making the conference in Tampa. He didn't of course, and while there, we were told that he passed away on August 20. It was literally at the conference, and either the day or day after the Utilities committee meeting. Needless to say that cast a very sad tone to our meetings.

In recognition of Kent's enthusiastic NCSLI work, the committee has placed a memorial note about Kent in the preface to RP-10, which we're just now finishing up with the 128 committee.

Kent ran a popular email discussion group amongst the Utilities committee members, and it even extended well beyond the few that participate on the committee. It was very active and popular with discussions on nuclear plant metrology and M&TE issues being passed around every few days. So far John Nystrom hasn't been able to secure his mailing list and has even had to scramble to reconstruct his list of committee members.

Not surprisingly, there is an informal fraternity of men who have grown up and moved around in the metrology activities of the nuclear community. Several of these friends of Kent contributed to this remembered sequence of Kent's life and work.

Kent was born in Lincoln, NE, and attended Milford Technical School. In 1983, he entered the nuclear family. He started as a contract Metrology Technician in Louisiana at LP&L's Waterford III plant, run by Shantheri Services, Inc. In the 1983-84, period, he moved to California, as a contract tech at PGE's Diablo Canyon facility. By 1986, he had moved to Bay City TX, as a metrology supervisor at HL&P's South Texas Project. And, in 1988, he was back at Diablo Canyon, as an I&C procedure writer. By 2003, he and his wife Catherine moved to Missouri, as a procedure writer for Ameren Energy at their Callaway Plant.

Kent was a music lover, who played bass guitar. He played in several bands in CA. He also enjoyed golf and travel. He leaves his wife, Catherine, who has moved back to her home in Lincoln.

**The Odd Couple**—One of Kent's longtime friends, Mark Whittaker, offered this insightful image of Kent, for his wife Catherine to read at his services.

If you don't believe opposites attract, consider this:

Rock & Roll	vs.	Country
Sports Car		Pickup Truck
Pacifist		Marine
Cornhusker		Badger
Democrat		Republican
Tennis Shoes		Cowboy Boots
Union		Right to work
Long Hair		High & Tight
Cats		Dogs
Miller's		Bud

So how could two such different people end up being best buds?

Since our early days together in Louisiana, I feel it was a mutual respect for each other's ability to learn and a belief in doing a full day's work for a day's pay. My first conversation with Kent was a phone interview. Although he admitted not knowing what a dead-weight tester was, he convinced me he could learn anything and be able to do it better in a short time.

He was right. I, as did most people, spent the following years learning from Kent. He never tired of trying to improve things in his area of influence. He was always striving for perfection, whether it was work, music, golf, or life in general.

Yes, we did have our differences, but we always were able to work through them. Unlike many things he and I discussed over the years, I cannot put this latest chapter in his life in perspective. My only condolence is that I know he is in the "better place" reserved for good guys like Kent. For me, he was a true friend, mentor, and best of all, a big brother. May he be hitting them long and straight with all his putts, center cup. I miss him dearly.

Mark (the Marine).

*Editor's Note: I think it's a little-known fact, to our members, that over the 4 decades of NCSLI, a solid percentage of our member organizations have been those associated with nuclear power and other such technologies. When you think of it, it makes a whole lot of sense, because who should be more concerned with accurate measurements and competent quality procedures than the folks running our global nuclear facilities?*

*This long line of NCSLI volunteers have their own industrial fraternity, as it were, and even now, our organization owes a lot to the support of their companies. Our first Chairman in 1961 was Curt Biggs of Sandia Corp. Today it is Harry Moody, Dick Pettit, John Nystrom, Keith Scoggins, and a long line, back through Dave Braudaway, Selden Mcknight and Maurice Sexey and many others I have forgotten.*

*My thanks to a number of Kent's friends, from this informal group, who helped me piece together this picture of Kent; Mark Whittaker, Catherine Crow, Michael Cleary, John Nystrom, Keith Scoggins, and more.*

## REMEMBERING ANTHONY ULRICH



**Anthony Ulrich**

**1967 - 2004**

On January 7th of this year we lost a good friend and fellow metrologist to a tragic wintertime accident. Anthony enjoyed being with friends and participating in life to the fullest.

Anthony graduated from McGill University with his degree in Civil Engineering in 1991. After graduating, he worked in telecommunication tower construction for two years, thereby earning his P.Eng. designation. In 1993, he joined his father to work in the family metrology business in Montreal.

Anthony took a keen interest in the business and had a terrific appetite for learning and actively seeking information about how to do things better. He was meticulous about details and was one of the Canadian front-runners in taking part in the Accreditation program through NRC's CLAS program. As President of Ulrich Metrology Inc., Anthony expanded operations, became accredited to ISO/IEC 17025, developed a loyal customer base and laid plans for future growth.

Anthony was a long time member of our group and had recently been appointed the Quebec Section Coordinator for NCSLI Canadian Region. He also had accepted the position as Chair at our CLAS Lab meetings which were held before our annual Canadian NCSLI conferences. He will be remembered as an energetic young man who enjoyed his work and always contributed lively and passionate opinions to our meetings. His strong work ethic, attention to details, and love of life made him a successful business person, a respected metrologist, and a valued friend.

Anthony was a dedicated son to his father Ferdinand and late mother Erika, a cherished brother to his sister Ingrid (Ron), and a wonderful uncle to his godson Brandon, his nephew Spencer and his niece Emily. He will be sadly missed by his soulmate Christine, his godfather Franz, his aunt Marianne, his cousins, Christian, Volker, and Sigrid and also many friends.

It was a pleasure to know Anthony and to have had the opportunity to work with him over the years. Anthony had the special ability to make everyone feel important and always treated people with respect. He listened well but also enjoyed having his turn to share his practical insight. He owned a grin that spoke volumes and yet was always the perfect gentleman. All I can say, Anthony, is that we will miss you and we will do our best to follow your lead to make sure things make sense when "the rubber hits the road." (One of Anthony's favorite expressions).

*Jim Mullins*  
*NCSLI Canadian Region Coordinator*

# SCENES FROM THE MONTEREY BOARD MEETING



*So, now I'm working for a guy with Imperial ambitions. Retiring NCSLI President Steve Stahley crowns incoming President Dave Agy. I guess this beats the previous "passing of the gavel" ceremony.*



*President Dave Agy presents retiring VP Woody Tramel a plaque recognizing his long years of contributions.*



*Graham Cameron looks on as the room votes for continuing the meeting vs. going surfing. Just kidding.*



*A goodly number of ex-presidents show up for a group picture. Suraci, Minck, Agy, Anderson, Motzko, Abell and Jaeger. Charlie seems none the worse for his recent hospital episode, except his wife has edicted a slowdown.*



*Catherine Pritchard presents a small "welcome to America" gift to Barbara Wallard (c) while Andrew looks on (r). This was not Barbara's first trip to California, but by far the funniest -- thanks to the glorious madness of "girl power." "They know who they are!"*



*See what industrial volunteering gets you, a trip to the California Coast? The meeting hotel looked out over Monterey Bay, towards downtown and the Cannery Row. The weather was a bit overcast with a cold onshore breeze.*

More Board pictures on page 35.

---

# COMMITTEE NEWS

---

## Does a blank space mean No Report or No Activity?

With 35+ committees, and all their diverse activities, it is probably a good thing that each and every committee doesn't report on their work in each quarterly issue of this newsletter. Chairmen, after all, do have a real-life job, and their work and travel often means that their NCSLI committee literally does not have any progress to report.

I used to run committee names in most issues, with the chair's names and a "No report" notation. But that fact seems self-obvious, so subsequently if there is no report, I won't run those redundant words.

## ARCHIVAL

*Jim Allred*

The Archival Committee met at the 2004 MSC to discuss a path forward for the committee. Participants were Mike Stears, Craig Gulka and Jim Allred. A schedule was developed for indexing all the material now in Boulder.

Jim will visit the NCSL International Business Office this year.

\*\*\*\*\*

## STANDARDS POLICY

*Doug Sugg, V.P. (was Jack Ferris)*

## U.S. MEASUREMENT REQUIREMENTS COMMITTEE (USMRC)

*Jeff Walden*

The USMRC had a booth at the Symposium & Workshop in Tampa. This was an exceptional opportunity, offered by the Board of Directors, to showcase the work of NCSLI committees.

Committee activities began with the session "Magnetism in Mass Measurement," led by Georgia Harris. The committee hosted Session 3A, which was a panel with the title "Transformation in Measurement Requirements." Panel members were representative of a broad range of interests. There was an active audience of well over fifty. Special thanks to Dick Pettit for arranging the program so that the NIST-sponsored Session 4A on Measurement Strategy followed immediately, and in the same room.

The committee met, following the panel session, and identified several actions to promote the value of the USMRC to the NCSLI membership:

1. Promote the use of our on-line survey.
2. Promote the USMRC with other NCSLI committees
3. Prepare a 3-minute PowerPoint presentation, put it on a CD and send copies to Region and Section Coordinators. Encourage coordinators to show the CD at local meetings.
4. Organize another panel for the Measurement Science Conference in January '04.

During MSC 2004, the committee hosted another panel, titled "Early Identification of Measurement Requirements." Participants in that panel included Dave Braudaway, with an IEEE perspective; Victor Cleland, Chair of the Airline Metrology Committee; Tim Osborne, of A2LA, Mike Suraci, with an ISA perspective; and Jeff Walden, USMRC Chair and US Navy Metrology R&D.

The committee met to discuss the action items and progress made since the Tampa meeting. Committee members were given a short presentation by Craig Gulka on the new Forums pages on the NCSLI website. An action was taken to investigate the linking of the USMRC forum page to the survey. The number one priority for the committee is to continue pursuing ways to be of more service to the measurement community.

## GLOSSARY AND ACRONYMS COMMITTEE

*Emil Hazarian*

Verba volant, scripta manent.  
(The words fly away, the writings remain)

The activity of the Glossary Committee since NCSLI Workshop in Tampa, Florida, was mainly focused to find, secure and consolidate people willing to work and donate their time and expertise to the committee. We are looking at both domestic and international increasing demands in communication. These demands are asking for more communication speed and volume, and this is not possible without an adequate uniformity in our professional vocabulary.

We have two confirmed committee members, Gloria Neely and Robert Williams. Dr. S.V. Gupta, from India, was added to the list of possible members. The recruiting process is still on. Also another immediate goal was to secure the existing material and documentation and update the committee web site. With the help of Jack Ferris and Craig Gulka, I obtained access to the glossary database for future modifications. I am working to update the glossary committee web site, clarifying who needs to do the update

All these issues have been discussed at an interim meeting in December 2003 at NSWC Corona, U.S. Navy. The proposed committee is as follows:

1. Claude Fouroux, retired, member,
2. Dr. S.V. Gupta, India, retired, member
3. Emil Hazarian, NSWC Corona, U.S. Navy, Committee Chairman,
4. Dr. Nick Moiso, Pressurements Ltd., United Kingdom, member,
5. Gloria Neely, NSWC Corona, U.S. Navy, confirmed member,
6. Dr. Dan Sporea, National Institute of Lasers Physics, Bucharest, Romania, member,
7. Robert Williams, NSWC Corona, U.S. Navy, confirmed member.

The new committee will maintain the existing goals and objectives. They are reiterated below with one addition for the year 2004. Future adjustments of our goals and objectives may occur in the process and will follow the standard sequence for posting and publication.

**2004 Goals and Objectives**

1. Routinely revise and update existing NCSLI Glossary of Metrology-Related Terms.
2. Review the requirement for a "Metrology Dictionary" of technical terms, words and acronyms, complete with meanings and applications issues:
  - \*National or international dictionary?
  - \* Will a dictionary replace the NCSLI Glossary?
  - \* Format, plagiarism, and editorial control?
3. Update the NCSLI Glossary of Metrology-Related Terms and Acronym List on the Web site
4. Explore the possibility of adding the Quality Assurance and Statistics related terms

**2005-2008 Goals and Objectives**

1. Reconvene Committee each year to review, and update the Glossary and Acronym List if deemed necessary.
2. Amend Charter as needed to incorporate an NCSLI Dictionary if a dictionary is deemed necessary.
3. Work with the business office to maintain the NCSLI Internet site and control access as necessary.

We welcome any suggestions and comments about this schedule at the address below. Thank you with anticipation.

\*\*\*\*\*

**INDUSTRIAL PROGRAMS**

*Jeff Gust, V.P.*

**UTILITIES**

*John Nystrom*

On January 13th of 2004, at the recent MSC Conference held in California, the NCSLI Utilities Committee met for a general meeting. Our primary order of business was the status report and discussion on the pending revision to RP- 10, Establishment and Operation of an Electrical Utility Metrology Laboratory.

The committee has completed work on this revision and it is now ready for presentation to the NCSLI Board of Directors for approval. This RP has been restructured and completely rewritten to provide guidance for utility labs to manage program requirements from such sources as NCSLI RPs, ANSI/ISO/IEC 17025, ANS 3.2, 10CFR50 and 10CFR21. It is hoped with the board's approval this document will be available from NCSLI by the 2004 annual conference.

Since our last meeting at Tampa last summer many committee members worked on the finalization of the draft. Special thanks are given to Larry Nielsen of Edison ESI, Peter Buzzard of PSEG and Clint Eldridge of PG&E for their contributions in making this a viable aid for utility laboratories.

January, 20, 2004 - The NCSLI Board of Directors voted to accept the submitted revision to RP-10. The document has now moved on to publication.

Also discussed at this meeting were pending changes to ANS 3.2 to a risk-informed QA program and the acceptance of accreditation to ANSI/ISO/IEC 17025 as a basis for qualifying outside metrology services for the nuclear industry.

The next meeting of this committee will be at the 2004 NCSLI conference at Salt Lake City.

The committee members wish to thank Jack Burdick and Larry Nielsen of Edison ESI for once again hosting this meeting. This type of corporate support for the committee is not only essential to our continued existence but is a measure of the high quality of people found in the world of commercial metrology.

**Attendees:**

John Nystrom	PG&E
Larry Nielsen	Edison ESI
Dennis Dubro	PG&E
Clint Eldridge	PG&E
Anita Barnette	TXU
Jim Boulanger	APSC
Peter Buzzard	PSEG
Larry Sumner	WCNOC
Jose Gazca	Ameren UE
Bob Price	Constellation Energy Group
Keith Scoggins	STP

\*\*\*\*\*

**EDUCATION AND TRAINING**

*Terrelle Wilson, V.P.*

**Education and Training Committee Personnel changes in 2004**

Burt Sutherland resigned as chair of the 161 Training Resources committee to become the 147 Chemical Metrology committee chair. Jesse Martinez resigned as co-chair of the 163 Personnel Training Requirements committee to take on the acting chairmanship of the 161 committee. Gloria Neely has moved from co-chair to full chair of the 163 Personnel Training Requirements committee. Paul Hansen has agreed to head up a new committee activity in development to support our IACET (International Association for Continuing Education and Training) CEU (Continuing Education Units) initiative.

Please welcome Mark Lapinskes, Technical Training and Support Mgr for Sypris Test & Measurement Inc. out of Orlando, Florida, to our Education and Training team. Mark has agreed to become the new 164 Education Systems Liaison chair. This committee has primary responsibility for managing and administering NCSLI scholarships. This position opened up when Terrelle Wilson was elected as VP of Education and Training.

Our goal to have accredited NCSLI CEUs ready to offer for tutorials at our next conference in Salt Lake City continues on track. Terrelle Wilson attended an IACET CEU Workshop in December and with the help of the business office, is in the process of writing our process and procedures.

The Education and Training survey that was introduced in paper format at the Tampa conference was brought up and running on the NCSLI web site in October. Since then many of you have provided us with your input and opinions. We need to hear from all of our membership. If you have not yet completed the survey, please go to the NCSLI web site and tell us what you think. The future of measurements training could depend on it.

We solicited Fall reports from scholarship recipient schools as directed in the guideline. We received reports from Butler CC, Central Georgia Tech, Rock Valley College and Purdue University. Sir Fleming College, Tidewater CC, UNC Charlotte and Ridgewater CC have not yet submitted reports.

## PERSONNEL TRAINING REQUIREMENTS

*Gloria Neely*

We had a great turnout at our January meeting at MSC. We are currently making extensive changes to the DRAFT "Guide to Personnel Metrology Training," with a goal of having the Final DRAFT ready for submission by April, 2004. Completion of this document will free our members to work on several newly proposed projects.

\*\*\*\*\*

## DOCUMENTARY STANDARDS APPLICATIONS

*Larry Nielsen, V.P.*

## LABORATORY EVALUATION RESOURCES

*(Vacant)*

This committee will be reactivated to develop a handbook for the replacement standard for Z540.1-1994 scheduled for 2005.

## LABORATORY FACILITIES

*Dr. David Braudaway*

*Doug Cooper*

Work continues on an update of RP-14, "Recommended Practice for Selecting Standards Laboratory Environments."

## METROLOGY PRACTICES

*Dr. Howard Castrup*

Projects for 2004 as follows,

- 1) update RP-1, Calibration Intervals,
- 2) produce new RP on managing calibration program decision variables and
- 3) develop new RP on measurement decision risk analysis.

Work on updating RP-12, Determining and Reporting Measurement Uncertainty and development of a new RP on statistical process controls for metrology are scheduled for 2005.

## WRITING COMMITTEE

*Jesse Morse*

*Doug Sugg*

The present focus is on development of a replacement standard for Z540.1-1994.

### Report:

Working Group 1 is continuing to make great progress in the development of a draft standard to replace the existing Z540.1. They held two well-attended meetings during Q4. The results of the WG1, in the form a draft document, will be presented to the consensus body during the meeting at MSC 2004. A future action plan will be developed during the meeting. A Project Initiation Notification (PIN) has been submitted by the secretariat (Craig Gulka) to ANSI (11/14). The PIN requests the designation Z540.3 be assigned, and to have it supercede Z540.1-1994.

It continues to be difficult for this committee to transact business at the two formal meetings each year. This is because most members

do not travel to shows. It is also difficult to get most members to respond to requests by the chair and other active members. Members on this committee are required to be active in representing their "Interest Groups." The secretariat and I are required to review the membership annually. This year I sent a request to the members asking for their desire and ability to continue as active members. After two weeks only half of the members had responded. I am actively working on either increasing participation, or reducing the size of the committee.

ANSI has posted new (October) "Essential Requirements (ER) 2003" for this committee to live by. (It is posted on our committee web site.) As a result, the "Model Procedures" we have historically used for guidance and direction are eliminated as they were not made part of the "ER." So, after conversations with ANSI, the original "Model Procedures" have been rewritten to comply with the new "ER." This new procedure document will be previewed at the MSC 2004 meeting. Then, it will be presented to the entire committee during 2004-Q1 for approval via letter ballot.

Our committee met at MSC.

## ACCREDITATION RESOURCES

*James Jenkins*

Work continues on an update of RP-9, "Calibration Laboratory Capability Documentation Guideline." New projects under consideration are a guide to getting the most from an accredited laboratory and a survey of accredited laboratories.

## CALIBRATION/CERTIFICATION PROCEDURES

*Dale Varner*

The Calibration/Certification Procedures Committee met at the Measurement Science Conference in Anaheim, California in January 2004. Five team members were present (Dave Larson, Gloria Neely, Thu Ngo, Dale Varner, and Bob Williams), and several issues were discussed and agreements reached.

Our teleconferences will now be held on the 1st and 3rd Wednesday of each month. The next teleconference will be held on Wednesday, February 4, 2004. The teleconference time and call-in number will remain the same. 8:00 AM Pacific, 9:00 AM Mountain, 10:00 AM Central, 11:00 AM Eastern, 303-977-4827 Code 6308#

Each Committee 176 Member or Site will select an Alternate. Alternates will be added to the email distribution list and be copied on all correspondence. Committee Members should keep their Alternates up to date on committee activities and their views, positions, and action items so the Alternates can be productive when filling in for the Members at the Wednesday teleconferences. Please ensure that either the Member or Alternate is available for the Wednesday teleconferences.

In the revision of RP-3, the committee will focus on aligning it with ISO 17025 and not spend any effort with ANSI/NCSL Z540-1 or ISO 10012-1.

February 4, 2004 - Bimonthly teleconference meeting was held and seven committee members attended (David Larson, Gloria Neely, Thu Ngo, Duke Payne, Jan Stenstrom, Dale Varner and Bob Williams). We discussed and came to preliminary agreements on the requirements listed in ISO 17025, Section 5.4.4. We exchanged

information regarding the selection of alternate members. An action item was assigned to document the preliminary agreements to the requirements of ISO 17025, Section 5.4.4 by utilizing the sub-sections as the draft RP-3 headings.

February 18, 2004 - Bimonthly teleconference meeting was held and five committee members attended (David Larson, Gloria Neely, Thu Ngo, Dale Varner and Bob Williams). We discussed the draft RP-3 containing the information listed in the previous meeting and identified necessary changes, additions, and clarifications. We agreed to solicit all committee members to supply examples for the ISO 17025, Section 5.4.4 sub-sections from their own calibration/test procedures of which they are particularly proud to use in the RP-3 draft.

In addition to our bimonthly teleconference meetings, this committee will meet in Salt Lake City, Utah at the annual NCSLI conference. Any measurement professional interested in participating in the re-write of RP-3 should contact Dale Varner at 303-977-5523 or email at < dale.varner@lmco.com >. You do not have to be an NCSLI member or member delegate to participate.

#### Committee 176 Roster:

Bucklew, Scott	Radian Research
Coleman, Stan	AF Metrology
Czech, Michael	St. Jude Medical, Inc.
Ray Gil	AAR Corp.
Johnson, David	Steris
Masiello, Laurie	Masy Systems, Inc.
Neely, Gloria	Navy Measurement Science
Ngo, Thu	NSWC/GIDEP
Payne, Duke	Jacob Sverdrup
Plumb, Michael	Tidewater Community College
Rohde, Dave	NSWC Corona
Stenstrom, Jan	Brunson
Tollerud, Jan	National Institute of Technology
Varner, Dale	Lockheed Martin
Williams, Bob	Navy Measurement Science
Wilson, Terrelle	Lockheed Martin
Zaja, Bob	NSWC Corona



*The three Larry's: Larry Nielsen (Southern Cal Edison), Larry Yates (Acument Strategies), and Larry Warner (Fluke) all meet in one place, causing something like a Guinness World Record incident?*



*Andrew Wallard flies in from BIPM France to make his report to the board.*



*Kim and Derek Porter look happy at the Board luncheon on Wednesday noon. But, the meeting was over and they were headed home.*

---

# NEWS FROM THE NMIs

---

## GREETING ANOTHER NEW YEAR WITHOUT A LEAP SECOND

Does it seem like the world is speeding up? That the pace of life is increasing?

If you feel that way, there's scientific evidence to prove your point. The world has sped up over the last few years. Timekeepers at the National Institute of Standards and Technology (NIST) note that they have not had to insert an extra second (called a leap second) into their time scale for five years. Why? Because the rate of the Earth's rotation has sped up since 1999.

From 1972 (when the world went to the current system of atomic timekeeping) until 1999, 22 seconds were added to the world's time in order to keep atomic time synchronized with Earth's time, as measured by the Earth's spin. Since then, none, nada. Scientists are not sure why this is so, but they do offer some thoughts.

Tom O'Brian, a physicist and chief of NIST's Time and Frequency Division in Boulder, Colo., suggests changes in motion of the Earth's core, the effect of ocean tides and weather, and changes in the shape of the Earth may all be affecting the spin of Mother Earth. In general, he notes, the long-term trend has been for the Earth's rotation to slow down, but not in the last five years.

O'Brian said most scientists expect the Earth to continue slowing down again in the future. So maybe there is hope for those feeling particularly harried.

"The Earth's rotation rate has been the primary clock for nearly all of human history," he says, adding that "only in the last 50 years have we had clocks accurate enough to measure changes in the Earth's spin." NIST introduced the world's first atomic clock in 1949. For more information about leap seconds, see <http://tf.nist.gov/general/leaps.htm>.

\*\*\*\*\*

## LOW-COST, DIGITAL DISPLAYS THROUGH INK JET PRINTING

Convergent technology is one thing-but using your computer's printer to make a new TV screen?

Not quite, but close. In a breakthrough for low-cost electronics manufacturing, researchers at Palo Alto Research Center (PARC), a Xerox subsidiary, have successfully created a transistor array of the type used to control a flat-panel display using a modified ink-jet printer and semiconductor "ink." Still under development, the technique is expected to dramatically lower the cost of the popular displays by replacing more expensive photolithography techniques that dominate display manufacturing. The new technology, co-funded by the NIST, is expected to work on either rigid or flexible substrates, and could create whole new opportunities for wall-sized TV's, unbreakable cell phone displays, computer displays that could roll up like a window shade and electronic paper.

PARC researchers used a new polymer-based semiconductor ink from Xerox Research Center Canada (XRCC) to build a prototype flat-panel display circuit. Transistor arrays are complex devices with multiple layers of conductors, insulators and semiconductors. Conventional photolithography uses a multistep process for each layer, first laying down the appropriate material, then creating a pattern for the components, and finally etching or transferring the pattern to the material. By contrast, PARC's ink-jet process patterns and prints the components of each layer of the transistor array in one step. A key innovation, according to PARC, was a computer-vision system that ensures precise registration of each layer even if the substrate deforms slightly during the process.

The PARC research is part of a joint R&D partnership with Xerox, Motorola Inc. and Dow Chemical Company that is co-funded under NIST's Advanced Technology Program (ATP). The semiconductor polymer ink also was developed under the ATP award. For more information on the ATP project, go to [jazz.nist.gov/atpcf/prjbriefts/prjbrief.cfm?ProjectNumber=00-00-4209](http://jazz.nist.gov/atpcf/prjbriefts/prjbrief.cfm?ProjectNumber=00-00-4209).

\*\*\*\*\*

## CONE-SHAPED TOOL AIDS DIGITAL PROJECTOR TESTS

Inside Hollywood's historic Pacific Theater, engineers have set up a new tool based on technology developed at the NIST to help the motion picture industry move more smoothly into a digital future.

The relatively simple new NIST tool-dubbed a stray-light elimination tube-improves measurements of the contrast and sharpness of images produced with digital projectors. It also may help reduce errors in assessing other projection systems.

Digital cinema should offer movie-goers sharper, brighter pictures, but digital projectors currently are expensive and complex. Engineers from the Digital Cinema Lab, a project of the Entertainment Technology Center (ETC), are using the NIST-developed device as one of many tools to evaluate the performance of these new projectors. ETC is part of the University of Southern California, and is funded by major studios and other organizations.

The tool, which costs under \$100 to construct, is a simple tube made of glossy black plastic with cone-shaped inserts. Light measurements are taken at one end of the tube, while the other end is aimed toward the projector. The cones have a hole in the center (typically 2 inches) so that only those rays arriving directly from the projector reach the light detector, while stray, ambient lighting is filtered out. The device is typically about two feet long and is attached to a tripod or other adjustable, stable mount so that it can be moved to take multiple readings from images projected on a screen. Traditional methods for judging the light output of projectors may introduce errors of 40 percent or more because ambient light is inadvertently included in the measurement.

Contact: Scott Nance, (301) 975-5226

## 2003 BALDRIGE AWARD GOES TO SEVEN ORGANIZATIONS

Four companies, two hospital systems, and one school district were named by President Bush and Commerce Secretary Evans to receive the 2003 Malcolm Baldrige National Quality Award, the nation's highest honor for quality and performance excellence. This is the most Baldrige Award recipients since the program started in 1988 and the first time that recipients were named in all five Baldrige Award categories.

The 2003 Baldrige Award recipients are: Medrad, Inc., Indianola, Pa. (manufacturing); Boeing Aerospace Support, St. Louis, Mo. (service); Caterpillar Financial Services Corp., Nashville, Tenn. (service); Stoner Inc., Quarryville, Pa. (small business); Community Consolidated School District 15, Palatine, Ill. (education); Baptist Hospital, Inc., Pensacola, Fla. (health care); and Saint Luke's Hospital of Kansas City, Kansas City, Mo. (health care).

The Baldrige program is managed by NIST in conjunction with the private sector. The new recipient organizations were selected from among 68 applicants. All seven were evaluated by an independent board of examiners in seven areas: leadership, strategic planning, customer and market focus, information and analysis, human resource focus, process management, and results. The six-month evaluation process included about 1,000 hours of review and an on-site visit by teams of examiners to clarify questions and verify information in the applications. The seven organizations are expected to be presented with the Baldrige Award in a ceremony in Washington, D.C., early next year.

See:

<[www.nist.gov/public\\_affairs/releases/2003baldrigewinners.htm](http://www.nist.gov/public_affairs/releases/2003baldrigewinners.htm)>

\*\*\*\*\*

## TESTS MEASURE COMPATIBILITY OF DVD DISKS AND DRIVES

The next time you try to watch a homemade movie, or access your files from a recordable DVD on your computer's DVD drive, you might be in for an unpleasant surprise. It might not work.

Initial tests conducted by researchers at NIST in collaboration with the DVD Association and the Optical Storage Technology Association show that compatibility between recordable DVDs and DVD drives is only 85 percent. This means that if a recording is made on 10 different brands of DVDs, the odds are that at least one will not work. The problematic results range from DVDs that do not work at all, suddenly freeze, or have video or audio "drop out." Currently, no drive reads all discs, and no discs are compatible with all drives. However, newer drives perform significantly better than older drives.

The first phase of testing included 14 models of DVD-ROM drives, representing about 60 percent of the installed base in America as of last year. Each drive was tested with more than 50 different brands and types of recordable DVD discs.

A second phase of testing will include new drives and media, including those drives that allow consumers to record their own DVDs. Computer scientists at NIST have developed specialized

software and a comprehensive test plan, which was published in October as NIST Special Publication 500-254, DVD-ROM Drive Compatibility Test.

The results of the test will be made available to manufacturers to help them improve the compatibility of their products.

Contact: Phil Bulman, (301) 975-5661

\*\*\*\*\*

## TESTING RESCUE ROBOTS AT ARENAS AROUND THE GLOBE

Opportunities for major strides in robotic search and rescue technology should advance in December when Italy opens a year-round, robot-testing arena in Rome. The arena, patterned after one created by the NIST, simulates conditions in collapsed buildings. The Rome facility duplicates arenas already fabricated in the United States and Japan. Two more robot arenas based on NIST design are scheduled to open next year in Germany and Portugal.

The arenas host "RoboCupRescue," an international robotic search and rescue team competition designed to advance robot rescue capabilities. Researchers also use the arenas to perform robot experiments and support collaboration between organizations. Like real collapsed buildings, all the arenas include sections that range in difficulty from level, uncluttered surfaces to areas that require stair climbing and navigation among "pancaked" floors and rubble.

The next RoboCupRescue event is scheduled for Lisbon in June, 2004. Revised competition rules and improved ways to measure robot performance should increase the relevance of such events for real emergencies. For example, new limitations on robot-human radio communications better reflect real disaster conditions in which frequencies are usually overloaded with emergency communications and structural debris often interferes with transmission. Multiple sensor identifications of simulated "victims" also are now encouraged and false positive identifications, that in real life would jeopardize rescuers, are penalized. To comply, teams are adding sensors for body heat and other signs of life (body movement), sound (moaning, tapping) and carbon dioxide (breathing). Sensors that can detect human urine and sweat as well as hazards such as gas leaks are also under development.

During these international competitions, both NIST and National Science Foundation-funded researchers videotape the robots and operator interfaces to identify "best in class" algorithms, sensors, and mechanisms. They also gather information from robot operators to help in continuing to refine robot performance measures.

Contact: John Blair, (301) 975-4261

\*\*\*\*\*

## CELL PHONE STILL TOO BIG? MICRO-OSCILLATORS MAY HELP

A three-dimensional plot shows how the microwave frequency (x axis) generated by a new NIST oscillator varies with changes in the current (y axis). The height of each peak represents the power of the signal produced at specific frequencies.

A tiny, novel device for generating tunable microwave signals has been developed by researchers at the NIST. Described in the Jan. 16 issue of *Physical Review Letters*, the device measures just a few micro-meters square and is hundreds of times smaller than typical microwave signal generators in use today in cell phones, wireless Internet devices, radar systems and other applications.

The device works by exploiting the fact that individual electrons in an electric current behave like minuscule magnets, each one with a "spin" that is either up or down, just as an ordinary magnet has a north and a south pole.

The NIST device consists of two magnetic films separated by a non-magnetic layer of copper. As an electric current passes through the first magnetic film, the electrons in the current align their spins to match the magnetic orientation in the film. But when the now aligned electrons flow through the second magnetic film, the process is reversed. This time the alignment of the electrons is transferred to the film. The result is that the magnetization of the film rapidly switches direction, or oscillates, generating a microwave signal. The microwave signal can be tuned from less than 5 gigahertz (5 billion oscillations a second) to greater than 40 GHz.

The NIST experiments confirm predictions made by theorists at IBM Corp. and Carnegie Mellon University in 1996. NIST physicist William Rippard says the new oscillators can be built into integrated circuits with the same technologies now used to make computer chips and that they may eventually replace bulkier technologies at a greatly reduced cost.

Contact: Fred McGehan, (303) 497-3246

\*\*\*\*\*

## ADVICE FOR DESIGNING RELIABLE NANOMATERIALS

Stronger or tougher? For designers of advanced materials, this trade-off may complicate efforts to devise efficient methods for assembling nanometer-scale building blocks into exotic ceramics, glasses and other types of customized materials.

"Not all properties may benefit from microstructural refinement, so due caution needs to be exercised in materials design," writes NIST's Brian Lawn in the January issue of *Journal of Materials Research*.<sup>\*</sup> An expert on brittle materials, Lawn advises that past experience is not always a useful guide for predicting material properties and performance when film thicknesses, grain sizes and other characteristic dimensions shrink toward molecular proportions. At this level, materials designers must reckon with interatomic force laws that are obscured at larger scales, from micrometers (millionths of a meter) on up.

"Generally in brittle materials, strength (resistance to crack initiation) increases and toughness (resistance to crack propagation) decreases as characteristic scaling dimensions diminish," Lawn concludes from his work to refine ceramics used in biomechanical applications such as dental crowns and orthopedic implants. At the nanoscale, tiny cracks require more load to spread them, but have little resistance to extension once they start and are, therefore, more likely to spread catastrophically. Depending on the application in

mind, the decrease in fracture toughness may more than offset initial gains in strength, or the ability to withstand stresses that squeeze, stretch or twist the material.

This poses challenges for designers who choose to build minuscule devices and tiny systems with ceramics because of its light weight, high strength and hardness. Lawn says contact points in devices with moving parts will require especially close attention. As the size of contacts decreases, he notes, stresses will become more concentrated, "increasing the potential for irreversible damage and premature failure at ever-lower critical loads."

Contact: Mark Bello, (301) 975-3776

\*B.R. Lawn, "Fracture and Deformation in Brittle Solids: A Perspective on the Issue of Scale," *J. Mater. Res.*, Vol. 19, No. 1, Jan. 2004.

\*\*\*\*\*

## ONLINE CALCULATOR IMPROVES ANALYSIS OF CHEMICAL DATA

NIST scientists recently unveiled an online calculator on NIST's Web site designed to make chemical analysis by mass spectrometry faster and more reliable. The tool also may make some chemical evidence introduced in criminal cases more trustworthy.

The NIST tool, called MassSpectator, automates the mathematical calculations needed to convert plots of mass spectrometry data into final results—a listing of the chemical components and concentrations of substances in a mixture of unknown composition.

Mass spectrometry works by measuring the mass of single molecules within a chemical compound. It does this by first turning solid or liquid substances into charged particles called ions. The ions then are manipulated with magnetic fields, radio frequencies or other means so that molecules with different masses hit a detector at different times and/or locations. Signals from the detector are plotted as "peaks" that represent molecules of different sizes.

The NIST software automatically, without any user involvement, identifies and calculates the size of the peaks. Previously available software required user interaction to take that second step.

By automating the entire calculation process, MassSpectator saves time; makes it much easier to work with massive datasets such as those used to study the functions of proteins; and eliminates errors or bias that might be introduced by manually translating mass spectrometry peaks into final chemical results. For example, by using Mass Spectator's automated calculations, law enforcement agencies can increase confidence in chemical analyses conducted during criminal investigations.

For further information, see < [www.nist.gov/maldi](http://www.nist.gov/maldi) >.

## NEW CRYOGENIC REFRIGERATOR DIPS CHIPS INTO A DEEP FREEZE

In a major advance for cryogenics, researchers at the National Institute of Standards and Technology (NIST) have developed a compact, solid-state refrigerator capable of reaching temperatures as low as 100 milliKelvin. The refrigerator works by removing hot electrons in a manner similar to an evaporative air-conditioner or "swamp cooler."

When combined with an X-ray sensor, also being developed at NIST, the instrument will be useful in semiconductor manufacturing for identifying trace contaminants and in the astronomical community for X-ray telescopes. The device can be made in a wide range of sizes and shapes, as well as readily integrated with other cryogenic devices ranging in size from nanometers to millimeters.

A report of the work is featured on the cover of the January 26, 2004, issue of Applied Physics Letters. "The idea is to use a solid-state refrigerator for on-chip cooling of these cryogenic sensors," says Anna M. Clark, the report's lead author. "We have a working refrigerator that reduces temperatures low enough to be used with highly sensitive X-ray detectors. These detectors require subKelvin temperatures to minimize thermal noise and maximize their resolution."

Current equipment capable of cooling to 100 milliKelvin is bulky and expensive. By combining an on-chip cooler with an X-ray sensor, the NIST device may substantially reduce the weight and cost of such equipment.

The refrigerator is made from a sandwich of normal-metal/insulator/superconductor junctions. When a voltage is applied across the "sandwich," high-energy (hot) electrons tunnel from the normal metal through the insulator and into the superconductor. As the hottest electrons leave, the temperature of the normal metal drops dramatically.

Contact: Gail Porter, (301) 975-3392

\*\*\*\*\*

## STIRRING RESEARCH PROVIDES RECIPE FOR NANOTUBE SUCCESS

If manufacturing is entering the "Golden Age" of nanotechnology, then carbon nanotubes are the "Golden Child." In recent years, these tubes of graphite, many times thinner than a human hair, have become a much-touted emerging technology because of their potential ability to add strength and other important properties to materials.

Adding carbon nanotubes to plastics and other polymers has the potential to make automobile and airplane bodies stronger and lighter, and textiles more tear-resistant. Because of their electrical properties, carbon nanotubes also may be used to embed sensors in clothing for military and medical applications. By one estimate, the carbon nanotube market valued at approximately \$12 million in 2002 could grow to \$700 million by 2005.

One problem, however, is that the nanotubes tend to clump together in certain applications. Just as an oil and water salad dressing must be shaken thoroughly to mix well, carbon nanotube formulations must be thoroughly blended to perform their best.

In a set of experiments reported in the Jan. 30 issue of Physical Review Letters, researchers at the National Institute of Standards and Technology (NIST) have started to quantify both the problem and the solution. The scientists used a microscope and an "optical flow cell" to measure the force needed to mix different concentrations of nanotubes. Their findings suggest that flow conditions often encountered in the processing of carbon nanotube suspensions can actually have the opposite effect, leading to demixing. The effect is related directly to the long fiber-like structure of the nanotubes. Although this work only sets the stage for resolving what will be an important technological issue, the findings give researchers insight into how to process nanotubes more efficiently.

Contact: Scott Nance, (301) 975-5226

## LASER METHOD IDENTIFIES, COUNTS TOXIC MOLECULES

A spectroscopy technique that offers advances in detection of toxic chemicals and counting of molecules has been demonstrated by a NIST scientist and collaborators. Described in the Feb. 8 issue of the Journal of Chemical Physics, the NIST-patented technique may be useful for development of miniaturized chemical sensors, as well as for fundamental surface science studies.

The technique (a variation on cavity ring-down spectroscopy) relies on laser light reflecting and circulating inside a prism-like optical resonator. The time it takes the light to diminish (or ring down) changes depending on whether specific chemicals are present near the resonator and on how much light they absorb. This information can be used to identify and quantify specific molecules.

The technique can detect small amounts (100 parts per million) of trichloroethylene, a toxic commercial solvent that is prevalent but difficult to locate in the environment. The sensitivity is equivalent to the best of other published optical methods that could be used outside a laboratory. A highly selective coating is expected to enhance performance further.

The technique also was used to determine the number of molecules per unit area on a surface ("absolute coverage") without the need for ultrahigh vacuum experimental conditions, which are typically required for such measurements. Hence, the new approach enables quantitative studies of real-world surface processes, such as catalytic reactions. Absolute coverage measurements are useful in surface science, providing key information about surface reactions or structures for many applications, such as improving solar cell efficiency.

The research was performed with collaborators from Eindhoven University of Technology in the Netherlands and the University of Maryland; partial funding was provided by the U.S. Department of Energy, Environmental Management Science Program.

Contact: Laura Ost, (301) 975-4034

## TESTING STICKY STUFF WITH A 'FLY'S EYE'

A new collaboration at the NIST will contend with lots of sticking points, by design. NIST and industry researchers intend to devise rapid screening and measurement methods that speed discovery of new epoxies, pressure-sensitive adhesives and other products manufactured for the \$30 billion global adhesives market.

In a project just getting under way, the partners will refine and extend miniaturized technologies for simultaneous testing of hundreds of systematically varying adhesive formulations. One test platform is designed for screening new combinations of components used to make labels, skin patches and other pressure-sensitive adhesives, a fast-growing segment of the market. It includes an array of up to 1,600 "micro lenses," an arrangement resembling a fly's compound eye. In an automated process, each lens is coated with an incrementally different formulation. The array is lowered until each lens contacts a wafer-like substrate coated with a thin film that also can vary in chemical composition and thickness. The array then is raised until each lens detaches from the substrate.

Arrays of multi-colored dots indicate the strength of different adhesives measured with the NIST multi-lens testing system. Red areas indicate the stronger bonds, blue areas the weaker.

From measurements of changes in the position of lenses and other preselected variables, researchers can deduce the adhesive strength of different formulations under deliberately varied conditions. A microscope mounted below the testing platform monitors the entire process. The resulting color-coded maps show changes in adhesion energy (an indicator of an adhesive's strength) as lens and substrate bond, and then, separate.

Another system for high-throughput testing of prospective epoxies and other adhesives for the microelectronics and other industries also is under development as part of this new collaborative effort.

Partners in the project include Intel and National Starch and Chemical, an ICI company. Both Intel and ICI are members of the NIST Combinatorial Methods Center (NMC) consortium. For more information, go to <<http://polymers.mscl.nist.gov/combi/index.html>>.

\*\*\*\*\*

## RESEARCHERS OFFER TIPS FOR LONGER LIVED CD, DVDS

You should never use a pen, pencil or hard-tip marker to write on your CDs. That is among several recommendations made by computer scientists at the NIST, who sliced, diced and baked CDs and DVDs to see how long the digital information would survive.

Most CDs and DVDs will last 30 years or more if handled with care, but many factors can slash their longevity. Direct exposure to sunlight can do a great deal of damage both from the sun's ultraviolet rays and the heat. Indeed, any rapid significant change in temperature or humidity can stress the materials. The study also found that fingerprints and smudges frequently do more harm than scratches, and recommends handling discs by the outer edge or the center hole.

Discs may be cleaned with a cotton cloth by wiping in a straight line from the center of the disc toward the outer edge. Isopropyl alcohol may be used for extra cleaning power.

Discs last longest when stored in plastic cases in a cool, dark, dry environment. Because gravity can gradually bend the disc, storing it upright like a book is best for long-term storage.

Many libraries, archives and government agencies store information on optical media, and NIST collaborated with the Council on Library and Information Resources to issue the research report.

A quick reference guide to the research group's findings is available at <[www.itl.nist.gov/div895/carefordisc/discare.html](http://www.itl.nist.gov/div895/carefordisc/discare.html)>.

\*\*\*\*\*

## FEDERAL STANDARD ISSUED FOR IMPROVING IT SECURITY

Computer security specialists at the NIST have developed a new standard to help federal agencies better protect their computer networks. The standard provides a new way to categorize government information and information systems.

"Protecting our government networks remains a critical priority for this administration," said U.S. Commerce Secretary Donald L. Evans. "This new standard will help agencies better handle security threats by providing better information and guidance to federal agencies so they can make sound decisions."

The standard was developed following passage of the Federal Information Security Management Act (FISMA) of 2002. Federal Information Processing Standard (FIPS) 199, Standards for the Security Categorization of Federal Information and Information Systems, introduces significant changes in how the federal government protects information and the computerized networks that store information by giving detailed guidance on how to categorize systems.

The standard includes criteria to be used by civilian agencies in categorizing information and information systems, providing appropriate levels of security according to a range of impact levels. Under the standard, agencies will assess the potential impact on their missions that would result from a security breach due to loss of confidentiality (unauthorized disclosure of information), integrity (unauthorized modification of information) or availability (denial of service).

The mandatory standard will be a critical component of an agency's risk management program. As required by FISMA, NIST is also developing a companion standard that will specify minimum security requirements for all federal systems. A draft of that material was published by NIST in 2003 for public comment. Together, these two standards will help ensure that appropriate, cost-effective security measures are put in place for each federal system. NIST also has a variety of computer security guidelines that may be used in conjunction with the new standard.

A copy of the standard is available at <<http://csrc.nist.gov>>.

## CURRENT SMOKE ALARMS PASS LIFE-SAVING TESTS

Today's home smoke alarms-both ionization and photoelectric types-consistently provide enough time for people to escape most fires. Immediate response to an alarm, however, is critical, since the tests affirmed previous findings that individuals caught in a flaming fire (as opposed to a smoldering fire) have only an average of three minutes to escape untenable or unsurvivable conditions. Those are the key conclusions of a two-year NIST study, the first comprehensive look at smoke alarms since NIST tests 25 years ago.

"The three-minute escape window for flaming fires differs from the 17 minutes NIST recorded in its seminal smoke alarm tests in the 1970s," said Richard Bukowski, the NIST researcher who conducted both studies. "It confirms what fire scientists have recognized for some time: fires today seem to burn faster and kill quicker because the contents of modern homes (such as furnishings) can burn faster and more intensely. Our new research, however, proves that even with a three-minute warning, smoke alarms still offer enough time to save your life," Bukowski stressed. "When the alarm sounds, it is important that everyone just get out of the house."

NIST found that ionization smoke detectors activate quicker for flaming fires than photoelectric alarms. Photoelectric alarms, on the other hand, often provide faster response time to smoldering fires. Placement of either type on every level of the house would save lives. The tests also showed how closed bedroom doors and proper placement of smoke alarms improved prospects for survival. In both cases, time to escape untenable conditions increased, providing the individual was not in the room where the fire originated.

The study was sponsored and supported with in-kind contributions by eight federal and non-profit agencies. To download the full report,\* visit <<http://smokealarm.nist.gov>>.

\*Bukowski, Richard, et al., Performance of Home Smoke Alarms, Analysis of the Response of Several Available Technologies in Residential Fire Settings

\*\*\*\*\*

## USING WATER AS A LENS TO SHRINK CHIP DIMENSIONS

Thanks in part to highly accurate measurements made by NIST researchers, semiconductor manufacturers will be able to pursue a new production method that will enable them to produce new generations of computer chips using existing equipment-saving the industry hundreds of millions of dollars.

Creating ever more powerful computer chips relies on being able to increasingly miniaturize the features on those chips. Industry had thought it might be nearing the end of the useful life of equipment that creates features using 193 nanometer (nm) wavelength light.

However, a new method called immersion lithography uses a thin layer of water like a lens to shorten the effective wavelengths of ultraviolet light used in patterning semiconductor chips. The method relies on the fact that light travels slower through water than air. The frequency of the light remains the same, so the distance between peaks (the wavelength) must shorten to compensate.

The method should enable manufacturers to use 193 nm equipment to create circuit lines and other features at least as small as 45 nm. Such a breakthrough allows manufacturers to create much more powerful chips while getting more life out of their current fabrication equipment, which can cost around \$20 million per tool.

The industry began to take immersion lithography seriously about a year ago. With the support of International SEMATECH, the semiconductor industry's R&D consortium, NIST scientists made highly accurate measurements of a property called refractive index, a measure of how much ultraviolet light at a wavelength of 193 nm bends when it moves from air to water. This new data helped enable the semiconductor industry to design immersion lithography systems.

NIST researchers described key results of their work at the International Society for Optical Engineering's Microlithography 2004 conference held Feb. 23-28 in Santa Clara, CA.

The researchers also are working with industry on new immersion fluids for 157 nm wavelength chipmaking tools, so that this equipment can produce features of 32 nm or below.

Contact: Scott Nance, (301) 975-5226

\*\*\*\*\*

## QUICK LINKS

### New Values for Fundamental Constants

Accurate values for fundamental physical constants-like the speed of light in a vacuum, the mass of an electron, or Avogadro's constant-are required in many practical calculations made in scientific and technical work. New values for more than 300 basic constants and conversion factors are now available. These values, recommended by the international Committee on Data for Science and Technology (CODATA), are the result of an adjustment carried out by NIST physicists under the auspices of the CODATA Task Group on Fundamental Constants. For more information, see <<http://physics.nist.gov/constants>>.

### Learn from the Best

Organizations large or small; in service, manufacturing, education or health care; with one office or multiple sites around the globe-all can benefit from the knowledge and experience of the seven recipients of the 2003 Malcolm Baldrige National Quality Award.

The Quest for Excellence XVI conference will be the first opportunity to learn about the exceptional practices and results of the 2003 recipients: Medrad, Inc. (manufacturing); Boeing Aerospace Support (service); Caterpillar Financial Services Corporation U.S. (service); Stoner, Inc. (small business); Community Consolidated School District 15 (education); Baptist Hospital, Inc. (health care); and Saint Luke's Hospital of Kansas City (health care). The conference was held March 28-31, 2004, in Washington, D.C. For further information, call (301) 975-2036 or visit the Baldrige National Quality Program Web site at <[http://baldrige.nist.gov/Quest\\_for\\_Excellence.htm](http://baldrige.nist.gov/Quest_for_Excellence.htm)>.

### **Baldrige Criteria for 2004 Available**

In addition to being the basis for a Baldrige Award application, Baldrige Performance Excellence Criteria are used by thousands of organizations to assess and improve their performance in a wide range of areas, including leadership, corporate governance and ethics, employee and customer relations, and results. The 2004 Baldrige criteria for business, education and health care are now available. The criteria may be downloaded from <http://baldrige.nist.gov> or may be requested by calling (301) 975-2036.

### **Sensor on a Chip**

In a Dec. 12 presentation, researchers at the NIST reported new results at an Institute of Electronics and Electrical Engineers device research conference showing that a NIST "sensor on a chip" device is 100 times more sensitive in detecting toxic gases than other systems described in the open literature. The device integrates chemical sensor technology with its related electronics on a single semiconductor chip. The technology is based on MEMS, or Micro Electro Mechanical Systems, which is the creation of devices and machinery at the microscale. Such integration should make gas sensors for homeland security or other applications not only more sensitive and cheap to manufacture, but also much more flexible and customizable. For details, see <http://www.eeel.nist.gov/812/files/afриди-MEMS-Based%20Gas%20Sensor.pdf>.

### **Technology Transfer**

On Dec. 18, Gov. Robert L. Ehrlich (R-Md.) announced a memorandum of understanding (MoU) between the Maryland Technology Development Corp. (TEDCO) and the National Institute of Standards and Technology (NIST) to increase technology transfer initiatives between the agency and the state's small businesses and universities. The agreement calls for NIST and TEDCO to focus on mutually beneficial links by identifying activities that will leverage the capabilities and resources of NIST, Maryland technology-oriented small businesses and leading institutions of higher education. NIST will identify technologies that are available for licensing as well as provide guidance and support on procedures for submitting a license application. For more information, go to [www.nist.gov/public\\_affairs/releases/tedcomou.htm](http://www.nist.gov/public_affairs/releases/tedcomou.htm).

### **Nanotechnology Act Calls for Major Role for NIST**

The "21st Century Nanotechnology Research and Development Act," signed into law by President Bush on December 3, 2003 specifies a major role for the NIST. The Act requires the director of NIST to "establish a research program on the development and manufacture of nanotechnology, including metrology, reliability and quality assurance, processes control and manufacturing best practices and to utilize the Manufacturing Extension Partnership to disseminate the results of the program." For details see: [www.house.gov/science](http://www.house.gov/science).

### **Spam Technology Workshop**

The NIST held a workshop on Feb. 17, 2004, examining the technical means for controlling unwanted e-mail known as spam. The workshop covered technical topics such as ways to detect and reduce spam and the technical possibility of creating "do not spam" lists. More information is available at <http://csrc.nist.gov/spam>.

### **Computerized Welding**

The 13th International Conference on Computer Technology in Welding was held in Orlando, Fla., on June 18, 2003. The conference was sponsored by NIST, the American Welding Society, and the Welding Institute. Topics included modeling, weld data flow, and computers and automation. Hard copies or CDs of the proceedings are available from [siewert@boulder.nist.gov](mailto:siewert@boulder.nist.gov).

### **Nanotechnology workshop**

The NIST hosted more than 200 representatives of government, academia and industry Jan. 27-29 for a "Grand Challenge" workshop aimed at developing the equivalent of a roadmap for metrology and instrumentation to further develop the emerging field of nanotechnology. When will the sizable federal investment in nanotechnology begin to deliver tangible returns? A big part of the answer lies within the domain of instrumentation and metrology,

NIST Director Arden L. Bement Jr. told workshop attendees. "To be sure, new and better measurement tools are needed to sustain advances and discoveries in the laboratory—to distinguish artifact from novel phenomenon, for example, and to enable replication and verification of research results across laboratories," he said. "Without such tools, science will not acquire the detailed knowledge it needs of the exotic properties and the odd behavior of matter at the nanoscale." For the full text of Bement's remarks, go to

[http://www.nist.gov/speeches/bement\\_012704.htm](http://www.nist.gov/speeches/bement_012704.htm)

# NCSLI NEWSNOTES

## URGENT ACTION NEEDED FOR JOE D. SIMMONS SCHOLARSHIP

Editor's Note: If you have a student who might be interested in this technical award, be sure to immediately request the application forms, since one requires written recommendations of a faculty member by May 1.

Joe Simmons was one of our most dedicated industrial volunteers. For a number of years before his untimely death, he was Chief of the NIST Calibration Program, and was the NIST representative on our NCSLI Board.

The Simmons Scholarship, in his name, is soliciting candidates for an award of \$1500 to support the study of metrology and quality during the 2004-2005 school year.

Educational institutions having curricula with substantial metrology content are urged to encourage high-potential students to apply.

To apply, a potential candidate must submit:

- a completed application form;
- a list of courses taken and planned to be taken in pursuit of a degree (Associate, Bachelor, Master, etc.);
- an endorsement from one or more of the school faculty teaching metrology or quality related subjects;
- a transcript of grades in all courses to date; and
- an essay indicating metrology and quality concepts learned and applied in academic or work settings, and describing the student's career aspirations. The essay need not be overly lengthy.

Submissions may be made either electronically or by mail (preferably the former) as indicated below. The above materials must be received by the Scholarship Committee before May 1, 2004.

Contact:

The Joe D. Simmons Memorial Scholarship  
7413 Mill Run Drive  
Derwood, MD 20855-1156  
< simmons\_scholar@comcast.net >

## NCSLI COORDINATOR CHRIS GRACHANEN IS AWARDED 2004 TEST ENGINEER OF THE YEAR

We're proud to report that NCSLI's active South Central Region Coordinator and ASQ Liaison, Chris Grachanen of Hewlett-Packard, was just announced as 2004 Test Engineer of the Year. The announcement was made by Test & Measurement World, a preeminent trade magazine in our measurement field.

Chris's position as manager of Hewlett-Packard's Metrology Group, in Houston, TX, results from his taking advantage of serendipitous career and education opportunities, which have propelled him far from his rural Ohio hometown and original career ambitions. Chris, a voluble and personable 45-year-old, has contributed to his employer and to the measurement community in many ways:

- In 1998, he shepherded his lab-then part of Compaq-through the National Voluntary Laboratory Accreditation Program (NVLAP) accreditation, making the Compaq lab one of the first to meet NVLAP's stringent requirements.
- He has developed several software tools for metrologists-including tolerance and uncertainty calculators-and made them available free to the engineering community.
- In 2002, he spearheaded an effort through the American Society of Quality (ASQ) to develop a program for certifying calibration technicians.
- He has authored numerous conference papers for the NCSLI and other events, and he has authored many articles for *Test & Measurement World* and other publications.
- He's an active member of industry organizations including the ASQ and NCSL International, serving as the NCSLI Southwest regional coordinator.

In the September 2003 issue, T&MW profiled the major accomplishments of six outstanding test engineers from a variety of industries, and asked readers to vote for the Test Engineer of the Year. As part of this honor, Chris designated several engineering programs to receive a total of \$20,000 in education grants, courtesy of the Award sponsor, National Instruments.

- Ridgewater College of Minnesota
- Butler County Community College of Pennsylvania
- Central Georgia Technical College
- Tidewater Community College of Virginia

"Some small community colleges have tried to step in to fill the need for the calibration personnel that PMELs once turned out," Grachanen says. "But the equipment is so gosh-darned expensive. They really have a hard time providing the equipment for students to learn on. Take the Fluke 8.5-digit DMM-[educators] are chomping at the bit to afford something like that. These schools are doing all the right things, within the constraints of their too-limited budgets."

*Editor's Note: Chris really deserves one of our NCSLI Newsletter's personality profiles, and we will plan that for a later issue, but meantime, be sure to visit this T&M World website for a complete story on Chris's accomplishments.*

< <http://www.reed-electronics.com/tmworld/article/CA385791?stt=000&pub-date=3%2F1%2F2004> >

---

# LIAISON NEWS

---

## AMERICAN SOCIETY FOR QUALITY (ASQ)--MQD

*Christopher L. Grachanen, Liaison Delegate*

### Conference 2004 - Call for Papers

ASQ's Measurement Quality Division (proud sponsor of the CCT program) and ASQ's Inspection Division are pleased to announce a joint division conference on September 23-24, 2004. The conference will be held at the USAF Primary Standards Laboratory, Conference & Cafeteria Facilities, Newark Metrology Operations in Heath, Ohio. Heath, Ohio, is located 20 miles east of Columbus off I-70 and served by Columbus airport. Many hotel and dining facilities exist in the surrounding area.

Abstract submissions of less than 100 words are invited from the following suggested (but not limited to) categories: Measurement Uncertainty, Training, Standards affecting Inspection and Measurement, Measurement Techniques, Inspection Techniques, Certification, Laboratory Accreditation, Inspection and Measurement Quality, and Statistical Application in Inspection and Measurement.

Please submit abstracts to Hershaw Brewer at <hbrewer@iasonline.org> before May 1, 2004.

For conference information please visit <<http://www.measurementquality.org/index.html>>.

### CCT Program

The latest offering of the ASQ Certified Calibration Technician (CCT) exam was administered on 07 Dec. 2003 at various locations across the U.S. There were 109 individuals that sat for the four-hour exam with 69 of them passing it yielding a 63% pass rate (the first offering of the CCT exam in June 2003 resulted in a 71% pass rate). Future CCT exam dates:

Exam Date	Application Deadline	Location
23-May-04	23-Apr-04	Toronto, Ontario, Canada at ASQ's Annual Quality Congress
5-Jun-04	9-Apr-04	ASQ Local Sections and International Sites
4-Dec-04	1-Oct-04	ASQ Local Sections and International Sites

Sample exam questions are available for review at <<http://www.asq.org/cert/types/cct/studyguide.html>>

For information about the CCT program please visit <<http://www.asq.org/cert/types/cct/index.html>>

or e-mail Mary Martin at <[MMartin@asq.org](mailto:MMartin@asq.org)>

### CCT Workshops

There will be a CCT workshop for the first half of 2004 to develop and review new test items for the CCT exam (April 23 & 24). The workshop will be held at ASQ's Milwaukee Headquarters (ASQ pays transportation, lodging and meals) and are open to all those who have passed the CCT exam. For more information please contact Mary Martin, ASQ Administrator at: <[MMartin@asq.org](mailto:MMartin@asq.org)>

\*\*\*\*\*

### INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

*David Braudaway, Liaison Delegate*

IEEE now has activated the Joseph F. Keithley Field Award in Instrumentation and Metrology.

This is a completely updated form of an old award, the Morris E. Leeds Award, which has been inactive for the past several years. The honorarium for the award is \$10,000, and the first recipient of the new Award is Henry Parsons Hall. Henry's career was at General Radio and its successor firms where he became known for very innovative impedance bridges. The presentation will be made at the IMTC Conference in Como, Italy, next May.

\*\*\*\*\*

### COUNCIL FOR OPTICAL RADIATION MEASUREMENTS (CORM)

*Sally Bruce, Liaison Delegate*

The CORM Board of Directors recently met in Orlando, Florida, for their quarterly meeting. Hosted by Optronics Laboratories, the two-day meeting included planning for the upcoming 2 CORM conferences: CORM 2004 and CORM 2005.

CORM 2004 will be from May 12-14th 2004 at NIST's headquarters in Gaithersburg, Maryland. This promises to be an exciting and important conference, covering Advances in Color and Appearance Metrology. The conference will be run in conjunction with the Inter-Society Color Council Annual Technical Meeting to be held from May 10-12th, also at NIST, Gaithersburg. Following the CORM Meeting, ASTM E-12 will meet from Monday through Wednesday, May 17-19th, also in Gaithersburg. For additional details and registration information about CORM 2004 visit the website listed below.

An adhoc committee for student outreach was formed at the board meeting and this year's CORM conference will offer for the first time a discount registration fee for students.

Changes have been made to the CORM website. It contains a fresh look and improved navigation <<http://www.corm.org>>. Check the website frequently as improvements will continue throughout the year. In addition, the CORM tri-fold brochure will be updated in June to include the changes in the board membership.

CORM 2005 will be held in May of 2005 at NIST in Boulder, CO. Topics and theme areas will include laser power, fiber optic, and display measurements. Additional information will be made available as the date approaches.

The board meeting included a tour of the Optronic Laboratory facilities. In the business for more than 30 years, Optronic Laboratory provides the optical radiation community with light measurement instrumentation, manufacturing, characterization, calibration standards, and measurement services.

\*\*\*\*\*

## INTERNATIONALE MESSTECHNISCHE KONFEDERATION (IMEKO)

*Chester Franklin, Liaison Delegate*

Dr. Mladen Borsic, the IMEKO Vice-president of the XBVII World Congress, attended MSC in January and reaffirmed the interest that IMEKO has in working closely with NCSLI. As with NCSLI, much of their work is accomplished through committees. IMEKO has 20 Technical Committees and they organize many conferences and symposia throughout the year, which are held at various locations around the world. The technical committees of IMEKO have many common interests with NCSLI committees. Dave Braudaway is active with TC 4, Measurement of Electrical Quantities.

Dr. M. Sedláček of the Czech Technical University, Faculty of Electrical Engineering, Department of Measurement, is the chairman of TC 4. Any NCSLI member wanting more information is encouraged to contact him at < sedlacem@feld.cvut.cz >, or check out the IMEKO website at < www.imeko.org >, or contact me. Also, don't forget the IMEKO General Congress (like our Workshop and Symposium, except that over 50 countries participate) in June of 2006.

IMEKO XVIII, "Metrology for a Sustainable Development," will be held May 7 - 12, 2006, in Rio de Janeiro, Brazil, under the direction of Dr. Mauricio Frota. Mauricio is VP for IMEKO XVIII, and the NCSLI Region Coordinator for Brazil. Here are some important dates for those wanting to participate:

- July 7, 2005: Submission of Extended Abstracts
- Sept 22, 2005: Notification of Acceptance and Full Paper Instructions
- Submission of Full Paper for Proceedings: December 15, 2005

I will remind you of those dates in future newsletters.

For those interested in Experimental Mechanics, IMEKO is one of the co-sponsoring organizations for the Society of Experimental Mechanics' SEM X International Congress and Exposition on Experimental and Applied Mechanics, in Costa Mesa, California, June 7 - 10, 2004; and ICEM 12, the International Conference on Experimental Mechanics, to be held in Italy from August 29 through September 2, 2004.

If you would like more information on IMEKO go to <www.imeko.org>. If you have suggestions for me, as to what I might do to improve our relationship with IMEKO, just let me know.

## ISA INTERNATIONAL

*Mike Suraci*

Communications have been maintained with staff at ISA. The parallel activities of the 2 organizations present opportunities to share experiences.

As a reminder, ISA has hosted NCSLI staff (Craig Gulka) at a workshop in the past. Also, Klaus Jaeger has visited ISA headquarters in Research Triangle Park to hold discussions.

Potential areas of cooperation have included:

- Long-term Conference planning
- Web site activities
- Training opportunities
- Headquarters requirements
- Publications

\*\*\*\*\*

## GIDEP METROLOGY

*Jim Carlton*

### Metrology Data DVDs

- DVD\_0004 is ready for release to GIDEP participants. It contains metrology data submitted to GIDEP from 1 May 2002 through 31 October 2003. The metrology DVDs are available to all participants at no cost. Subscription forms for the DVDs can be downloaded from the GIDEP Home Page/Data/Metrology and click on "Metrology DVD".
- The complete GIDEP Metrology DVD set consists of DVD\_0001, DVD\_0002, DVD\_0003, and DVD\_0004. The entire metrology DVD set contains metrology data submitted to GIDEP from 1 October 1993 through 31 October 2003. The GIDEP metrology DVDs can be used on a local hard drive or in a network environment.
- In addition to the metrology documents, DVD\_0004 includes the Air Force Technical Order 33K-1-100, Technical Manual TMDE Calibration Interval Technical Order and Work Unit Code Reference Guide, and the Army's metrology procedures index TB 43-180. The Air Force and Army indexes contain instrument calibration intervals, which enable users to search for calibration information by manufacturer's model number, National Stock Number, or Calibration Procedure number.

If you have input for this committee, please contact Harry Moody at <harryjmoody@cs.com>

John Minck, Editor extraordinaire and past NCSLI president, joined the Board on Wednesday morning for the second workshop and a discussion of the newsletter - past, present and future. This was the first of several Board discussions that will determine the overall direction of our Newsletter as we move into the 21st century.

### New Board Member

It is my great pleasure to announce that Roxanne Robinson of the American Association for Laboratory Accreditation [A2LA] has agreed to a one-year appointment to our Board of Directors. She becomes the eighteenth voting member and will serve as the Northeastern US Division Vice President. Roxanne has been with A2LA since 1990. As Vice President, her responsibilities include overseeing the day-to-day accreditation operations, as well as coordinating assessor development.

She is an active member of the NCSLI 174 Writing Committee, past President of the National Cooperation for Laboratory Accreditation (NACLA), and participates on several committees associated with international metrology organizations. She also represents A2LA and the American Society for Testing and Materials [ASTM] as a liaison delegate to NCSLI. Most recently, Roxanne was a presenter at the NCSLI Accreditation Workshops. We're delighted to have her join our Board.

### International Organization

As I mentioned in January, Klaus Jaeger has accepted the position of International Vice President. As such, he is responsible for NCSLI activity outside the United States. At the January Board meeting, Klaus presented a draft road map for further development of the International Region. I would like to share a few of the highlights of that presentation. The Board recognized many years ago that the international development of NCSLI would involve more than one Board member and various region and section coordinators from around the world. However, in the past, this activity has been informal, that is to say, when the International VP could not attend a function or meeting he would ask for volunteers from the Board or other roster members.

To formalize the International Organization, Klaus is planning to divide the International Division into five regions. Each region will have a deputy appointed by the VP. As an example, one of the regions will be the 'Americas', which will include Canada, Mexico, Central and South America. The deputy will be responsible for organizing the NCSLI activity and maintaining contact with the appropriate metrology organizations in that region. Malcolm Smith, Section 1750 Coordinator, has accepted the position of Deputy for the Americas.

Along with deputies, a second new position has been defined - special envoys. These are individuals that have a background in one or more disciplines in metrology and whose job function includes international travel. Whenever possible, NCSLI would schedule events to coincide with travel already planned by the envoys. Activities would include presentations at both NCSLI meetings and other metrology functions. If you meet the above requirements and are interested in participating, please contact Klaus Jaeger at <jaegerenterprises@comcast.net>.

### European Trip

Klaus Jaeger and Harry Moody traveled to Europe during March. Their first stop was the Eurolab [European Federation of National Associations of Measurement, Testing and Analytical Laboratories] International Workshop and General Assembly. Eurolab is an organization much like NCSLI with membership from organizations all over Europe. Then they moved on to the Bureau International des Poids et Mesures [BIPM] and discussions with Andrew Wallard. Finally, they visited the Federal Institute for Material Research (BAM) in Berlin as well as the Physikalisch-Technische Bundesanstalt (PTB), the National Metrology Institute of Germany. There was not time to get a full report of their activities for the April Newsletter, however one will be included in the July issue.

### NIST Visit

Graciously hosted by Rich Kayser, NIST Director Technology Services, and Belinda Collins, Deputy Director Technology Services, Harry Moody, Bill Simmons and I visited NIST in Mid-February. During our visit, we met with representatives from the seven NIST Laboratories, the Technology Services Group, Arden Bement, NIST Director, and Hratch Semerjian, newly appointed Deputy Director.

As it turned out, NIST had just received the 2004 budget from Congress, a much-reduced budget compared to 2003. And, to make a difficult situation worse, the fiscal year was nearly 30% over when the budget was received. They were just in the early planning stages to accommodate the budget cuts, so didn't have detailed information to share with us. However, here are a few of the impacted areas:

- Staffing---a reduction-in-force at both the Gaithersburg and Boulder facilities. Loss of key personnel that will be irreplaceable, even if budgets return to pre-2004 levels.
- USA standards and related activities---NIST engineers and scientists will be less involved promoting USA standards and participating with standards writing bodies. This will have a direct affect on many NCSLI members companies that participate in international trade.
- Grants to Universities and other non-profit organizations---reduces work in precision measurement, microelectronics, chemical science, and material science.
- Advanced Measurement Laboratory---failure to take full advantage of the AML, which is scheduled to begin operation this year, due to insufficient research funds.
- Plasma physics research---Optical technology research will be cut, work on laser wavelength, and detector standards will be delayed, all with application to homeland security.
- Partnerships---NIST, over the years, has forged partnerships with many organizations throughout the United States. Funding for many of these partnerships will be severely reduced.

Needless to say, NIST is deeply worried about these cuts and working with the Administration and Congress to improve the situation for 2005, while taking the actions necessary to remain fiscally solvent for 2004. NIST realizes that some of these cuts are likely to affect NCSLI members and wants to work with NCSLI to understand and lessen the impact of the cuts.

The principal reason for the visit was to renew our long-standing NIST - NCSLI relationship. NIST has undergone some significant changes in management in the last couple of years - including a new

## President's Message

Director and Deputy Director. To make the situation even more interesting, Dr. Bement will be acting as the Director of the National Science Foundation until a permanent director can be found. Although he will continue to be involved in high-level activity at NIST, Hratch Semerjian will assume the role of acting Director. Rich Kayser will become the acting Deputy Director, and Belinda Collins will be acting Director Technology Services. All these players were present at the meeting and engaged in a cordial discussion of opportunities for greater cooperation and collaboration.

During our visit, we discussed on-going cooperation for greater NIST participation in NCSLI meetings and committees, better communication about NIST plans for measurement services, developing means for NCSLI to comment on NIST-led measurement initiatives and strategies, and follow-up on NIST metrology training and value to the community. We also had an opportunity to tour the new Advanced Measurements Laboratory, which will allow NIST to offer world-class measurements.

Thanks to the efforts of prior NCSLI Executive Committee members, we have a very good working relationship with NIST and I believe that this association will continue in to the future.

### **Training Facility**

The NCSLI training center at the Boulder Office is now available for rental. If you or your company have need for a classroom that will accommodate up to 25 students, please contact the Boulder Office or go to < <http://www.metrologytraining.org> >. See an example on page 17.

### **Annual Workshop & Symposium**

With leadership provided by Conference VP Carol Hockert and Conference Director Bernard Morris, their committee is well underway to providing us the best conference ever. Dick Pettit has completed and posted the preliminary technical program on the NCSLI web page, with abstracts located at < [www.ncsli.org/conference/2004/abstracts.cfm](http://www.ncsli.org/conference/2004/abstracts.cfm) >.

When you visit the site, you'll notice that we are trying something new this year - plenary sessions on Tuesday and Wednesday mornings. Tuesday's session, with three speakers, will concentrate on international issues, while Wednesday's session is a panel discussion and open forum on traceability. Give us your feedback on the plenary sessions to help us plan for the 2005 Conference. Klaus Jaeger has put together a great collection of 17 tutorials to select from this year. (pp 5-7) When you register for the conference, be sure to review each of these tutorials and sign up for them at the same time.

Remember the Conference is earlier than the past several years; July 11-15 2004. Plan NOW to join us in Salt Lake City for what will surely be one of the best metrology conferences anywhere!

Dave Agy  
NCSLI President

# NEW NCSLI MEMBERS

## NY/PA/NJ REGION

In Control, LLC  
 Basking Ridge, NJ 07920  
 Member Delegate:  
 Kevin L. Ravaoli  
 (908) 604-6603

## MID-WESTERN US REGION

Bowser Morner, Inc.  
 Dayton, OH 45401  
 Member Delegate:  
 Donald Duncan  
 (937) 236-8805

Honeywell Sensotec  
 Columbus, OH 43228-4112  
 Member Delegate:  
 Chuck Pitzten  
 (614) 850-6000

## MID-ATLANTIC US REGION

Wyeth  
 Sanford, NC27330  
 Member Delegate:  
 Aaron Stewart  
 (919) 775-7100

## SOUTHERN US REGION

Northrop Grumman Corp.  
 Apopka, FL 32703  
 Member Delegate:  
 Robert M. Clement  
 (407) 297-4691

Stryker Puerto Rico, Ltd.  
 Arroyo, PR 00714  
 Member Delegate:  
 Gilma P. Rivas  
 (939) 307-2500 x2720

## NORTH CENTRAL US REGION

SiteCal, Inc.  
 St. Francis, MN 55070  
 Member Delegate:  
 Jerry Flor  
 (763) 213-1284

## SOUTH CENTRAL US REGION

Applied Geo Technologies, Inc.  
 Stennis Space Center, MS 39529  
 Member Delegate:  
 Kirk Foster  
 (228) 688-1844

Woodward Governor  
 Fort Collins, CO 80525  
 Member Delegate:  
 Charles G. Hunter  
 (970) 498-3441

## CENTRAL CA/NV REGION

Micro Precision, Bay Area Div.  
 San Jose, CA 95133  
 Member Delegate:  
 Bradley Charles  
 (408) 937-6600

Parker Test Equipment  
 Placerville, CA 95667  
 Member Delegate:  
 Jeffery T. Parker  
 (530) 622-7007

## SOUTHWESTERN US REGION

The Bionetics Corporation  
 Layton, UT 84041  
 Member Delegate:  
 Brent Watling  
 (801) 825-8997

## INTERNATIONAL REGION

Nissan Motor Co., Ltd.  
 Atsugi-shi, Japan 243-0192  
 Member Delegate:  
 Chihiro Mochizuki  
 81-46-270-1665

## 2004 NCSLI INTERNATIONAL WORKSHOP & SYMPOSIUM July 11-15, 2004 Salt Lake City, UT

VP/Conference Management	Carol Hockert	(651) 215-5823	FAX (651) 639-4014
Director	Bernard Morris	(801) 763-1600	FAX (801) 763-1010
Minutes	Lynn Matthews	(425) 446-5530	FAX (425) 446-5992
Meeting Planner	Tom Huttemann	(252) 255-1690	FAX (252) 255-1927
Exhibits	Tom Huttemann	(252) 255-1690	FAX (252) 255-1927
Registration	Joan Wilshire	(303) 440-3339	FAX (303) 440-3384
	Craig Gulka	(303) 440-3339	FAX (303) 440-3384
Technical Program	Richard Pettit	(505) 292-0789	FAX (505) 844-4372
Tutorials Program	Klaus Jaeger	(408) 867-1743	FAX (408) 867-3705
Guest Program	Tom Huttemann	(252) 763-1600	FAX (252) 255-1927
Publicity/Marketing	Jesse Morse	(425) 446-5468	FAX (425) 446-5992
	Jim Smith	(714) 896-1670	FAX (714) 896-5534
Finance	Jack Ferris	(231) 334-4891	FAX (231) 334-3788
Best Paper Selection	Jeff Gust	(260) 244-7450	FAX (260) 244-7905
	Doug Sugg	(909) 273-5380	FAX (909) 273-5500
Conference Evaluation	Larry Yates	(941) 429-4377	FAX (941) 429-4377
Entertainment	Carol Hockert	(651) 215-5823	FAX (651) 639-4014
Door Prizes	Mike Suraci	(206) 842-7321	FAX (206) 780-8157
NCSLI Exhibit Booth	Craig Gulka	(303) 440-3339	FAX (303) 440-3384
Site Selection	Tony Anderson	(407) 333-3327	FAX (407) 333-3309
VP Operations	Georgia Harris	(301) 975-4014	FAX (301) 926-0647
2005 Conference Director	Gary Jennings	(410) 993-5400	FAX (410) 993-5001

# NCSL INTERNATIONAL BOARD OF DIRECTORS 2004

## 10 PRESIDENT \*



Dave Agy  
Fluke Corporation  
MS: 275G  
P.O. Box 9090  
Everett, WA 98206-9090  
(425) 446-5471 FAX(425) 446-5992  
e-mail: <Dave.Agy@fluke.com>

## 20 EXECUTIVE VICE PRESIDENT \*



Harry Moody  
Harry J. Moody Enterprises  
155 Harrisburg Ln.  
Idaho Falls, ID 83404  
(208) 522-9774 FAX(208) 522-9774  
e-mail: <harrymoody@cs.com>

## 30 PAST PRESIDENT \*



Steve Stahley  
SRS Technical Services  
24037 Hilltop Rd.  
Oldenburg, IN 47036  
(812) 933-1638 FAX(253) 390-9086  
e-mail: <srstahley@srsts.com>

## 40 SECRETARY \*



Dave Abell  
Agilent Technologies  
1021 Diamond Dr.  
Arcata, CA 95521  
(408) 553-4425 FAX(707) 825-0440  
e-mail: <dave\_abell@agilent.com>

## 50 TREASURER \*



Jack Ferris  
Sleeping Bear Metrology  
P.O. Box 691  
Glen Arbor, MI 49636-0691  
(231) 334-4891 FAX(231) 334-3788  
e-mail: <sleeping\_bear@hotmail.com>

## 61 NIST REPRESENTATIVE TO THE BOARD



Dr. Richard F. Kayser  
NIST  
100 Bureau Dr., Stop 2000  
Gaithersburg, MD 20899-2000  
(301) 975-4500 FAX(301) 975-2183  
e-mail: <richard.kayser@nist.gov>

## 120 VP - OPERATIONS



Georgia Harris  
NIST  
Office of Weights & Measures  
100 Bureau Dr., Stop 2600  
Gaithersburg, MD 20899  
(301) 975-4014 FAX(301) 926-0647  
e-mail: <gharris@nist.gov>

## 130 VP - STANDARDS POLICY



Doug Sugg  
NSWC Corona Div.  
MS: 00A  
P.O. Box 5000  
Corona, CA 92878-5000  
(909) 273-5380 FAX (909) 273-5500  
e-mail: <douglas.sugg@navy.mil>

## 140 VP - MEASUREMENT SCIENCE & TECHNOLOGY



Dr. Richard Pettit  
7808 Hendrix NE  
Albuquerque, NM 87110-1522  
(505) 292-0789 FAX(505) 844-4372  
e-mail: <randpettit@comcast.net>

## 150 VP - INDUSTRIAL PROGRAMS



Jeff Gust  
Quametek Corporation  
Proficiency Testing Services  
501 W. Van Buren, Unit C  
Columbia City, IN 46725  
(260) 244-7450 FAX(260) 244-7905  
e-mail: <gust@quametek-pt.com>

## 62 INMS REPRESENTATIVE TO THE BOARD



Gary C. Hysert  
Natl. Res. Council of Canada  
Inst. for Natl. Meas. Stds.  
Montreal Rd., Bldg. M36  
Ottawa, ON K1A 0R6 Canada  
(613) 998-5648 FAX(613) 952-1394  
e-mail: <gary.hysert@nrc.ca>

## 63 CENAM REPRESENTATIVE TO THE BOARD



Dr. Salvador Echeverria-Villagomez  
CENAM  
A.P. 1-100, Centro  
Queretaro, Qro.  
C.P. 76000, Mexico  
(52-42) 11-05-50 FAX(52-42) 11-05-53  
e-mail: <saleche@cenam.mx>

## 70 BIPM REPRESENTATIVE TO THE BOARD



Prof. Andrew Wallard  
Bureau Intl. des Poids et Mesures  
Pavillon de Breteuil  
Sevres, Cedex 92312 France  
33-145-07-70-00 FAX:33-145-34-86-70  
e-mail: <awallard@bipm.org>

## 71 SIM REPRESENTATIVE TO THE BOARD



Joao Alziro Herz de Jornada  
INMETRO  
DIMCI  
Rua Santa Alexandrina, 416  
Rio de Janeiro, RJ 20261-232 Brazil  
55-21-563-2905 FAX:55-21-293-6559  
e-mail: <jajornada@inmetro.gov.br>

## 72 DIRECTOR TO ILAC/NACLA



Anthony Anderson  
Guildline Instruments, Inc.  
103 Commerce St., Suite 160  
Lake Mary, FL 32746  
(407) 333-3327 FAX(407) 333-3309  
e-mail: <tanderson@ncsli.org>

## 73 EUROMET REPRESENTATIVE TO THE BOARD



Seton Bennett  
National Physical Laboratory  
Queens Road  
Teddington, Middlesex, TW11 0LW United Kingdom  
44-20-8943-6920 FAX:44-20-8943-6082  
e-mail: <seton.bennett@npl.uk>

## OPERATIONS VICE PRESIDENTS

### 160 VP - EDUCATION & TRAINING



Terrelle Wilson  
LMTO Metrology Services Training  
12016 W. Temple Dr.  
Morrison, CO 80465  
(303) 932-9725 FAX(303) 904-1328  
e-mail: <terrelle.wilson@lmco.com>

### 170 VP - DOCUMENTARY STDS APPLICATIONS



Larry E. Nielsen  
Southern California Edison  
Metrology  
7300 Fenwick Ln.  
Westminster, CA 92683  
(714) 895-0489 FAX(714) 895-0686  
e-mail: <larry.nielsen@sce.com>

### 180 VP - MARKETING



Edward Pritchard  
BWXT Y-12, LLC  
Oak Ridge Metrology Center  
P.O. Box 2009  
Oak Ridge, TN 37831-8091  
(865) 574-4261 FAX(865) 574-2802  
e-mail: <pritchardew@y12.doe.gov>

### 190 VP - CONFERENCE MANAGEMENT



Carol Hockert  
MN Dept. of Commerce  
Weights & Measures Div.  
2277 Highway 36  
Roxeville, MN 55113  
(651) 215-5823 FAX(651) 639-4014  
e-mail: <carol.hockert@state.mn.us>

# NCSL INTERNATIONAL BOARD OF DIRECTORS (Cont'd)

## DIVISION VICE PRESIDENTS

### 1100 VP - NORTHEASTERN US



Roxanne Robinson  
American Assn. for Lab Accreditation  
5301 Buckeystown Pike, Suite 350  
Frederick, MD 21704  
(301) 644-3208 FAX(301) 662-2974  
e-mail: <rrobinson@a2la.org>

### 1400 VP - WESTERN US



Derek Porter  
Boeing Commercial Airplane Group  
MS: 19-MC  
P.O. Box 3707  
Seattle, WA 98124  
(206) 655-8258 FAX(206) 655-5713  
e-mail: <derek.j.porter@boeing.com>

### 1200 VP - SOUTHEASTERN US



Mike Suraci  
265 Shannon Dr. SE  
Bainbridge Island, WA 98110-2460  
(206) 842-7321 FAX(206) 780-8157  
e-mail: <mikesuraci@aol.com>

### 10000 VP - INTERNATIONAL



Klaus Jaeger  
Bionetics/Jaeger Enterprises  
13685 Calle Tacuba  
Saratoga, CA 95070-4918  
(408) 867-1743 FAX(408) 867-3705  
e-mail: <jjaegerenterprises@comcast.net>

### 1300 VP - CENTRAL US



Tom Wunsch  
Sandia National Laboratories  
Primary Standards Lab  
P.O. Box 5800  
Albuquerque, NM 87185-0665  
(505) 844-4359 FAX(505) 844-7699  
e-mail: <tfwunsch@sandia.gov>

## NCSL INTERNATIONAL COMMITTEE CHAIRS 2004

### 21 US GOVERNMENT AFFAIRS



Bill Simmons  
Wyle Laboratories  
3200 Magruder Blvd.  
Hampton, VA 23666  
(757) 865-0000 x240 FAX(757) 865-1498  
<bsimmons@hmp.wylelabs.com>

### 126 ANSI SECRETARIAT



Craig Gulka  
NCSL International  
2995 Wilderness Place, Suite 107  
Boulder, CO 80301-5404  
(303) 440-3339 FAX(303) 440-3384  
e-mail: <cgulka@ncsli.org>

### 22 LIAISON DELEGATES



Harry Moody  
Harry J. Moody Enterprises  
155 Harrisburg Ln.  
Idaho Falls, ID 83404  
(208) 522-9774 FAX(208) 822-9774  
e-mail: <harryjmoody@cs.com>

### 127 NEWSLETTER



John Minck  
642 Towle Pl.  
Palo Alto, CA 94306-2535  
(650) 493-3955 FAX(650) 493-3955  
e-mail: <john\_minck@non.agilent.com>

### 31 ARCHIVAL



Jim Allred  
Bechtel BWXT Idaho, LLC  
MS: 4137  
P.O. Box 1625  
Idaho Falls, ID 83415-4137  
(208) 526-2017 FAX(208) 526-5462  
e-mail: <wjja@inel.gov>

### 128 PUBLICATIONS OVERSIGHT



Dr. Stuart Kupferman  
Sandia National Laboratories  
Div. 1542, MS-0665  
P.O. Box 5800  
Albuquerque, NM 87185-0665  
(505) 845-8249 FAX(505) 844-4372  
e-mail: <slkupfe@sandia.gov>

### 41 BY-LAWS



Dave Abell  
Agilent Technologies  
1021 Diamond Dr.  
Arcata, CA 95521  
(408) 553-4425 FAX(707) 825-0444  
e-mail: <dave\_abell@agilent.com>

### 130 VP - STANDARDS POLICY

**Doug Sugg**

### 131 U.S. MEASUREMENT REQUIREMENTS



Jeff Walden  
Naval Warfare Assessment Station  
Measurement Science Directorate  
P.O. Box 5000  
Corona, CA 92878-5000  
(909) 273-4481 FAX(909) 273-5446  
e-mail: <waldenjw@corona.navy.mil>

### 120 VP - OPERATIONS

**Georgia Harris**

### 121 NCSL INTERNATIONAL BUSINESS MANAGER



Craig Gulka  
NCSL International  
2995 Wilderness Place, Suite 107  
Boulder, CO 80301-5404  
(303) 440-3339 FAX(303) 440-3384  
e-mail: <cgulka@ncsli.org>

### 132 CANADIAN MEASUREMENT REQUIREMENTS



Dave Stevens (Co-Chair)  
Pulse Engineering, Ltd.  
1137 Keewatin St.  
Winnipeg, MB R2X 2Z3 Canada  
(204) 633-4321 FAX(204) 697-2264  
e-mail: <sales@pulse-engineering.com>

# NCSL INTERNATIONAL COMMITTEE CHAIRS (Cont'd)



Lorraine Yeomans (Co-Chair)  
Pulse Engineering, Ltd.  
1137 Keewatin St.  
Winnipeg, MB R2X 2Z3 Canada  
(204) 633-4321 FAX(204) 697-2264  
e-mail: <sales@pulse-engineering.com>

## 133 GLOSSARY



Emil Hazarian  
NSWC Corona Division  
MS: 33  
P.O. Box 5000  
Corona, CA 92878-5000  
(909) 273-4902 FAX(909) 273-4279  
e-mail: <emil.hazarian@navy.mil>

## 140 VP - MEAS. SCIENCE & TECHNOLOGY

**Richard Pettit**

## 141 AUTOMATIC TEST & CALIBRATION SYSTEMS



Scott Sowerby  
Verizon Logistics  
3301 Wayne Trace  
Fort Wayne, IN 46806  
(260) 428-6909 FAX(260) 428-6124  
e-mail: <scott.sowerby@verizon.com>

## 142 MEASUREMENT COMPARISON PROGRAMS



James C. Wheeler (Co-Chair)  
Navy Primary Standards Lab  
Code 4144, Bldg. 469  
NADEP North Island  
San Diego, CA 92135-7058  
(619) 545-9698 FAX(619) 545-9861  
e-mail: <wheelerjc@navair.navy.mil>



Al Teruel (Co-Chair)  
Navy Primary Standards Lab  
Naval Aviation Depot, Code 41430, Bldg. 469 South  
NAS North Island  
San Diego, CA 92135  
(619) 545-2857 FAX(619) 545-2868  
e-mail: <teruelat@navair.navy.mil>

## 143 INTRINSIC & DERIVED STANDARDS



John Ball  
U.S. Army Primary Stds. Lab  
Attn: AMSAM-TMD-S  
Redstone Arsenal, AL 35898-5000  
(256) 876-2666 FAX(256) 842-8757  
e-mail: <john.ball@redstone.army.mil>

## 147 CHEMICAL METROLOGY



Burton W. Sutherland  
NS Software Services  
1794 Ledger Rd.  
Chipley, FL 32428  
(850) 516-6016  
e-mail: <sutherlandbw@mcsc.usmc.mil>

## 150 VP - INDUSTRIAL PROGRAMS

**Jeff Gust**

## 151 HEALTHCARE METROLOGY



David H. Walters  
Abbott Laboratories  
Dept. 0736, Bldg. M4  
1401 Sheridan Rd.  
N. Chicago, IL 60064-6323  
(847) 938-3653 FAX(847) 935-9808  
e-mail: <david.walters@abbott.com>

## 153 UTILITIES



John Nystrom  
Pacific Gas & Electric Co.  
P.O. Box 56  
Avila Beach, CA 93424  
(805) 545-4795 FAX(805) 545-3009  
e-mail: <JJNL@pge.com>

## 155 EQUIPMENT MANAGEMENT FORUM



Rob Parchinski  
The Boeing Company (TEMC)  
M/S: Bldg. 22-2  
5301 Bolsa Ave.  
Huntington Beach, CA 92647-2099  
(714) 896-2391 FAX(714) 896-5534  
e-mail: <rob.parchinski@boeing.com>

## 156 AIRLINE METROLOGY



Victor Cleland  
United Airlines, Inc.  
San Francisco Intl. Airport  
San Francisco, CA 94128  
(650) 634-3157 FAX(650) 634-2243  
e-mail: <victor.cleland@ual.com>

## 157 AUTOMOTIVE METROLOGY



Timothy W. Kypka  
Borg Warner  
Emission/Thermal Systems  
3800 Automation Ave.  
Auburn Hills, MI 48326  
(248) 754-0628 FAX(248) 754-9030  
e-mail: <tkypka@afs.bwauto.com>

## 158 TESTING LABORATORIES



TBD

## 159 SMALL BUSINESS INITIATIVE



Dr. Malcolm Smith  
Wescan Calibration Services  
#9 - 12240 Horseshoe Way  
Richmond, BC V7A 4X9 Canada  
(604) 275-0600 FAX(604) 275-0610  
e-mail: <msmith@nwcal.com>

## 160 VP - EDUCATION & TRAINING

**Terrelle Wilson**

## 161 TRAINING RESOURCES



Jesse Martinez  
Norfox Software  
10835 Highway 150  
Greenville, IN 47124-9214  
(812) 923-1182 FAX(502) 876-5514  
e-mail: <iceman2874@earthlink.net>

## 162 TRAINING INFORMATION DIRECTORY



Paul Hanssen  
Workplace Training  
3195 Casco Cir.  
Wayzata, MN 55391  
(952) 471-8554  
e-mail: <phanssen@wptraining.com>

## 163 PERSONNEL TRAINING REQUIREMENTS



Gloria Neely  
Naval Surface Warfare Center  
MS: 44  
P.O. Box 5000  
Corona, CA 92878-5000  
(909) 273-5469 FAX(909) 273-4237  
e-mail: <gloria.neely@navy.mil>

## 164 EDUCATION SYSTEM LIAISON



Terrelle J. Wilson  
LMTO Metrology Services Training  
12016 W. Temple Dr.  
Morrison, CO 80465  
(303) 932-9725 FAX(303) 904-1328  
e-mail: <terrelle.wilson@lmco.com>

# NCSL INTERNATIONAL COMMITTEE CHAIRS (Cont'd)

## 170 VP - DOCUMENTARY STDS. APPLICATIONS

Larry Nielsen

## 171 LABORATORY EVALUATION RESOURCES



TBD

## 172 LABORATORY FACILITIES



Dr. David Braudaway (Co-Chair)  
103 Ranch Rd.  
P.O. Box 9  
Sandia Park, NM 87047-0009  
(505) 281-3691 FAX: same (call first)  
e-mail: <dwbraudaway@worldnet.att.net>



Doug Cooper (Co-Chair)  
TAC Americas  
1770 Mason Morrow Rd.  
Lebanon, OH 45036  
(513) 398-9800 x329 FAX(513) 398-9048  
e-mail: <doug\_cooper@tac-americas.com>

## 173 METROLOGY PRACTICES



Howard Castrup  
Integrated Sciences Group  
14608 Casitas Canyon Rd.  
Bakersfield, CA 93386  
(661) 872-1683 FAX(661) 872-3669  
e-mail: <hcastrup@isgmax.com>

## 174 WRITING COMMITTEE



Jesse Morse (Co-Chair)  
Fluke Corporation  
MS: 275-G  
P.O. Box 9090  
Everett, WA 98206  
(425) 446-5468 FAX(425) 446-5992  
e-mail: <jesse.morse@fluke.com>



Doug Sugg (Co-Chair)  
Naval Surfaces Warfare Center  
MS: 00A  
P.O. Box 5000  
Corona, CA 91718-5000  
(909) 273-5380 FAX(909) 273-5500  
e-mail: <douglas.sugg@navy.mil>

## 175 ACCREDITATION RESOURCES



James Jenkins  
Quametec Corp.  
17600 Collinson Ave.  
Eastpointe, MI 48021  
(586) 775-5495 FAX(586) 775-5123  
e-mail: <jjenkins@quametec.com>

## 176 CALIBRATION/CERTIFICATION PROCEDURES



Dale Varner  
Lockheed Martin Technical Operations  
MS: P9682  
P.O. Box 179  
Denver, CO 80201  
(303) 977-5523 FAX(303) 971-5635  
e-mail: <dale.varner@lmco.com>

## 180 VP - MARKETING Edward Pritchard

## 181 HONORS & AWARDS



James Tavernier  
RCM Technologies, Inc.  
JPL MS: 125-B18  
4800 Oak Grove Dr.  
Pasadena, CA 91109  
(818) 393-7670 FAX(818) 393-5015  
e-mail: <jimtav@yahoo.com>

## 182 BENCHMARKING PROGRAMS



John Wade Keith III  
Boeing  
MS: H014-C422  
5301 Bolsa Ave.  
Huntington Beach, CA 92647  
(714) 896-2070 FAX(714) 372-2714  
e-mail: <wade.keith@boeing.com>

## 183 MEMBERSHIP



Larry Yates  
Acumen Strategies  
5425 Sabal Trace Dr.  
North Port, FL 34287  
(941) 429-4377 FAX(941) 429-4377  
e-mail: <larryy2002@aol.com>

## 184 PUBLICITY



James E. Smith  
The Boeing Company (TEMC)  
MS: H021-F144 Attn: Jim  
5301 Bolsa Ave.  
Huntington Beach, CA 92647-2099  
(714) 896-1670 FAX(714) 896-5534  
e-mail: <james.e.smith4@boeing.com>

## 190 VP - CONFERENCE MANAGEMENT Carol Hockert

## 191 SITE SELECTION



Anthony Anderson  
Guidline Instruments, Inc.  
103 Commerce St., Suite 160  
Lake Mary, FL 32746  
(407) 333-3327 FAX(407) 333-3309  
e-mail: <tanderson@ncsli.org>

## 192 WORKSHOP & SYMPOSIUM STAFF 2004 DIRECTOR



Bernard Morris  
Hart Scientific, Inc.  
799 E. Utah Valley Dr.  
American Fork, UT 84003-9775  
(801) 763-1600 FAX(801) 763-1010  
e-mail: <bernard\_morris@hartscientific.com>

## 2004 TECHNICAL PROGRAM CHAIRMAN



Dr. Richard Pettit  
Sandia National Laboratories  
Dept. 2542, MS: 0665  
P.O. Box 5800  
Albuquerque, NM 87185-0665  
(505) 844-6242 FAX(505) 844-4372  
e-mail: <rbpetti@sandia.gov>

## 2004 TUTORIAL PROGRAM CHAIRMAN



Klaus Jaeger  
Bionetics/Jaeger Enterprises  
13685 Calle Tacuba  
Saratoga, CA 95070-4918  
(408) 867-1743 FAX(408) 867-3705  
e-mail: <jaegerenterprises@comcast.net>

## 2005 DIRECTOR



Gary Jennings  
Northrop Grumman  
MS: M21  
P.O. Box 746  
Baltimore, MD 21203-0746  
(410) 993-5400 FAX(410) 993-5001  
e-mail: <gary.jennings@ngc.com>

# NCSL INTERNATIONAL REGION COORDINATORS 2004

## 1100 VP - NORTHEASTERN US

Roxanne Robinson

## 1110 New England Region



Philip Noll  
Hamilton Sundstrand  
M/S 1A-1-W61  
One Hamilton Rd.  
Windsor Locks, CT 06096-1010  
(860) 654-4542 FAX(860) 654-4953  
e-mail: <philip.noll.@hs.utc.com>

## 1120 New York/Pennsylvania/New Jersey Region



TBD

## 1121 New York City Section



Don Bansen  
Dayton T. Brown, Inc.  
Calibration Lab, Dept. 14  
1195 Church St.  
Bohemia, NY 11716-5301  
(631) 589-6300 x723 FAX(631) 244-6234  
e-mail: <dbansen@dtb.com>

## 1122 Upstate New York Section



Kyle Laukaitis  
CalSource  
1005 W. Fayette St., Suite 4D  
Syracuse, NY 13204  
(315) 425-1151 FAX(315) 425-1175  
e-mail: <kyle@calsource.com>

## 1123 Philadelphia Section



Joe Moran  
Henry Troemner LLC  
P.O. Box 87  
Thorofare, NJ 08086  
(856) 686-4261 FAX(856) 686-1601  
e-mail: <jmoran@troemner.com>

## 1124 Pittsburgh Section



Karl Klevens  
Process Instruments  
615 E. Carson St.  
Pittsburgh, PA 15203  
(412) 431-4600 FAX(412) 431-3792  
e-mail: <kklevens@procinst.com>

## 1130 Mid-Western US Region



Lloyd Baker  
Dynamic Technology, Inc.  
P.O. Box 559  
Hartland, MI 48353  
(810) 225-4601 FAX(810) 225-4802  
e-mail: <lbaker@dynamictechnology.com>

## 1131 Northern Ohio Section



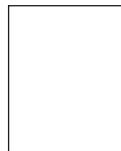
Tom Powis  
Broadview Instrumentation Service, Inc.  
7632B Hub Pkwy.  
Valley View, OH 44125  
(216) 525-0050 FAX(216) 525-0051  
e-mail: <tp1@calibrationservice.com>

## 1132 Southern Ohio/Kentucky Section



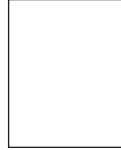
Charlie Mays  
The Bionetics Corporation  
813 Irving-Wick Dr. West  
Heath, OH 43056-6118  
(740) 788-5413 FAX(740) 788-5404  
e-mail: <cmays@afpsl.bionetics.com>

## 1133 Central Indiana Section



Marcus Freeland  
Tangent Labs, LLC  
5603 W. Raymond St., Suite 1  
Indianapolis, IN 46241  
(317) 487-2378 x204 FAX(317) 487-2375  
e-mail: <mfreeland@tangentlabs.com>

## 1134 Northern Indiana Section



TBD

## 1135 Michigan Section



Lonnie Spires  
Dynamic Technology, Inc.  
1200 N. Old US-23  
P.O. Box 559  
Hartland, MI 48353-0559  
(810) 225-4601 x277 FAX(810) 225-4602  
e-mail: <lspires@dynamictechnology.com>

## 1200 VP - SOUTHEASTERN US

J. Michael Suraci

## 1210 Mid-Atlantic US Region



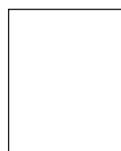
Dana Leaman  
American Assn. for Lab Accreditation  
Suite 350  
5301 Buckeystown Pike  
Frederick, MD 21704  
(301) 644-3248 FAX(301) 662-2974  
e-mail: <dleaman@a2la.org>

## 1211 Maryland Section



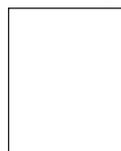
Rudy Stim  
Northrop Grumman Corp.  
ESSD - MS: 751  
P.O. Box 746  
Baltimore, MD 21203  
(410) 993-3074  
e-mail: <henry.stim@ngc.com>

## 1212 North Carolina Section



TBD

## 1213 Virginia Section



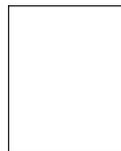
TBD

## 1220 Southern US Region



Robert Gangawer  
Guidline Instruments, Inc.  
103 Commerce St., Suite 160  
Lake Mary, FL 32746  
(407) 333-3327 FAX(407) 333-3309  
e-mail: <rgangawer@cs.com>

## 1221 Atlanta Section



Jay Romanek  
Southern Marketing Associates  
1950 Redd Rd.  
Alpharetta, GA 30201  
(770) 664-9797 FAX(770) 664-9795  
e-mail: <smajay@aol.com>

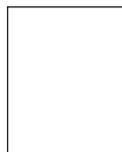
# NCSL INTERNATIONAL REGION COORDINATORS (Cont'd)

## 1222 Central Florida Section



Ray Minchin  
Lockheed Martin Information Systems  
MP 829  
12506 Lake Underhill Rd.  
Orlando, FL 32825-5002  
(407) 306-1270 FAX(407) 306-2271  
e-mail: <raymond.l.minchin@lmco.com>

## 1315 Central Illinois Section



TBD

## 1223 Huntsville Section



Greg St. Charles  
Boeing Huntsville  
MS: JY-66  
P.O. Box 240002  
Huntsville, AL 35824  
(256) 461-5656 FAX(256) 772-2613  
e-mail: <gregory.stcharles@hsv.boeing.com>

## 1316 Rockford Illinois Section



Gordon Skattum  
Rock Valley College  
3301 N. Mulford Rd.  
Rockford, IL 61114-5699  
(815) 654-5537 FAX(815) 654-4459  
e-mail: <adt3gcs@rvc.cc.il.us>

## 1224 Tennessee Section



Ada McConnell  
Eastman Chemical Co.  
Tennessee Eastman Div. Bldg. 277A  
P.O. Box 511  
Kingsport, TN 37662  
(423) 229-1041 FAX(423) 229-5516  
e-mail: <ada@eastman.com>

## 1317 Madison Wisconsin Section



Jay Bucher  
Promega Corp.  
5445 E. Cheryl Pkwy.  
Madison, WI 53711  
(608) 277-2522 FAX(608) 277-2516  
e-mail: <jbucher@promega.com>

## 1225 Puerto Rico Section



Angel Pabellon  
Advanced Instruments  
P.O. Box 29502  
San Juan, PR 00929  
(787) 622-1133 FAX(787) 762-1833  
e-mail: <apabellon@advpr.com>

## 1320 South Central US Region



Christopher Grachanen  
Hewlett Packard Co.  
Corp. Metrol., MS: 070110  
P.O. Box 692000  
Houston, TX 77070-2698  
(281) 518-8486 FAX(281) 518-7275  
e-mail: <chris.grachanen@hp.com>

## 1300 VP - CENTRAL US Tom Wunsch

## 1310 North Central US Region



Terry Conder  
3M Metrology Lab  
3M Center Bldg. 205-1-01  
St. Paul, MN 55144-1000  
(651) 736-4331 FAX(651) 736-7325  
e-mail: <tmconder@mmm.com>

## 1321 Central Texas Section



Gregg Shuman  
Verizon ERS Metrology  
4255 Patriot Dr., Suite 401  
Grapevine, TX 76051  
(972) 724-6086 FAX(972) 724-6344  
e-mail: <gregg.shuman@verizon.com>

## 1311 Twin Cities Section



Shawn Mason  
St. Jude Medical  
177 E. County Rd. B  
St. Paul, MN 55117  
(651) 490-4476  
(651) 490-4498 FAX  
e-mail: <smason@sjm.com>

## 1322 South Texas Section



Keith Scoggins  
South Texas Project Nuclear Operating Co.  
MS: L-1001, Metrol. & Radiol.  
P.O. Box 289  
Wadsworth, TX 77414  
(361) 972-7742 FAX(361) 972-8368  
e-mail: <dkscoggins6@hotmail.com>

## 1312 Chicago Section



Tom Waltrich  
Baxter Healthcare Corp.  
MS: WG2-2S  
Route 120 & Wilson Rd.  
Round Lake, IL 60073-0490  
(847) 270-2600 FAX(847) 270-5559  
e-mail: <thomas\_waltrich@baxter.com>

## 1323 Boulder/Denver Section



Dale Varner  
Lockheed Martin Technical Operations  
MS: P9682  
P.O. Box 179  
Denver, CO 80201  
(303) 977-5523 FAX(303) 971-5635  
e-mail: <dale.varner@lmco.com>

## 1313 St. Louis Section



Brent W. Griffith  
Boeing Company  
MC: S102-2199  
P.O. Box 516  
St. Louis, MO 63166-0516  
(314) 232-9247 FAX(314) 232-3445  
e-mail: <brent.w.griffith@boeing.com>

## 1324 Albuquerque Section



Tom Wunsch  
Sandia National Laboratories  
Primary Standards Laboratory  
P.O. Box 5800  
Albuquerque, NM 87185-0665  
(505) 844-4359 FAX(505) 844-7699  
e-mail: <tfwunsch@sandia.gov >

## 1314 Kansas City Section



Roger Burton  
Honeywell FM&T  
E14 BR28  
P.O. Box 419159  
Kansas City, MO 64141-6159  
(816) 997-5431 FAX(816) 997-3856  
e-mail: <rburton@kcp.com>

## 1325 Gulf Coast Section



Ken Garcia  
Lockheed Martin Technical Operations  
Bldg. 5100, Rm. M110  
Stennis Space Center, MS 39529  
(228) 813-2075 FAX(228) 813-2073  
e-mail: <kenneth.j.garcia@lmco.com>

# NCSL INTERNATIONAL REGION COORDINATORS (Cont'd)

## 1400 VP - WESTERN US

Derek Porter

## 1410 Central California/Nevada Region



Guy Fleming  
Lockheed Martin Technical Operations  
Bldg. 195A, O/43-91  
P.O. Box 61687  
Sunnyvale, CA 94088-1687  
(408) 742-7857 FAX(408) 742-4435  
e-mail: <guy.fleming@lmco.com>

## 1420 Southwestern US Region



James E. Smith  
The Boeing Company (TEMC)  
MS: H021-F144 Attn: Jim  
5301 Bolsa Ave.  
Huntington Beach, CA 92647-2099  
(714) 896-1670 FAX(714) 896-5534  
e-mail: <james.e.smith4@boeing.com>

## 1421 LA/Valley Section



Miguel Cerezo  
Amgen, Inc.  
MS: 21-2-C  
1 Amgen Center  
Thousand Oaks, CA 91320-1789  
(805) 447-1128 FAX(805) 499-8733  
e-mail: <mcerezo@amgen.com>

## 1422 LA/Orange Co. Section



James E. Smith  
The Boeing Company (TEMC)  
MS: H021-F144 Attn: Jim  
5301 Bolsa Ave.  
Huntington Beach, CA 92647-2099  
(714) 896-1670 FAX(714) 896-5534  
e-mail: <james.e.smith4@boeing.com>

## 1423 San Diego Section



TBD

## 1424 Phoenix-Tucson Section



Wayne Benda  
Raytheon Systems Company  
Bldg. 811  
P.O. Box 11337  
Tucson, AZ 85734  
(520) 794-4483 FAX(520) 794-5658  
e-mail: <webenda@raytheon.com>

## 1425 Utah Section



Bernard Morris  
Hart Scientific, Inc.  
799 E. Utah Valley Dr.  
American Fork, UT 84003-9775  
(801) 763-1600 FAX(801) 763-1010  
e-mail: <bernard\_morris@hartscientific.com>

## 1430 Northwest US Region



Keith Cable  
Northwest Calibration Systems  
P.O. Box 81205  
Seattle, WA 98108-1205  
(206) 762-2515 FAX(206) 762-5880  
e-mail: <kcable@nwcsl.com>

## 10000 VP - INTERNATIONAL

Klaus Jaeger

## 1700 CANADA REGION



Jim Mullins  
Pylon Electronics, Inc.  
147 Collonnade Rd.  
Nepean, ON K2E 7L9 Canada  
(613) 226-7920 FAX(613) 226-8195  
e-mail: <jmullins@pylonelectronics.com>

## 1700.1 Canada Region Secretariat



Wayne Sampson  
Pylon Atlantic, Inc.  
201 Wright Ave.  
Dartmouth, NS B3B 1V6 Canada  
(902) 468-3344 x244 FAX(902) 468-1203  
e-mail: <wsampson@pylonelectronics.com>

## 1710 Eastern Canada Section



Wayne Sampson  
Pylon Atlantic, Inc.  
201 Wright Ave.  
Dartmouth, NS B3B 1V6 Canada  
(902) 468-3344 x244 FAX(902) 468-1203  
e-mail: <wsampson@pylonelectronics.com>

## 1720 Eastern Ontario Section



Carlos Sannzzaros  
Atomic Energy of Canada, Ltd.  
CPFS Sheridan Park SP3  
2251 Speakman Dr.  
Mississauga, ON L5K 1B2 Canada  
(905) 823-9040 x2199 FAX(905) 823-6448  
e-mail: <sannzzaros@aecl.ca>

## 1730 Quebec Section



Robert Armand  
Hydro-Quebec/IREQ  
Lab d'etalonnage et reparation  
1800, Boul. Lionel-Boulet  
Varenes, QC J3X1S1 Canada  
(450) 652-8036 FAX(450) 652-8041  
e-mail: <armand.robert@ireq.ca>

## 1740 Western Ontario Section



Mark Reid  
techniCAL Systems 2002, Inc.  
436 Jacqueline Blvd.  
Hamilton, ON L9B 2R3  
(905) 575-1941 FAX(905) 575-0386  
e-mail: <mreid@technical-sys.com>

## 1750 Western Canada Section



Dr. Malcolm Smith  
Wescan Calibration Services  
12240 Horseshoe Way, Unit 9  
Richmond, BC V7A 4X9 Canada  
(604) 275-0600 FAX(604) 275-0610  
e-mail: <msmith@nwcsl.com>

## 1800 Mexico Region



Roberto Benitez  
Metrica, S.A. de C.V.  
Alfonso Reyes #2620  
Fracc. B. Reyes  
Monterrey, N.L. 64280 Mexico  
011-52-81-8370-2600 FAX:011-52-81-8129-4646  
e-mail: <roberto@metrica.com.mx>

# NCSL INTERNATIONAL REGIONAL COORDINATORS (Cont'd)

## 2000 Latin/South America Region

### 2100 Caribbean



Hermon Edmondson  
Jamaica Bureau of Standards  
6 Winchester Rd.  
P.O. Box 113  
Kingston 10, Jamaica  
011-876-929-3140 FAX 011-876-929-4736  
hedmondson@jbs.org.jm

### 2200 Brazil



Mauricio Nogueira Frota  
Sociedade Brasileira de Metrologia  
Av. Beira Mar, 262/5 Andar/Castelo  
Rio de Janeiro, RJ 20021-060 Brazil  
011-5521-544-5751 FAX:011-5521-544-5527  
e-mail: <mfrota@mec.puc-rio.br>

### 2300 Ecuador



Felipe Urresta  
Ecuadorian Standards Institute  
454 Baquerizo Moreno St.  
P.O. Box 17-01-3999  
Quito, Ecuador  
011-593-256-5626 FAX:011-593-256-7815  
e-mail: <inen1@inen.gov.ec>

### 3000 European Region

#### 3100 United Kingdom



TBD

#### 3200 Nordic



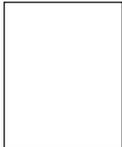
Haakan Nilsson  
Swedish National Testing & Research Institute  
Measurement Technology  
P.O. Box 857  
Boras, Sweden SE-501 15  
011-46-33-16-53-87 FAX:011-46-33-16-56-20  
e-mail: <hakan.nilsson@sp.se>

#### 3300 France



Jean Claude Krynicki  
Agilent Technologies France  
11 rue Ambroise Croizat  
ZAE Les Glaizes  
Palaiseau, 91873 France  
011-33-1-64-53-5367 FAX:011-33-1-64-53-5618  
e-mail: <jean-claude\_krynicki@agilent.com>

#### 3400 Netherlands



TBD

## 4000 Middle East/Africa Region

### 4100 Egypt



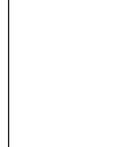
Prof. Dr. Ahmed A. El Sayed  
Natl. Laboratory Accreditation Bureau  
National Institute for Standards  
Tersa St., El Haram, Giza 12211 Egypt  
011-20-2-3879242 FAX:011-20-2-3829446  
e-mail: <AhmedAli@nlab.nis.sci.eg>

### 4200 Turkey



Dr. Huseyin Ugur  
National Metrology Institute  
PK 21  
41470 Gebze  
Kocaeli, Turkey  
011-90-262-643-6093 FAX:011-90-262-643-6092  
e-mail: <ugurh@ume.tubitak.gov.tr>

### 4300 South Africa



Dr. Wynand Louw  
CSIR - National Metrology Laboratory  
P.O. Box 395  
Pretoria 0001, South Africa  
011-27-12-841-4227 FAX:011-27-12-841-2131  
e-mail: <wlouw@csir.co.za>

### 4400 Israel



Dr. Ilya Kuselman  
National Physical Lab of Israel  
Givat Ram  
Jerusalem, 91904 Israel  
011-972-2-566-1856 FAX:011-972-2-652-0797  
e-mail: <ilya\_kus@netvision.net.il>

## 5000 Asia Pacific Region

### 5100 Taiwan



Dr. Jia-Ruey Duann  
Center for Meas. Stds. ITRI  
Bldg. 16, 321, Sec. 2, Kuang Fu Road  
Hsinchu, Taiwan 30042 R.O.C.  
011-866-35-7352140 FAX:011-886-35-716193  
e-mail: <jia-ruey.duann@itri.org.tw>

### 5200 Japan



Kazumi Hayakawa  
K.K. Fluke  
Izumi Shiba Daimon Bldg.  
2-2-11 Shiba Daimon, Minato-ku  
Tokyo, 105-0012 Japan  
011-81-3-3434-0181 FAX:011-81-3-3434-0170  
e-mail: <kaz.hayakawa@fluke.com>

### 5300 China



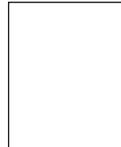
Xunsheng Li  
Wavetek China  
Rm. 302, Tower A, Fu Hua Mansion  
#8 Chao Yang Men North Ave.  
Beijing, 100027 P.R. China  
011-86-10-65928044 FAX:011-86-10-65008199  
e-mail: <xunshengli@yahoo.com>

### 5400 India Region



Dr. S.L. Sarnot  
Dept. Elec., STQC Directorate  
Ministry of Information Technology  
6 CGO Complex  
New Delhi, 110 003 India  
011-91-11-436-3089 FAX:011-91-11-436-3083  
e-mail: <sarnot@mit.gov.in>

### 5410 Bombay Section



TBD

# NCSL INTERNATIONAL REGIONAL COORDINATORS (Cont'd)

## 5420 Hyderabad Section



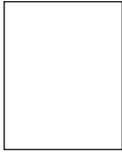
Dr. S.P. Vasireddi  
Vimta Labs Limited  
142, IDA Phase II  
Cherlapally, RR Dist.  
Hyderabad - 500 051, India  
011 91 40 2726 4400 FAX:011 91 40 2726 3657  
e-mail: <hyd\_vimtahq@sancharnet.in>

## 5440 Delhi Section



S.K. Kimothi  
Electronics Regional Test Lab (North)  
STQC Directorate  
'S' Block, Okhla Industrial Area, Phase II  
New Delhi 110 020, India  
011 91 80 699 8595 FAX:011 91 80 674  
e-mail: <ertn@ernet.in>

## 5430 Bangalore Section



B.K. Srinivas  
Bharat Heavy Electricals Limited  
(Electronics Division)  
P.B. No. 2606, Mysore Road  
Bangalore, Karnataka - 560 0286, India  
011 91 80 6998595 FAX:011 91 80 6740137  
e-mail: <srinivasbk@bheledn.com>

## LIAISON DELEGATES

### 22.02 GIDEP METROLOGY COMMITTEE



Thu Ngo  
GIDEP Operations Center  
P.O. Box 8000  
Corona, CA 92878-8000  
(909) 273-5420 FAX(909) 273-5200  
e-mail: <thu.ngo@navy.mil>

### 22.09 ISA INTERNATIONAL



Mike Suraci  
265 Shannon Dr. SE  
Bainbridge Island, WA 98110-2460  
(206) 842-7321 FAX(206) 780-8157  
e-mail: <mikesuraci@aol.com>

### 22.03 MEASUREMENT SCIENCE CONFERENCE (MSC)



TBD

### 22.10 EUROPEAN COOPERATION FOR ACCREDITATION (EA)



Graham Cameron  
Standards Council of Canada  
270 Albert St., Suite 200  
Ottawa, Ontario K1P 6N7 Canada  
(613) 238-3222 x496 FAX(613) 569-7808  
e-mail: <gcameron@scc.ca>

### 22.04 ORGANISATION INTERNATIONALE DE METROLOGIE LEGALE (OIML)



Dr. Charles Ehrlich  
NIST  
Bldg. 820, Rm 234  
100 Bureau Dr., Stop 2150  
Gaithersburg, MD 20899-2150  
(301) 975-4834 FAX(301) 975-5414  
email: <charles.ehrlich@nist.gov>

### 22.11 INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS INSTRUMENTATION & MEASUREMENT (IEEE I&M)



Dr. David Braudaway  
103 Ranch Rd.  
P.O. Box 9  
Sandia Park, NM 87047-0009  
(505) 281-3691 FAX: same (call first)  
e-mail: <dwbraudaway@worldnet.att.net>

### 22.05 AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION (A2LA)



Dana Leaman  
American Assn. for Lab Accreditation  
5301 Buckeystown Pike, Suite 350  
Frederick, MD 21704  
(301) 644-3248 FAX(301) 662-2974  
e-mail: <dleaman@a2la.org>

### 22.12 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)



Roxanne Robinson  
American Assn. for Lab Accreditation  
5301 Buckeystown Pike, Suite 350  
Frederick, MD 21704  
(301) 644-3208 FAX(301) 662-2974  
e-mail: <rrobinson@a2la.org>

### 22.06 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)



John Kalemkerian  
ANSI  
25 W. 43rd St.  
New York, NY 10036  
(212) 642-4920 FAX(212) 719-0971  
e-mail: <jkalemke@ansi.org>

### 22.13 COUNCIL FOR OPTICAL RADIATION MEASUREMENTS (CORM)



Sally Bruce  
NIST  
Optical Technology Div., MS: 8441  
100 Bureau Dr.  
Gaithersburg, MD 20899-8441  
(301) 975-2323 FAX(301) 869-5700  
e-mail: <sbruce@nist.gov>

### 22.07 CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENT (CPEM)



Norman B. Belecki  
7413 Mill Run Dr.  
Derwood, MD 20855-1156  
(301) 869-4520  
e-mail: <n.belecki@ieee.org>

### 22.14 JLC/CCG



Arman Hovakemian  
Naval Surface Warfare Center  
MS00  
P.O. Box 5000  
Corona, CA 92878-5000  
(909) 273-5221 FAX(909) 273-4904  
e-mail: <hovakemiana@corona.navy.mil>

**22.15 INTERNATIONALE MESSTECHNISCHE KONFEDERATION (IMEKO)**



Chester Franklin  
CSC Norco  
2727 Hamner Ave.  
Norco, CA 92860-1995  
(909) 898-3114 FAX(909) 736-7390  
e-mail: <cfranklin@dynwest.com>

**22.19 AMERICAN PHYSICAL SOCIETY**



Dr. Klaus Jaeger  
Bionetics/Jaeger Enterprises  
13685 Calle Tacuba  
Saratoga, CA 95070-4918  
(408) 867-1743 FAX(408) 867-3705  
e-mail: <jaegerenterprises@comcast.net>

**22.21 INTL LAB ACCREDITATION COOP. (ILAC)**



Anthony Anderson  
Guildline Instruments, Inc.  
103 Commerce St., Suite 160  
Lake Mary, FL 32746  
(407) 333-3327 FAX(407) 333-3309  
e-mail: <tanderson@ncsli.org>

**22.25 NATL. CONF. OF WEIGHTS & MEASURES**



Georgia Harris  
NIST  
Office of Weights & Measures  
100 Bureau Dr., Stop 2600  
Gaithersburg, MD 20899-2600  
(301) 975-4014 FAX(301) 926-0647  
e-mail: <gharris@nist.gov >

**22.26 ASIA/PACIFIC METROLOGY PROGRAM**



Dr. Takashi Usuda  
Natl. Metrology Institute of Japan  
1-1-4 Umezono, Tsukuba Science City  
Ibaraki, Japan 305-8563  
011-81-298-61-4363 FAX:011-81-298-61-4393  
e-mail: <s-apmp@m.aist.go.jp>

**22.27 ASOCIACION MEXICANA DE METROLOGIA (AMMAC)**



Roberto Benitez  
Metrica, S.A. de C.V.  
Alfonso Reyes #2620  
Fracc. B. Reyes  
Monterrey, N.L. 64280 Mexico  
011-52-81-83-702600 FAX:011-52-81-8129-4646  
e-mail: <roberto@metrica.com.mx>

**22.28 AMERICAN SOCIETY FOR QUALITY (ASQ)/ MEASURE-  
MENT QUALITY DIVISION**



Christopher L. Grachanen  
Hewlett Packard Co.  
Corporate Metrology, MS: 070110  
P.O. Box 692000  
Houston, TX 77070-2698  
(281) 518-8486 FAX(281) 518-7275  
e-mail: <chris.grachanen@compaq.com>

**22.29 NORTH AMERICAN CALIBRATION COOPERATION/  
NORTH AMERICAN METROLOGY COOPERATION  
(NACC/NORAMET)**



Doug Faison  
NIST  
Stop 2140  
100 Bureau Dr.  
Gaithersburg, MD 20899-2140  
(301) 975-5304  
e-mail: <faisond@nist.gov>

**22.30 INSTITUTE OF ENVIRONMENTAL SCI. & TECH.**



Robert L. Mielke  
Abbott Laboratories  
Dept. 736, M4  
1400 Sheridan Rd.  
N. Chicago, IL 60064  
(847) 938-9111 FAX(847) 937-4634  
e-mail: <robert.mielke@abbott.com>

**22.33 ASIA PACIFIC LABORATORY ACCREDITATION  
COOPERATION (APLAC)**



Peter S. Unger  
American Assn. for Lab Accreditation  
5301 Buckeystown Pike, Suite 350  
Frederick, MD 21704-8373  
(301) 644-3212 FAX(301) 662-2974  
e-mail: <punger@a2la.org>

**22.35 BRAZILIAN SOCIETY OF METROLOGY (SBM)**



Mauricio Nogueira Frota  
Sociedade Brasileira de Metrologia  
Av. Beira Mar. 262/5 Andar Castelo  
Rio de Janeiro, RJ 20021-060 Brazil  
011-5521-544-5751 FAX:011-5521-544-5527  
e-mail: <mfrota@mec.puc-rio.br>

**IF YOU HAVE NAME/ADDRESS/PHONE/FAX/E-MAIL CHANGES TO THE NEWSLETTER ORGANIZATIONAL ROSTER, OR CHANGES TO THE ORGANIZATION CHART, MAPS, OR METROLOGY CALENDAR Please fax changes directly to the NCSL International Business Office, (303) 440-3384, or E-mail at <info@ncsli.org>**

# USEFUL INFORMATION ON THE NCSLI WEBSITE

## AVAILABLE PUBLICATIONS

A comprehensive list of NCSLI publications are available from our NCSLI website. You can access a full page listing of publications, ranging from Laboratory Management Practices (9), to NCSLI Recommended Practices (14), to Intrinsic/Derived Standards (6), plus others. Along with the Publications Price List you can print out a Publication Order Form. If your organization is already an NCSLI member and you have other facilities that would like to participate in NCSLI activities with regular mailings of NCSLI publications, have them join the NCSLI Publications Club.

- < [http://www.ncsli.org/publications/publication\\_list.cfm](http://www.ncsli.org/publications/publication_list.cfm) > on-line pubs list
- < [http://www.ncsli.org/publications/pdf/order\\_form.pdf](http://www.ncsli.org/publications/pdf/order_form.pdf) > order form in pdf format



## MEMBERSHIP APPLICATION FORMS

Two classes of NCSLI Membership are available for participation in our global activities:

1. Corporate or Organizational Membership
2. Individual Professional or Student Membership

You can download the application form from our NCSLI website:  
< <http://www.ncsli.org/membership/> >



## OTHER USEFUL ORGANIZATIONAL DOCUMENTS

An Organizational Chart for NCSLI plus two global maps, showing the regional and section assignments are available for downloading at



[www.ncsli.org/regions/index.cfm](http://www.ncsli.org/regions/index.cfm) >



## NCSLI International

2995 Wilderness Pl., Suite 107, Boulder, CO 80301-5404

(303) 440-3339 • FAX: (303) 440-3384

<pubs@ncsli.org> • <www.ncsli.org>

### PUBLICATIONS PRICE LIST

#### Available Formats

	CD	PDF	HC	OD	Members	Non-Members
<b>Newsletter:</b>						
NCSLI Newsletter (single copy)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....\$ 5.00	.....10.00
One-year NCSLI Newsletter Subscription	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....40.00
<b>Laboratory Management Publications:</b>						
Laboratory Management Publications CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....65.00	.....95.00
Calibration Laboratory Manager's Guidebook (11/90)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....10.00	.....20.00
Acronym List (7/99)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....10.00	.....20.00
NCSLI Glossary of Metrology-Related Terms (9/99)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....10.00	.....20.00
Catalog of Intrinsic and Derived Standards (3/99)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
1999 or 2001 Benchmarking Survey (PDF Only)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....50.00	.....50.00
U.S. or Canadian National Measurement Requirements Comm. Report 2000	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....50.00	.....50.00
"Guide to Achieving Laboratory Accreditation" (3/02)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....50.00	.....50.00
"Guide to Measurement Uncertainty for Calibration Laboratories" - DRAFT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....15.00	.....25.00
<b>Standards:</b>						
ANSI/NCSL Z540.1-1994 (R2002)						
(Calibration & Measurement & Test Equip. General Requirements)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....20.00	.....45.00
ANSI/NCSL Z540-1-1994 Handbook	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....20.00	.....45.00
ANSI/NCSL Z540-2-1997						
(U.S. Guide to the Expression of Uncertainty in Measurement)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....25.00	.....50.00
ANSI/ISO/IEC 17025: 2000						
(General Requirements for the Competence of Testing and Cal Labs)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....50.00	.....70.00
<b>NCSL Recommended Practices:</b>						
RP's on CD-ROM	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....90.00	.....160.00
RP-1 "Establishment & Adjustment of Calibration Intervals" (1/96)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....20.00	.....30.00
RP-3 "Preparation of Calibration Procedures" (1/90)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-4 "Calibration System Specifications" (7/71)						
superceded by ANSI/ISO/IEC 17025	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-6 "Calibration Control Systems for the						
Biomedical and Pharmaceutical Industry" (5/99)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-7 "Laboratory Design" (11/00)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....20.00	.....30.00
RP-8 "An Individual Equipment Evaluation Guide" (10/88)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-9 "Calibration Laboratory Capabilities Documentation Guidelines" 7/89)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-10 "Establishment & Operation of Electrical						
Utility Metrology Laboratory" (8/91)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-11 "Reports & Certificates of Calibration" (10/91)						
superceded by ANSI/ISO/IEC 17025	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-12 "Determining & Reporting Measurement Uncertainties" (4/95)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....20.00	.....30.00
RP-13 "Computer Systems in Metrology" (2/96)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-14 "Guide to Selecting Standards-Laboratory Environments" (3/99)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
RP-15 "Guide for Interlaboratory Comparisons" (3/99)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....25.00
<b>NCSL Workshop &amp; Symposium Proceedings:</b>						
1990-1997 Composite (CD-ROM only)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....50.00	.....65.00
1998, 1999, 2000, 2001 or 2002 (CD-ROM only) per CD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....35.00
2003 (CD ROM only)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....25.00	.....45.00
<b>NCSL Recommended Intrinsic/Derived Standards Practices:</b>						
RISP's on CD-ROM	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	.....30.00	.....70.00
RISP-1 "Array Josephson Junction" (1/02)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....15.00	.....35.00
RISP-2 "Triple Point of Water Cell" (5/95)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....35.00
RISP-3 "Quantized Hall Resistance" (8/97)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....35.00
RISP-4 "Deadweight Pressure Gauges" (7/98)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	.....15.00	.....35.00
RISP-5 "Two-Pressure, Two Temperature Humidity Generator" (3/02)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	.....15.00	.....35.00
<b>Miscellaneous:</b>						
Duplicate or Replacement Plaques (members only)					.....50.00	
NCSL 3-Ring Binders (pricing by contacting the NCSLI Business Office)						
Video "What Is NCSL International?"					.....5.00	.....10.00
Royal Egyptian Cubit (supply limited)					.....25.00	.....35.00

**Note:** Bound (HC) copies of all NCSLI publications are available only as supplies last. Otherwise, **Print On-demand** (OD) copies will be available at cost plus a \$20.00 handling charge.

**Payment:** Please remit payment with order (in U.S. funds only). Make checks payable to: NCSL International. Purchase Orders are accepted. Or charge to your Visa, MasterCard or American Express by phone.

**Shipping:** Member prices include shipment to U.S. locations via U.S. Mail or UPS Ground. Non-Member and Overseas shipments are sent via U.S. Mail, UPS Ground or by using an alternate courier. Contact the NCSLI Business Office for rates.



# NCSL International

2995 Wilderness Place, Suite 107, Boulder, Colorado 80301-5404  
 (303) 440-3339 ♦ Fax: (303) 440-3384  
 info@ncsli.org ♦ www.ncsli.org

## 2004 Application for Membership in NCSL International (Individual Professional, or Student)

NCSL International is a nonprofit association of laboratories or organizations that maintain or have an interest related to measurement standards and calibration facilities.

### Member Information:

Member Name \_\_\_\_\_

Mailing Address \_\_\_\_\_

\_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_ Country \_\_\_\_\_

(\_\_\_\_\_) \_\_\_\_\_

Telephone Number \_\_\_\_\_ Extension \_\_\_\_\_ Fax Number \_\_\_\_\_

E-mail Address \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

For NCSL International Use Only	
Date Recd	_____
Check/CC App #	_____
Date	_____
Approval Date	_____
Certificate Sent	_____
Computer Entry	_____
Region	_____
Account #	_____

**Student Memberships Only:**

Name and Location of School: \_\_\_\_\_

Contact Name: \_\_\_\_\_ Contact Phone: \_\_\_\_\_

To be eligible to join as a Student member, applicant must be classified as a full-time student at his or her respective school, which will be verified with that school.

New Individual Professional Membership Fee (Annual).....\$85

New Student Member Fee (Annual).....\$35

No Purchase Orders.....Please

Please remit with Application the amount shown above (in U.S. funds).  
 Make checks payable to: NCSL International

Or charge your: \_\_\_ Visa \_\_\_ MasterCard \_\_\_ American Express \_\_\_ Discover

Full name of card holder as it appears on card \_\_\_\_\_

Card Number \_\_\_\_\_ Expiration Date \_\_\_\_\_  
 month/year

Date \_\_\_\_\_ Signature \_\_\_\_\_

Individual and student membership would consist of:

- ♦ Subscription to Newsletter
- ♦ Post resumes on Website
- ♦ Search for jobs on Website
- ♦ Purchase publications at reduced member rates
- ♦ Borrow training aids
- ♦ Attend Conference and Tutorials at reduced member rates



# NCSL International

2995 Wilderness Pl., Suite 107 • Boulder, Colorado 80301-5404  
 (303) 440-3339 • Fax: (303) 440-3384  
 info@ncsli.org • www.ncsli.org

## 2004 Application for Membership in NCSL International

NCSL International is a nonprofit association of laboratories or organizations that maintain or have an interest related to measurement standards and calibration facilities. Each member organization appoints a "Member Delegate" who has the responsibility of representing the member company or organization in NCSL International.

Member Company or Organization (Enter name as it is to appear on membership certificate and wall plaque)

### Member Delegate information:

Member Delegate's Name \_\_\_\_\_  
 Title \_\_\_\_\_  
 Department or Division \_\_\_\_\_  
 Delegate's Business Mailing Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_ Country \_\_\_\_\_  
 ( ) \_\_\_\_\_  
 Telephone Number \_\_\_\_\_ Extension \_\_\_\_\_ Fax Number \_\_\_\_\_  
 E-mail address \_\_\_\_\_  
 Company's URL Address \_\_\_\_\_

### Appointing Officer\* information

Appointing Officer's Name \_\_\_\_\_  
 Title \_\_\_\_\_  
 Department or Division \_\_\_\_\_  
 Mailing Address (if different from Member Delegate) \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_ Country \_\_\_\_\_  
 ( ) \_\_\_\_\_  
 Telephone Number \_\_\_\_\_ Extension \_\_\_\_\_ Fax Number \_\_\_\_\_  
 E-mail address \_\_\_\_\_  
 Signature of Appointing Officer \_\_\_\_\_  
 Date \_\_\_\_\_

\* The Appointing Officer is the individual from the above company who is appointing the Member Delegate, and is usually the Member Delegate's supervisor.

<input type="checkbox"/> New Corporate Member Fee (Jan-Dec 2004)	\$400
<input type="checkbox"/> New Educational Institution Member Fee (Jan-Dec 2004)	\$400

New Membership above plus annual dues renewal (Advance payment is guaranteed at \$325 per year. No refund for advance payment.)

<input type="checkbox"/> New Member \$400 + 2005 dues \$325 = \$725
<input type="checkbox"/> New Member \$400 + 2005/2006 dues \$650 = \$1,050
<input type="checkbox"/> New Member \$400 + 2005/2006/2007 dues \$975 = \$1,375
<input type="checkbox"/> New Member \$400 + 2005/2006/2007/2008 dues \$1,300 = \$1,700

No Purchase Orders...Please  
 Please remit with Application the amount shown above (in U.S. funds).  
 Make checks payable to: NCSL International.

Or charge your: \_\_\_ Visa \_\_\_ MasterCard \_\_\_ Americal Express

Full name of card holder as it appears on card \_\_\_\_\_  
 Card number \_\_\_\_\_ Expiration Date \_\_\_\_\_  
 Date: \_\_\_\_\_ Signature: \_\_\_\_\_

For NCSL International use only

Date Recd \_\_\_\_\_  
 Check/CC App # \_\_\_\_\_  
 Date \_\_\_\_\_  
 Approved Date \_\_\_\_\_  
 Placque List # \_\_\_\_\_  
 Manual Sent \_\_\_\_\_  
 Computer Entry \_\_\_\_\_  
 Region \_\_\_\_\_  
 Account # \_\_\_\_\_  
 Pres. Div. VP Reg. Coord. \_\_\_\_\_  
 \_\_\_\_\_  
 SIC Codes \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_

## NCSL INTERNATIONAL STAFF



Craig Gulka  
Business Manager  
cgulka@ncsli.org



Joan Wilshire  
Office Manager  
jwilshire@ncsli.org



Doris Schaffner  
Admin. Support Asst.  
dschaffner@ncsli.org



Larry Johnson  
Computer Specialist  
lajohnson@ncsli.org

NCSL International Business Office (303) 440-3339  
2995 Wilderness Place Suite 107 or Toll Free (866) 519-NCSL  
Boulder, CO 80301-5404 Fax: (303) 440-3384  
<info@ncsli.org> <www.ncsli.org>

## NCSL MEETING PLANNER



Tom Huttemann  
170 Chicahauk Trail  
Southern Shores, NC 27949  
(252) 255-1690 FAX(252) 255-1927  
e-mail: <thuttemann@aol.com>

## BOARD OF DIRECTORS' MEETING DATES

April 11-14, 2004  
NCSL Business Office & Residence Inn  
Boulder, CO

July 11, 16-17, 2004  
Salt Palace  
Salt Lake City, UT  
(In conjunction with the NCSL International Workshop & Symposium, July 11-15, 2004)

October 3-6, 2004  
Crowne Plaza Hotel  
Ottawa, ON Canada

## NEWSLETTER EDITORIAL SCHEDULE FOR 2004-2005

Issue Date	In Mail	To Printer	Last Editorial to Editor
Jul. 04	10 Jul. 04	15 Jun. 04	1 Jun. 04
Oct. 04	10 Oct. 04	15 Sep. 04	1 Oct. 04
Jan 05	10 Jan. 05	15 Dec. 04	1 Dec. 04
Apr 05	10 Apr. 05	15 Mar. 05	1 Mar. 05

### EDITOR'S NOTE:

This schedule is for guidance for anyone who needs to submit material for publication in the Newsletter.

## FUTURE CONFERENCES

2004 NCSL International Workshop & Symposium  
July 11-15, 2004  
Salt Lake City, UT

2005 NCSL International Workshop & Symposium  
August 7-11, 2005  
Washington, DC

2006 NCSL International Workshop & Symposium  
August 6-10, 2006  
Nashville, TN

Abstracts are required for Workshops, Panels, and Papers. For more information contact:  
NCSL International Business Office  
2995 Wilderness Place, Suite 107  
Boulder, CO 80301-5404  
Tel: (303) 440-3339  
Fax: (303) 440-3384  
E-mail: <info@ncsli.org>

## NCSL INTERNATIONAL PUBLICATIONS CLUB

If your company is already a member of NCSL International, then you may be eligible to subscribe to the NCSL International Publications Club and receive your own copy of the many publications available through NCSL International. Contact the Business Office for details -- (303) 440-3339. See the NCSL International web site at <www.ncsli.org>



**NCSLI NEWSLETTER**  
NCSL International  
2995 Wilderness Pl.  
Suite 107  
Boulder, CO 80301-5404

#### **The NCSLI Vision**

Promote competitiveness and success of NCSL International members by improving the quality of products and services through excellence in calibration, testing, and metrology education and training.

#### **The NCSLI Mission**

NCSL International (NCSLI) is a continuing, nonprofit corporation, oriented toward organizations involved in Metrology and related activities.

The mission of NCSL International is to advance technical and managerial excellence in the field of Metrology, Measurement Standards, Conformity Assessment, Instrument Calibration, as well as Test and Measurement, through voluntary activities aimed at improving product and service quality, productivity, and the competitiveness of member Organizations in the international marketplace.