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Hello again! As you read this, I will be preparing for my second board meeting as President. I am pleased to introduce two new members to the board: Mark Lapinskes (Sypris) and Jim Salsbury (Mitutoyo). Mark was appointed because of the vacancy created by Malcolm Smith’s transition as our new Executive Vice President. Roxanne Robinson has replaced Malcolm Smith as the VP of International Affairs. Mark has been active as the Education Liaison committee chair. Jim Salsbury was appointed to replace Tom Wunsch, who resigned his position because of a job change. Jim has been active as the committee chair for Dimensional Metrology.

Besides being crowned by the board in January (literally – a purple crown with jewels!), I was also asked to restructure board agendas to make the best use of the board’s time. In order to do this I plan on conducting two operational board meetings in April and October, and holding a strategic board meeting in August in conjunction with the annual Workshop and Symposium. Board meetings are always open and the board welcomes participation from the membership. Operational board meetings will focus on the details of running the organization, literally the business operations and the processes being used to accomplish our strategic goals. Strategic board meetings will focus on setting the vision and direction of NCSLI, but will still allow for brief operational reports by NMI’s, liaisons and committee chairs.

It is also time for me to report to you on the progress we are making on the two key initiatives for 2008 that I introduced in January. The first initiative focused on education and training, an area that is drawing the attention of many in the metrology community. At the January board meeting, the board voted to change the title of the Vice President of Education and Training to the Vice President of Learning and Development. An article appears elsewhere in this issue that covers the background of the name change. There was a NCSLI Conference Visioning meeting held in February to work towards improving the annual conference. One of the goals of this meeting was to better design the conference for learning. Plans were developed for both short range (2008) and long range changes to create a better environment for learning at the conference. I am excited to see so many of our members involved in the learning and development activities of NCSLI, and encourage your continued participation.

The second key initiative focused on developing an international strategy for the board and for the organization as a whole. The board held a workshop in January with broad representation from the international community. Because of this workshop, an international task group was formed and short and long-term actions were identified. While additional work is necessary, the board made significant progress in accomplishing this goal.

World Metrology Day is coming on May 20. Check for celebrations near you. The NCSLI Conference website is up and waiting for your registration. Did you see the list of tutorials being offered this year? It’s incredible! This is such an exciting time to be involved in metrology!
Calendar Highlights

NCSLI Training Center
For detailed information on our classes go to www.ncsli.org.

Integrated Sciences Group
Tel 661.872.1683
April 23-25, 2008
Introduction to Uncertainty Analysis
June 23-27, 2008
Uncertainty / SPC Analysis

QUAMETEC
Tel 810.225.8588
May 12-14, 2008
Measurement Uncertainty Class
May 15-16, 2008
ISO/IEC17025 Quality Management System and Internal Auditing

WorkPlace Training
Tel 952.471.8554
April 7-10, 2008
ANSI Z540.3, ISO 17025 Compliance Workshop
June 9-13, 2008
CCT Primer and Exam
June 16-18, 2008
Measurement Uncertainty

For pricing and availability on the NCSLI Training Center, please contact the NCSLI Business Office at 303.440.3339 or email us at info@ncsli.org.

NCSLI Board of Directors Meetings

April 20–23, 2008
Napa Valley, California
Embassy Suites Hotel
707.252.9540

August 3, 8–9, 2008
Orlando, Florida
Swan & Dolphin
407.934.4000

October 18–22, 2008
Gatlinburg, Tennessee
Park Vista Hotel
800.227.5622

Region Meetings

Central CA/Nevada Region 1410
April 10, 2008
Richard Fertell
650.965.9355

Kansas City Section 1314
April 15, 2008
Ron Hanshaw
816.997.4126

Mid-Atlantic Region 1210 and Virginia Section 1213
April 23, 2008
Tom Hettenhouser
301.926.2884

Southern Ohio/Kentucky
Section 1132
April 23, 2008
Matthew Denslow
740.788.7129

Atlanta Section 1221
April 29, 2008
Cole Miller
678.662.9018

Northwestern US Region 1430
May 9, 2008
Keith Cable
425.286.1085

Tennessee Section 1224
October 23, 2008
Ed Pritchard
866.788.9555

For detailed information on Regional Meetings go to www.ncsli.org/calendar

Sponsored Events

CPEM
June 8–13, 2008
www.iCPEM.org/2008

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April 2008 : Metrologist 3
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For more information contact:
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info@gigahertzllc.com

Portland General Electric Instrument Lab
Portland General Electric (PGE) is a mid-sized electrical utility company serving the greater Portland Oregon metropolitan area. The Instrument Lab is responsible for the calibration and repair of all instruments used to make quantitative measurements within the PGE system.
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David Nelson
503.736.5580
David.nelson@pgn.com

Ecuadorian Army Metrology Center
The Laboratory calibrates electrical, temperature and pressure equipment. We have reference and working standards.
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For more information contact:
Joseph Minnix
617.613.4408
jminnix@shire.com

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National Laboratory Association

The NLA is a representative body whose members are drawn from both Testing as well as Calibration laboratories in South and Southern Africa. Currently over 100 members have more than 300 laboratories. The NLA is constituted as a Section 21, not for gain, company and has a board of directors who are elected from the members. The current Chairman is Mr. Prags Govender of Rand Water Scientific Services.

For more information contact:
Steve Sidney
2712.349.1500
steves@nla.org.za

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For more information contact:
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E_oliva@prodigy.net.mx

Architectural Testing, Inc.

For more information contact:
David G. Moyer
717.764.7700
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Continued on page 6
Teva Pharmaceuticals USA

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For more information contact: Dave Ayyayam 717.266.5775 micronipa@comcast.net

For more information on NCSLI membership go to www.ncsli.org. See inside back cover for additional information.
The venue for the January 7-9, 2008 NCSLI Board of Directors meeting was San Juan, Puerto Rico. Dimaries Nieves, the Puerto Rico Section Coordinator, took this opportunity to schedule a section meeting with several Board members in attendance. Twenty-nine people attended supported by their sponsoring companies or organizations. An unusual treat was the board dinner on Monday night for the attendees and some of their spouses. Denio Hernandez of INSCO, a frequent exhibitor at the Conference, and his wife Miertha hosted the entire group of over thirty-five people at their home for a wonderful meal prepared by their son Denis. With operations in Puerto Rico, Florida and Mexico, INSCO provides calibration instrumentation services and precision weights. The Board was very grateful to the Hernandez family for their generous exhibit of Puerto Rican hospitality.

Outgoing President Jack Ferris presented awards to Seton Bennett and Tom Wunsch for their development of Technical Programs at the Conference. Tom Wunsch is retiring from the Board and Jack gave him a plaque of appreciation for his contributions to NCSLI since 1997.

Incoming President Carol Hocker announced changes in the Board membership for the New Year. Jeff Gust leaves the Board position of Immediate Past President, and Jim Salisbury and Mark Lapinskes join as new members. Jim will assume the position of VP of Measurement Science and Technology, and Mark will be the VP of the Southeastern US. Other changes included Dana Leaman being appointed as the VP of the Northeastern US and Roxanne Robinson as the VP of International Regions Division. Pete Buzzard assumes the role of VP Industrial Programs. Malcolm Smith moves to Executive Vice President in anticipation of his Presidency in 2009.

During the two and a half day meeting, each Board member presented a report on his or her area of special focus. These reports ranged from activities at NIST, BIPM, SIM, CENAM, and NRC to reports of meetings held in local sections. Georgia Harris, VP of Education and Training initiated a successful motion to change the name of her position to the VP of Learning and Development to more closely mirror the focus of this very active group. Lonnie Spires, VP of Operations announced that the NCSLI directory, “Who’s Who in 2008” will be sent to members by the end of February. The first issue of the new metrologist was unveiled and has been mailed to members. The first issue includes a tribute to John Minck who edited the previous NCSLI Newsletter for twenty-nine years.

President Hockett led a workshop on the international aspects of NCSLI. The discussion led to a number of short term actions to strengthen the international focus of the organization. Carol also concentrated on a vision of what NCSLI “International” could become in the long term. She formed an International Task Group to continue the work.

Nominations for Wildhack and Education and Training Awards are due at the end of April 2008 and instructions for submission have been sent to members.

These meetings are open to all visitors and the next one is scheduled for April 20–23, 2008 in Napa Valley, California. Contact the NCSLI business office for more information 303.440.3339.

dave_abell@pa_chell.net
The origin of the Treaty of the Metre is discussed as the inspiration for World Metrology Day on May 20 each year. Themes for the 2007 and 2008 celebration of this event are presented, along with an explanation of the role that metrology plays in both measurements for the environment (the 2007 theme) and in sports (the 2008 theme). Details are given on the NIST celebration in 2007 along with plans for the 2008 celebration.

In 1875, 20 nations met in Paris to finalize the Treaty of the Meter, establishing what has become known as the International System of Units (SI) or metric, as the world system for measurement. The treaty establishing the Metre Convention was signed on May 20, 1875. The Convention created the International Bureau of Weights and Measures (BIPM) and set the framework for global collaboration in the science of measurement and in its industrial, commercial and societal applications. Today there are 51 Members of the Convention and 17 Associate States and Economies of the General Conference on Weights and Measures. The original aim of the Metre Convention – the worldwide uniformity of measurement – remains as important today, in 2008, as it was in 1875.

This is the fourth year that World Metrology Day will be celebrated around the world. Three years ago, the International Bureau of Weights and Measures (BIPM) formally established May 20th as World Metrology Day, and encouraged such National Measurement Institutes as the National Institute of Standards and Technology (NIST) to celebrate metrology and its importance to society.

NIST had its inaugural celebration of World Metrology Day on May 21, 2007. The theme was Measurements in our Environment. NIST research and measurements provide a significant foundation for environmental measurements. NIST invited a set of speakers to discuss NIST research and measures for the environment from a variety of perspectives, including climate research and applied technology in the built environment. NIST publicized the events with a variety of announcements, including all-staff e-mails, posters around NIST, and a declaration that May is Metrology Month. The NIST Research Library also created a collection of resources, both electronic and physical, which were on display throughout the month of May.

At the actual celebration, the following talks were given:

• Introduction to Measurements for the Environment and Climate Monitoring – Dr. Katharine Gebbie (Physics Laboratory)
• Climate Research: A Challenge for Metrology – Dr. Jerry Fraser (Physics Laboratory)
• Measurements and Standards to Characterize the Atmospheric Column – Ms. Pam Chu (Chemical Sciences and Technology Laboratory)
• Measurements and Methods to Remove Barriers facing the Photovoltaic Industry – Mr. Hunter Fanney (Building and Fire Research Laboratory)
• Concluding remarks – Dr. Willie May (Chemical Sciences and Technology Laboratory)
For May 20, 2008, Dr. Andrew Wallard, Director of the BIPM in Paris, has announced that this year’s theme is Metrology and Sports, recognizing the importance of measurements for time, length, mass, and physical fitness for sports, in this Olympic year. While you might think that metrology for sports is totally settled, with no current challenges, you may be surprised to learn that a recent marathon course in Chicago was inadvertently set to be one mile too long. The error was discovered only after the Lakeshore Marathon race had been completed.\(^1\) Another use of metrology in sports comes from the U.S. car racing community, where the ruling body (NASCAR) imposes a ¼ inch tolerance\(^2\) on ride heights of cars. A race car was recently disqualified because its front end didn’t meet the minimum height requirement. Similar tolerances are required for car weight in NASCAR races. In swim events, electronic timers take precedence over conventional timing, with a requirement that timing have a tolerance of 0.001 second. Of course, swimming pools must conform to national and international standards for length, while mass measurements underpin weight requirements for race horse jockeys to weight lifting. Information on measurement requirements for a number of sports can be found at www.infoplease.com/ipa/A0113430.html

The United States is slowly transitioning its measurements for sports to the global system. We regularly compete in 10K runs, for example. The Metric Program of the U.S. Department of Commerce offers Sporting Fast Facts to help understand units used in international events such as the Olympics. Examples include specifications for road racing bikes, whose frames are made from steel, aluminum, titanium, or carbon fiber, and which must be strong and lightweight (8 to 10 kilograms). Almost all track and field events involve the use of metric measurements. For example, competitors in the high jump are allowed a 25-meter run-up, the uprights are placed 4 meters apart, and the bar itself must not weigh more than 2 kilograms. For more examples, see: http://ts.nist.gov/WeightsAndMeasures/Metric/olympics.cfm.

Length, time, and mass are not the only measurements that affect sports, however. The use of chemical measurements to test for traces of performance-enhancing drugs, such as steroids and hormones, has become an increasingly familiar requirement for fair competition in events ranging from the Tour de France to baseball. Linking to last year’s World Metrology Day theme, measurements of air quality can be an important component that affects athletic performance. Still another use of metrology is found in a project at NIST which is providing measurements and standards for replacement joints needed by athletes and others as the originals wear out. See www.orthosupplier.com/bonezone/online/2007/fall/editorial_dagalakis.pdf All of these standards and requirements trace back to measurements made at the various NMIs, and ultimately back to the SI maintained by the BIPM.

NIST is planning another celebration for May 20, 2008, with talks on metrology in sports, as well as a set of information resources in the NIST Research Library. If you will be near NIST on May 20, please contact Sandra Auchmoody to make the necessary security and visitor arrangements to join us. Sandra.auchmoody@nist.gov

NCSLI encourages its sections to consider events for Metrology Day! It’s a great way to make metrology come alive as we think about its applications to society, such as the Olympics, Super Bowl, and other popular sporting events.

belinda.collins@nist.gov

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\(^2\) Customary units are used here since that is the NASCAR specification; NIST normally reports measurements in SI units.
Richard B. Pettit

Dr. Richard Pettit began his career after receiving his Bachelors of Science in Engineering Physics from the University of Michigan and then a Ph.D. in Applied Physics from Cornell University in 1971. In August 1971, he joined the technical staff of the High Temperature Science Division at Sandia National Laboratories in Albuquerque, New Mexico. In April 1986 he became the leader of electrical metrology at Sandia’s Primary Standards Laboratory, a position he held until his retirement in 2003.

This was his first major assignment in metrology and he has been an active member of NCSLI International ever since. His initial activity work was as the Department of Energy (DOE) member of the newly formed “Intrinsic and Derived Standards Committee.” Next, he became the committee’s chair from 1994-1998. During this time, he developed and published a “Catalogue of Intrinsic and Derived Standards” that documented the important properties, and associated literature references, for these standards. In addition, two new Recommended Intrinsic/Derived Standard Practice (RISPs) were published: (1) “Triple Point of Water Cell” and (2) "Quantized Hall Resistance." Finally, the "Array Josephson Junction" RISP was updated.

From 1998 through 2006, Dick served as Vice President of Measurement Science and Technology. During his tenure, the Chemical Metrology Committee was started, with the assistance of Klaus Jaeger, Lockheed Martin, and Tom Ouimet, Kodak. The committees reporting to him published a RISP detailing the calibration of deadweight pressure gauges (RISP-4); developed a definition for the term "Intrinsic Standard," developed a standard "Certificate of Participation" for laboratories that participated in NCSLI sponsored interlaboratory comparisons (ILCs); published a "Guide for Interlaboratory Comparisons" (RP-15); and published a RISP titled "Two-Pressure, Two-Temperature Humidity Generator" (RISP-5).

The highlight of his metrology volunteer activities was receiving the NCSLI Wildhack Award in 2003. The award was presented to Dick based on his more than 20 years of service to NCSLI in its management ranks, his contributions to the technical successes of NCSLI, his excellent management of the NCSLI conference technical program, and his considerable accomplishments in the field of metrology, including numerous technical publications.

The following awards and activities also helped accentuate Dick’s professional career:

• Department of Energy Solar Thermal Technology Award (1981).
• Certified Quality Engineer (CQE), ASQ, 1992.
• Member, American Association for the Advancement of Science (AAAS)
• Member, American Physical Society (APS)
• Member, American Society for Quality (ASQ)

One of his most satisfying activities was serving as NCSLI Workshop and Symposium "Technical Program Chair" for five consecutive conferences, beginning in 2001. This activity involved setting up a Technical Review Committee for rating of all unsolicited abstracts and then organizing the top rated abstracts.
into compatible technical/quality sessions. He also maintained a list of "Reserve Papers" that were used as replacement talks for speakers who could not attend the conference. Starting in 2002, he assisted the NCSLI Business Office in the development of a web-based system for the submission of both abstracts and manuscripts electronically. During his tenure, the submission of manuscripts from speakers has improved each year to a level of over 85%.

Most recently, he was part of a team that initiated the development of the new journal MEASURE. Based on the original idea of Tom Wunsch of Sandia, who was Operations Vice President, Tom, Craig Gulka, Mike Lombardi, Norm Belecki, and Dick, as the Managing Editor, set up the framework of the journal, which is aimed at publishing reviewed technical articles of interest to NCSLI members. The quarterly journal carries original papers, review articles, special reports, and technical tips on metrology topics including new or improved technical or management issues related to measurements, calibration, metrology, and/or laboratory accreditation. In addition, there is a section on current National Metrology Institute (NMI) News and General Metrology News items. Finally, the journal publishes new product or service information from NCSLI member organizations. MEASURE is now in its third year of publication and has published more than 75 technical papers. Recently a new feature has been added that highlights questions and answers that are of interest to NCSLI members from various NMIs that support NCSLI.

Dick has done volunteer work for technical organizations other than NCSLI. He was a charter member of the National Cooperation for Laboratory Accreditation (NACLA) representing the Dept. of Energy’s National Nuclear Security Administration (DOE/NNSA). He served on the Board of Directors for 2 years and was responsible for the development of the NACLA Quality Manual. In addition, by working with DOE/NNSA quality managers, he was successful in having DOE/NNSA officially accept the use of calibration laboratories that are accredited by a NACLA recognized accreditation body. The DOE/NNSA was the first US Federal Agency to adopt this policy, which is saving them 10’s of thousands of dollars each year. He also has assisted in working with the Nuclear Regulatory Commission (NRC) in order to obtain their acceptance of accredited calibration laboratories in specific situations.

Dick has written over 80 technical papers on a variety of subjects, including critical phenomena, optical measurement techniques, solar properties of materials, optical modeling of solar collectors, and so on. He has made frequent contributions to the metrology literature, authoring papers on maintaining intrinsic standards, uncertainty analysis in mechanical testing, process measurement assurance, and the uncertainties associated with multifunction calibrators (MFCs). He also contributed an uncertainty example on optical measurements for the NCSLI publication titled "Determining and Reporting Measurement Uncertainties.” He has presented several talks at NCSLI conferences, including topics such as traceability of measurements, techniques for maintaining a MFC, and uncertainty analysis.

Since his retirement from Sandia National Labs in 2003, Dick continues to live in Albuquerque with his wife, Ellen. They have two married children, William and Elizabeth, and two grandchildren, Anika, 11, and Landon, 5. In his spare time he does enjoy gardening, camping, bicycling, and photography. He and Ellen also enjoy traveling, and they have hosted several foreign exchange high school students over the past 20 years.

randepettit@comcast.net

Dick and his older brother, Bob, with their homemade sleds.

Photo Answer: Dick is on the right, younger brother, David, is in the middle, and Bob is on the left. Photo was taken when Dick was in High School.
1. Measurement

1.1 The International Bureau of Weights and Measures
The International Bureau of Weights and Measures, formally known by its French name, Bureau International des Poids et Mesures (BIPM) in Paris, is responsible for the definition of the International System of Units (SI) and promoting worldwide consistency of physical measurements. The institute coordinates many international metrology activities, and performs metrology research. The BIPM operates under the supervision of the International Committee for Weights and Measures (CIPM). The CIPM suggests modifications to the SI to the General Conference on Weights and Measures (CGPM) for formal adoption. The CGPM is the primary intergovernmental treaty organization responsible for the SI, representing nearly 50 countries. Both the BIPM and the CIPM were established by the Meter Convention, which was signed in Paris in 1875 by representatives of seventeen nations, including the United States. Refinement of the SI is an ongoing process aided by the work of BIPM’s Consultative Committees: Electricity and Magnetism, Photometry and Radiometry, Thermometry, Length, Time and Frequency, Units, Mass and related quantities, and Amount of substance.

1.2 National Metrology Institutes
Within countries, measurements are made consistent/comparable through traceability to their primary standards maintained by the National Metrology Institutes (NMIs); the United States’ NMI is the National Institute of Standards and Technology (NIST). Each NMI is responsible for maintaining the primary standards, usually recognized by national law, that serve in its country as the basis for assigning values to other standards of the quantity concerned.

1.3 Regional Metrology Organizations (RMO’s)
NIST is the U.S. member of the Inter-American Metrology System (SIM). All RMO’s have as their objectives:
• Information exchange on measurement standards and capabilities
• Provision of international credibility for measurement traceability and competence as a basis for a global Mutual Recognition Arrangement (MRA) for metrology standards and calibration certificates issued by National Metrology Institutes

1.4 Accreditation
Accreditation of calibration and testing laboratories serves the objectives of the government and the private sector (industry, consumers, and other stakeholders) by fostering and promoting a uniformly acceptable base of professional and technical competence in the laboratory community, and facilitating and promoting acceptance of calibration and test results among countries to avoid barriers to trade. Testing and calibration laboratory accreditations underpin an infrastructure of competent measurement laboratories supporting domestic and international trade and conformity assessment activities. Accreditation programs provide an unbiased third-party evaluation and recognition of capability and performance, as well as expert technical guidance to upgrade laboratory performance.

1.4.1 International Accreditation Organizations
The International Laboratory Accreditation Cooperation (ILAC) has the aim of developing international cooperation for facilitating trade by promotion of the acceptance of accredited test and calibration results. ILAC membership is open to laboratory accreditation organizations that have been accepted as signatories to the ILAC Mutual Recognition Arrangement. Each accreditation body that is a signatory to the Arrangement agrees to abide by its terms and conditions and by the ILAC evaluation procedures. To do this, the signatory must:
• Maintain conformance with ISO/IEC 17011 Conformity assessment: General requirements for accreditation bodies accrediting conformity assessment bodies, related ILAC guidance documents, and a few, but important, supplementary requirements;
• Ensure that all its accredited laboratories comply with ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories and related ILAC guidance documents.

1 The U.S. Constitution provides that the Senate must advise and consent to ratification of treaties that have been negotiated and agreed to by the President. The formal process among nations in negotiating treaties gives treaty organizations their ability to commit nations to agreements. It also requires governmental representation in all deliberations and decision-making.
These signatories have, in turn, been peer-reviewed and shown to meet ILAC’s criteria for competence.

The International Accreditation Forum, Inc. (IAF) is the world association of Conformity Assessment Accreditation Bodies and other bodies interested in conformity assessment in the fields of management systems, products, services, personnel and other similar programs of conformity assessment. The purpose of the IAF is to ensure that its accreditation body members accredit only competent bodies and to establish mutual recognition arrangements, known as Multilateral Recognition Arrangements (MLA), among its members. Accreditation body membership in IAF is open to organizations that accredit bodies for certification/registration of management systems, products, services, personnel or similar programs of conformity assessment.

1.4.2 Regional Laboratory Accreditation Organizations (RLAO’s)

RLAO’s that cooperate with members in their region and with ILAC and/or IAF to foster accreditation activities include:
• Asia Pacific Laboratory Accreditation Cooperation (APLAC)
• Central Asian Cooperation on Metrology Accreditation and Quality (CAC-MAS-Q)
• European Cooperation for Accreditation (EA)
• Inter-American Accreditation Cooperation (IAAC)
• Pacific Accreditation Cooperation (PAC), and
• Southern African Development Community in Accreditation (SADCA).

RLAO activities that support mutual recognition and acceptance of accredited services and results include: meetings for exchange of information and to promote discussion, such as common interpretation of standards; management of peer evaluations; organization of proficiency testing; development and promotion of mutual recognition arrangements among Members, and cooperation with other national, regional and international bodies with similar or complementary objectives. Accreditors domiciled in the United States seeking mutual recognition work through the APLAC.

2. Documentary Standards

2.1 The International Organization of Legal Metrology (OIML)

OIML is the international organization for developing documentary standards related to regulated and legally mandated measurements. OIML is an inter-governmental treaty organization established in 1955 by the “Convention” (the treaty), which has an objective of harmonization of national regulations and metrological controls (e.g., type approval, verification, etc.) applied by legal metrology authorities. There are 59 Member States (voting) and 56 Corresponding Members (nonvoting). The oversight body of OIML is the International Committee of Legal Metrology (CIML), which meets annually. Each Member State has one CIML Member. A meeting of the OIML Conference is held every four years to establish general policy, vote on the budget and confirm the decisions of the CIML. The United States ratified the Convention and joined OIML in 1972.

The OIML utilizes Technical Committees (TCs) and Subcommittees (SCs) comprised of representatives from member countries to develop model regulations and standards. The standards are referred to in OIML as Recommendations. International consensus in the legal metrology community is reached through TC and SC activities. The composition of the TCs and SCs includes representatives from Member States and liaison representation from international standardization and technical organizations, manufacturers’ associations and regional regulatory bodies. Under the coordination of a Secretariat, experts establish international technical guidelines for the metrological performance and testing procedures of measuring instruments subject to legal controls. The TCs are organized by general measurement discipline and the SCs are assigned specific types of measuring instruments or areas for standards development. During development, Recommendations go through successive incomplete drafts designated as 1 WD (Working Draft), 2 WD, etc. When a TC or SC addresses all necessary elements in a Recommendation, the designation shifts from a WD to a Committee Draft (CD) with successive drafts numbered 1CD, 2 CD, etc. Following a successful TC or SC ballot and approval a CD is designated as a Draft Document (DD) or a Draft Recommendation (DR) and sent to the International Bureau of Legal Metrology (BIML) for approval by the CIML. The BIML provides the administrative, technical and editorial staffing function for the OIML. Following CIML approval, the BIML publishes and provides free distribution of the Documents and Recommendations through the OIML web site.

The OIML has developed a Certificate System for measuring instruments that comply with the Recommendations to promote global regulatory-body acceptance of test reports, thereby avoiding duplicative type evaluation testing requirements. Manufacturers may submit instruments to testing facilities authorized by national Issuing Authorities, which are designated by their CIML Members. The OIML web site database lists the Issuing Authorities and the OIML Certificates of Conformity (CC) submitted by the various national Issuing Authorities for registration by the BIML.

The OIML has developed a Mutual Acceptance Arrangement (MAA) that is related to the OIML Certification system used for Type Evaluations. The goal of the MAA is for the participants to accept and utilize Test Reports validated by an OIML MAA Certificate of Conformity. The scheme designates Participants in the MAA as either Issuing Participants (IPs) or Utilizing Participants (UPs). Authorities that will issue and use OIML MAA Certificates of Conformity are designated as IPs. Tests reports associated with these OIML MAA Certificates will also be accepted and utilized by UPs to issue, for example, national type

Continued on page 14
approvals. To foster confidence, the MAA includes an evaluation of the competence and testing capabilities of the Testing Laboratories of OIML Issuing Authorities applying to be an IP, according to the international standard ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories. This evaluation may be carried out either by accreditation or by peer assessment.

The Committee on Participation Review (CPR), comprised of experts from participating countries, studies the applications of potential participants and decides if peer assessments are needed, by considering the accreditation of the Testing Laboratories and the scope of these accreditations. Evaluation reports are distributed to the participants, and when all participants agree on the acceptability of the IP applicants, the IP applicants are allowed to sign the Declaration of Mutual Confidence (DoMC). The initial MAA implementation covers OIML R 60 (Load cells) and OIML R 76 (Nonautomatic weighing instruments), for which a large number of OIML Certificates have been issued. The first two Declarations of Mutual Confidence were published by the BIML in September 2006. The National Conference on Weights and Measures (NCWM) signed the DoMC (as a Utilizing Participant) for R60. Consequently, the U.S. National Type Evaluation Program (NTEP) will accept test data on load cells that are tested according to the requirements in OIML R60 (and additional, agreed-upon requirements), from Issuing Participants under the DoMC, to use as the basis of issuing NTEP Certificates. A DoMC for OIML R49 (Water meters) was begun in 2007.

2.2 Other International Standards Organizations
To avoid conflicting requirements for measuring instruments, the OIML establishes liaisons with international and regional institutions concerning activities in metrology, standardization and related fields including: the International Bureau of Weights and Measures (BIPM), the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Federation of Clinical Chemistry (IFCC), and the International Union of Pure and Applied Physics (IUPAP). The complete list is on the OIML liaison website. These organizations develop standards for related aspects of measuring instruments, such as safety; interoperability, and performance requirements not necessarily directly related to legal metrology.

2.3 Regional Legal Metrology Organizations (RLMOs)
The RLMOs provide a forum for sharing information on legal metrology in member countries and economies to promote a harmonized and consistent approach to legal metrology requirements in the region. RLMOs also facilitate communications and shared training opportunities. Shared specific objectives include supporting an integrated measurement infrastructure in the region, promoting equity in the marketplace, improving the quality of life and facilitating international trade.

For the United States, NIST is a member of both the Inter-American Metrology System - Legal Metrology Working Group (SIM -LMWG), and the Asia-Pacific Legal Metrology Forum (APLMF).

Other regional legal metrology organizations with similar roles include the:
• Euro-Asian Cooperation of National Metrological Institutions (COOMET)
• Euro-Mediterranean Legal Metrology Forum (EMLMF), and
• European Cooperation in Legal Metrology (WELMEC)

3. Laws and Regulations
National, state and local governments determine through the legislative process how to ensure that equity in the marketplace, and the safety and health of the public are maintained. Measurements play a crucial role and are tied to laws and regulations that govern the accuracy of measuring instruments and their conformity to national or recognized international specifications. Legal metrology involves not only the facilitation of traceability, but also means for detecting fraud (tampering), accidental misuse, and inaccuracy caused by influence factors, which disrupt the measurement process. Instruments are controlled through a system of type approval, initial verification and marketplace surveillance.

4. Economic Promotion Organizations
Several global and regional organizations are focused on promoting international trade and fostering development necessary for free trade. An essential element for trade recognized by these organizations is legal metrology. The following organizations have supported developing such infrastructure in developing countries around the world.

The World Trade Organization (WTO) deals with the rules of trade among nations at a global or near-global level. It is an organization for liberalizing trade. It is a forum for governments to negotiate
Special Report

APPENDIX
Glossary of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>APLAC</td>
<td>Asia Pacific Laboratory Accreditation Cooperation</td>
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<tr>
<td>APLMF</td>
<td>Asia-Pacific Legal Metrology Forum</td>
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<tr>
<td>APMP</td>
<td>Asia Pacific Metrology Program</td>
</tr>
<tr>
<td>BIML</td>
<td>International Bureau of Legal Metrology</td>
</tr>
<tr>
<td>BIPM</td>
<td>International Bureau of Weights and Measures</td>
</tr>
<tr>
<td>CAC-MAS-Q</td>
<td>Central Asian Cooperation on Metrology Accreditation and Quality</td>
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<tr>
<td>CC</td>
<td>Certificate of Conformity</td>
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<tr>
<td>CD</td>
<td>Committee Draft</td>
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<tr>
<td>CGPM</td>
<td>General Conference on Weights and Measures</td>
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<tr>
<td>CIPM</td>
<td>International Committee for Weights and Measures</td>
</tr>
<tr>
<td>COOMET</td>
<td>Euro-Asian Cooperation of National Metrological Institutions</td>
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<tr>
<td>CPR</td>
<td>Committee on Participation Review</td>
</tr>
<tr>
<td>DD</td>
<td>Draft Document</td>
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<tr>
<td>DoMC</td>
<td>Declaration of Mutual Confidence</td>
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<td>DR</td>
<td>Draft Recommendation</td>
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<tr>
<td>EA</td>
<td>European Cooperation for Accreditation</td>
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<tr>
<td>EMLMF</td>
<td>Euro-Mediterranean Legal Metrology Forum</td>
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<tr>
<td>EUROMET</td>
<td>European Collaboration in Measurement Standards</td>
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<tr>
<td>IAAC</td>
<td>Inter-American Accreditation Cooperation</td>
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<td>IAF</td>
<td>International Accreditation Forum</td>
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<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
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<tr>
<td>IFCC</td>
<td>International Federation of Clinical Chemistry</td>
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<tr>
<td>ILAC</td>
<td>International Laboratory Accreditation Cooperation</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>IUPAP</td>
<td>International Union of Pure and Applied Physics</td>
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<td>MAA</td>
<td>Mutual Acceptance Arrangement</td>
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<td>MLA</td>
<td>Multilateral Recognition Arrangements</td>
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<tr>
<td>MRA</td>
<td>Mutual Recognition Arrangement</td>
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<td>NCWM</td>
<td>National Conference on Weights and Measures</td>
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<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
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<td>NMIs</td>
<td>National Metrology Institutes</td>
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<tr>
<td>NTEP</td>
<td>National Type Evaluation Program</td>
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<td>OAS</td>
<td>Organization of American States</td>
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<tr>
<td>OIML</td>
<td>International Organization of Legal Metrology</td>
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<tr>
<td>PAC</td>
<td>Pacific Accreditation Cooperation</td>
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<tr>
<td>R</td>
<td>Recommendation</td>
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<td>RLAOs</td>
<td>Regional Laboratory Accreditation Organizations</td>
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<td>RLMOs</td>
<td>Regional Legal Metrology Organizations</td>
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<td>RMOs</td>
<td>Regional Metrology Organizations</td>
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<td>SADCA</td>
<td>Southern African Development Community in Accreditation</td>
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<td>SADCMEL</td>
<td>Southern African Community Cooperation in Measurement Traceability</td>
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<td>SC</td>
<td>Technical Subcommittee</td>
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<td>SI</td>
<td>International System of Units</td>
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<tr>
<td>SIM</td>
<td>Inter-American Metrology System</td>
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<tr>
<td>SIM-LMWG</td>
<td>Inter-American Metrology System - Legal Metrology Working Group</td>
</tr>
<tr>
<td>TC</td>
<td>Technical Committee</td>
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<tr>
<td>UNIDO</td>
<td>United Nations Industrial Development Organization</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>WD</td>
<td>Working Draft</td>
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<tr>
<td>WELMEC</td>
<td>European Cooperation in Legal Metrology</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organization</td>
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</tbody>
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Note: Wayne Stiegel recently retired from NIST’s Weights and Measures Division, International Legal Metrology Group after spending over 40 years at NIST. Contact Chuck Ehrlich for further international legal metrology information.
NCSLI committees and activities associated with “Education and Training” have focused for many years on efforts well beyond just education and training. Seeking a more informative name, we considered the idea that “Learning” encompasses all education and training activities. Both of “education” and “training” has specific connotations in the workplace. “Education” generally refers to gaining knowledge from accredited schools and universities, or gaining an understanding of underlying concepts and theory. “Training” typically refers to the application of knowledge to skills, or simply learning skills; it includes everything from classroom instruction, multimedia resources, and on-the-job instruction and mentoring. This explanation is quite an oversimplification, but reflects how the two terms are generally understood.

In making the name change, we also considered that learning occurs in many ways within organizations and among individuals when they gain an understanding of educational and training materials, and then use that knowledge in context within the workplace. Learning also includes what individuals read and study on their own, as well as what they acquire through non-traditional and non-formal methods (e.g., experience gained from participating in technical committees, talking to experts, or even watching podcasts). Learning encompasses the entire scope of formal and informal methods of gaining an understanding of theoretical concepts, then applying that practical information to developing skills and expertise.

NCSLI’s “Education and Training” committees also conducted such activities as professional development and workplace development that are traditionally relegated to the HR (human resources, or personnel) function. Professional development refers to integrating learning into the workplace, updating skills and knowledge, and enhancing one’s career and employability, including certification. Workplace development refers to such activities as ensuring that current job descriptions and salary data are available for personnel offices and labor departments. Again, these efforts go well beyond the traditional usage of “education” and “training.”

Over the past year, we have seen our Metrology Outreach activities expand dramatically to interest young people in metrology careers. We hope now to move toward Executive Outreach to impart the importance of metrology and the learning and development requirements to corporate levels and to share “the case for metrology.” Documenting and presenting a case for metrology would help to explain the importance and impact of calibration, standards, as well as a good understanding of measurement science. Outreach efforts are also not just “education” or “training.”

The strategic framework and the eleven key areas that were developed as a part of the 2005 Strategic Roadmap are shown in Table 1. We have been organizing our activities and have reorganized the committee structure based on the strategic framework. However, you will note only two categories that dealt solely with education or training.

Eight of the categories are highlighted in green, showing that we have committees in place and are working on activities in these areas. Collaboration is highlighted in yellow, indicating that numerous activities are occurring world wide; none of the activities are formalized within a committee structure at this time. The two items in red are issues that have been identified as critical, but where little has been organized or funded to date. Identifying new technologies and determining what education and training will be required to support them in the metrology and calibration world is a critical function that we have not yet addressed. Capturing the incredible amount of knowledge from retiring personnel is another vital task for which we have no supporting system or infrastructure at this time.

The following list of activities shows how our efforts went beyond education and training over the past few years:

- Job description survey, analysis, and interaction with the U.S. Department of Labor and Office of Personnel Management (with the Measurement Quality Division (MQD) of the American Society of Quality (ASQ)), as a part of the previous 163.1 subcommittee.
- Guide to Personnel Qualifications, published by the 163 committee when it was Personnel Training and Qualifications. This guide was the result of a

<table>
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<tr>
<th>Human Resources</th>
<th>Education</th>
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<td>2. Workplace Development</td>
<td>4. Formal Programs</td>
<td>5. Training Resources</td>
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<td>3. Professional Development</td>
<td>6. Training Opportunities (Events)</td>
<td>7. Training Assessment</td>
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<tr>
<td>Infrastructure</td>
<td>8. Knowledge Management</td>
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<td>9. Technology Trend Analysis</td>
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<td></td>
<td>10. Collaboration</td>
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<td>11. Funding</td>
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</tbody>
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Table 1. Strategic Framework.
DACUM (Developing a Curriculum) study begun in the 1990’s at Aurora Community College, CO.
- Recommended Practice, RP 17, Documenting Metrology Education, Training, and On-the-Job Training, published by the 163 committee in 2007 (see the Committee News article in this issue by Committee chair Gloria Neely).
- Scholarships to schools with metrology programs and partial sponsorship of the Joe D. Simmons Memorial Scholarship (with Measurement Science Conference and ASQ-MQD).
- Addition of Outreach subcommittee to target teachers and students to get them interested in and excited about metrology careers.
- Accreditation Body, Assessor Survey to get initial insight on “training needs” in accredited laboratories.
- Past conference sessions on Job Descriptions, Personnel Certification, and Documenting Training.
- At the 2008 conference you will see sessions on: Training and Succession Plans, Professional Development, Student and Educator Perspectives, Workplace Development, Mentoring - International and E&T, Learning and Development Financial Resources.
  It is easy to see that the efforts described above are much more than “education and training.” As a group of committees seeking to meet many workforce challenges, we want to deal with the whole scope of issues related to human capital.
  You can see that these efforts go well beyond working with educators, providing scholarships, and making training resources available through a directory and member library. All of the committees in Learning and Development now have updated charters based on the name changes and based on the strategic roadmap effort that we established back in 2005. We changed the charters to highlight proposed outcomes of our efforts and our long-term objectives, as opposed to specific tasks and projects – to allow the committees an opportunity to consider new products and services that may not have been considered in the past.

Highlighted activities from the 2008 Strategic Plan are noted in the following section with each committee. We don’t often communicate our strategic goals widely enough; with the major changes to these committees, we wanted to give you an idea of what we’re up to and an opportunity to participate! Each year we will consider what activities will best help us meet workforce challenges. So, if you have ideas that you think will build on those stated here, please feel free to contact any of the committee chairs.

161: Training Resources
Chair: Helga Alexander (halexander@keithley.com)
Co-Chair: Matthew Denslow (matthew.denslow@afmetrocal.af.mil)
Charter: Ensure that information, resources, and opportunities for metrology learning are of high quality and are widely and readily available, and that needs and solution providers are identified where gaps exist. Ensure a high level of awareness of learning resources throughout the metrology community. Ensure development, implementation, and recognition of real-time (fast-response) metrology learning opportunities. Ensure development of a complete infrastructure to support metrology courses which result in accredited continuing education units (CEUs), and/or college credit, and/or ongoing instructor development and qualification.

2008 Activities
- Develop a new Regional Training program in conjunction with region/section coordinators that will provide options for education and training opportunities in half-day to multi-day segments.
- Obtain IACET (International Association for Continuing Education and Training) assessment to become an Authorized Provider for Continuing Education Units.
- Perform major revisions/updates of current resources in the NCSLI Training Library, Training Directory, and website in support of member training opportunities.
- Conduct (contract) a formal needs assessment study of education and training requirements (pending resources).

162: Financial Resources
Chair: Mark Lapinskes (mark.lapinskes@sypris.com)
Charter: Ensure that adequate resources are available to support metrology education, training, and metrology outreach through solicitation and oversight of grants and charitable contributions in the NCSLI Education Development Fund (EDF), the management of scholarships, and the oversight of awarded grants and contracts that are associated with strategically selected metrology education, training, and outreach projects.

2008 Activities
- Manage NCSLI Scholarship Resources, investigate new/international scholarship opportunities, and administer the NCSLI Education and Training award.
- Pursue new opportunities to obtain resources for education and training activities including Combined Federal Campaign, United Way, planned giving, and open solicitation from members and others.
- Implement and promote opportunities to support the NCSLI EDF. You may have seen the press release announcing this new program in May 2007 or the end-of-year request that highlighted a number of projects that we can only do if we obtain funds outside of the usual NCSLI budgeting process. You can contribute online by going directly to the Educational Development Fund in the NCSLI Store.
- Develop and implement the financial infrastructure needed to manage solicitations, income, grants, and contracts through the EDF, and institute an ongoing process to identify and select projects that have the greatest opportunity for impact. Write and disseminate requests for project proposals and information. Evaluate project proposals.

Primary projects requiring funding include:
- Multimedia DVD and Website Products - for use in outreach to teachers, students, and career counselors (a request for proposals is being developed);
- Needs Assessment Study - to determine current courses that are available, to identify what courses are needed, and present a gap analysis to allow the metrology community to focus training efforts;

Continued on page 18
• Sponsor 5000 copies of the American Society for Engineering Education - “Engineering - Go For It!” handout that can be used as an outreach tool to generate interest in metrology and engineering;

• Virtual Physical Laboratory - an interactive software tool for outreach to teachers and students and for use in secondary and university classrooms;

• Educational Measurement Kits - hands on demonstration tools for Outreach Ambassadors to use in classrooms; and

• Enhanced scholarship resources.

163: Workplace and Professional Development
Chair: Gloria Neely (gloria.neely@navy.mil)

Ensure that appropriate methods or systems are available in the workplace to provide appropriate recognition, qualification, credibility, and remuneration for the metrology professions. Ensure ongoing professional development in metrology and calibration careers by providing guidance, resources, and best practices to metrology and standards organizations, human resources offices, unions, and professional staff. Ensure that clear career paths are identified, communicated, and tracked as widely as possible and ensure that metrology and calibration careers are adequately recognized in the world-wide marketplace.

2008 Activities

• Create a new Recommended Practice on “How to Develop Training and Succession Plans” to support Workplace Development. A session on this topic will be held at the 2008 NCSLI conference.

• Develop a new standard “HR Package” that incorporates resources from the 2006-2007 Job Description Initiative and the 2007 NCSLI Benchmarking Study. This package will be available to disseminate to human resource offices in support of metrology/calibration positions. We will also continue our efforts with the U.S. Department of Labor and the U.S. Office of Personnel Management to integrate metrology/calibration job descriptions and labor statistics into publications and processes.

164: Education Liaison and Outreach
Chair: Chris Grachanen (chris.grachanen@hp.com)
Co-Chair: Phil Smith (psmith@2la.org)

Provide multiple forums for educators to interact on topics related to metrology learning and development, to encourage sharing of ideas and resources, and to help ensure that metrology stakeholder educational needs are met. Ensure awareness of metrology, measurement sciences, and needs for calibration and standards in such a way that it is readily recognized by educators, students, related professional organizations, and the general public. Develop and support initiatives and programs enabling world-wide Metrology Learning and Development.

2008 Activities

• Develop and provide resources, training, and encouragement to facilitate:
  1) educator and student involvement in NCSLI Sections, and
  2) section/member outreach to schools (K-12) and universities as Metrology Ambassadors (see article in January 2008 metrologist).
CONVERSATIONS with Metrology Ambassadors

by Christopher L. Grachanen

In my last article for *metrologist*, I talked about various ways individuals can become metrology ambassadors by engaging in activities which help enable/promote the metrology profession. To continue the theme of metrology ambassadorship, in this article I have interviewed a number of individuals who were identified by their peers as being metrology ambassadors. These individuals have volunteered their time and efforts toward metrology outreach activities in order to help get the word to students and educators about the metrology profession and to help potential candidates better understand what challenges/opportunities/rewards await them in a career in metrology. We commend these metrology professionals for their efforts; they are truly deserving to be recognized as metrology ambassadors. Our conversations begin with a series of questions posed to our ambassadors but first introductions are in order. Metrology ambassadors interviewed are:

Elizabeth J. Gentry (EG)
NIST, Weights and Measures Division, Laws and Metric Group
(164 committee member)

William Hinton (WH)
Florida Power and Lights, Seabrook Nuclear Power Station (FPL-SNPS)
(153 Utilities Committee chair)

Carol T. Hockert (CH)
NIST, Chief Weights and Measures Division (NCSLI President for 2008)

Van Hyder (VH)
North Carolina Department of Agriculture & Consumer Services

Thomas Weidmyer (TW)
Fairchild Controls Corp.
(164 Committee member)

Let us begin. Please note that I have used the interviewee’s initials to identify their responses. Some responses were edited for brevity.

Q: What prompted you to start your outreach activities?
EG: I became aware of and interested in metrology outreach activities when I attended my first NCSLI Conference (2005). The education and training sessions, which included the Strategic Framework and Knowledge Transfer topics, and ‘voting with the dots’ got me thinking about the future of metrology. I realized as a member of Generation X, I would be directly impacted as a part of the metrology workforce left to deal with the metrology personnel crisis when the baby boomers retire. That was my wake-up call.

Q: What was one of the most interesting/rewarding outreach activities you were involved in?
EG: Please don’t ask me to nail it down to one! Since I have been at NIST, I have had the opportunity to participate in the NIST Summer Middle School Teacher Institute, “Adopt-a-school” Partnership, “Science Get Psyched” (Girl Scouts), “Adventures in Science” (4-H), “Goals for Girls” Mentoring, and the “Sally Ride Toy Challenge” (Sigma Xi). I enjoy sharing my knowledge of measurement science and the metric system. My involvement with NCSLI Committee 164 has also been rewarding. The NIST Metric Program has been able to provide several metric (SI) publications to NCSLI region and section coordinators and other Metrology Ambassadors.

Q: What was some of the feedback you got from this activity?
EG: I have received positive feedback on the current 164 committee projects and have noted several opportunities for improvements. For instance, 2007 NCSLI conference attendees were able to see a first glimpse of the Metrology Outreach PowerPoint template that was presented
Learning and Development

by 164 committee member Michelle Fon-cannon. I have also received positive feedback from educators who appreciate materials that supplement their measurement and metric system (SI) lesson plans. I recently handed out NCSLI hologram metric rulers at an “Adventures in Science” event in Frederick, MD. You should have heard the “oohs” and “ahs!”

Q: What outreach activities do you plan for the future?
EG: I enjoy working on projects and strategies that focus on guiding younger aged children into the STEM (Science, Technology, Engineering, and Mathematics) education pipeline and ultimately the metrology labor pool. I would like to work on developing metrology career information in formats that will be used by our technosavvy youth (such as the 164 committee interactive DVD being developed). I don’t want to overlook college students who have already committed themselves to STEM track careers by working with universities programs, professors, and textbook authors to better integrate metrology information. I am also very excited about getting new metrology outreach tools in the hands of those who hold considerable influence on career choices.

Q: How can NCSLI help support your outreach activities?
EG: Become a Metrology Ambassador. Wouldn’t it be great if every individual member of NCSLI participated in one metrology outreach event this year? What an impact! The 164 committee needs to hear about your individual metrology outreach activities and how the NCSLI outreach tools are being used. NCSLI Metrology Ambassadors need to continue to share information on how the tools are working as well as identify additional outreach needs.

Q: What advice would you give to others contemplating outreach activities?
EG: Test the waters at home by using your laboratory, professional, and community connections as a starting point. Contact the teachers where your children go (or went) to school. Offer to enrich a science or math classroom with a one hour measurement science presentation. Contact a professor at a local university or your alma mater to invite students to an upcoming NCSLI section meeting. Introduce them to a career in metrology!

Q&A session with the students on the operation of FPL-SNPS and my job in the metrology laboratory. The instructor asked if I would repeat this event in the fall with both the honors chemistry and honors physics classes. I arranged the class visit and brought several pieces of M&TE to add realism along with a PowerPoint presentation. This was followed by a class visit to FPL-SNPS for six students with their instructors.

Q: What was one of the most interesting/rewarding outreach activities you were involved in?
WH: I enjoy the classroom time answering questions and interacting with the students. I have always been a hands-on person and I make an effort to ensure the students get involved in the discussion and have an item of M&TE to hold and inspect. I still see several of the students in my local community and one individual still talks about the visit to the plant, especially his chance to trip the reactor. It must be a guy thing.

Q: What was some of the feedback you got from this activity?
WH: My interviews with the students and feedback from the instructors revealed that this activity may need to be moved to the middle school as well. These students were seniors and most were already mapping out their college plans. The education establishment does not have a significant presence from the metrology
industry and none of the students voiced a desire to enter into the science of metrology. One student was planning on entering engineering but had no concept of how it could be applied to Metrology. They all asked, “How much do you make?”

Q: What outreach activities do you plan for the future?
WH: I am currently planning the spring version of last fall’s outreach activities at the request of the head of the Science Department. I am also working with the FPL-SNPS management in a similar effort of education outreach since this is a goal for FPL as well as NCSLI and the Utility Committee. Our site Vice President and his team are currently engaged in discussions with the State of New Hampshire to possibly arrange technical training through the state Vocational - Technical institutions in a manner similar to what is presently implemented by our counterparts in Florida. FPL actually sponsors seats in classes provided by the Dade County Community College for FPL employees who desire to advance their careers. Other seats are available to non-FPL students and FPL will offer internships to these students and possible employment upon successful graduation.

Q: How can NCSLI help support your outreach activities?
WH: Classroom materials and information packets would be excellent. Recommended content and suggested activities would be of benefit as well. The classroom materials and site visits I employed were crafted from previous training material and education center products. It worked very well but could be better. Age

Continued on page 22
appropriate material for the different primary school students would be a good approach as well.

Q: What advice would you give to others contemplating outreach activities?

WH: Obtain the support of your management (time and money) and the involvement of others at your facility such as the training department, Human Resources and technicians in your lab. It was the metrologist that arranged the laboratory calibration stations and provided the instruction and hand-on experience that really made it a success. The bottom line is, step out there and do it. The one student that showed excellent promise in his grasp of the technology is planning on being a disciple of measurement.

Q: What was one of the most interesting/rewarding outreach activities you were involved in?

VH: I participated in the Science Go Round at Morrisville Elementary School in Morrisville, NC. A friend is the chair for this year’s Science Go Round. She had about six or seven different scientists come to speak to over 150 students. Each scientist was given a classroom for the day and each period a new class would come to my room. The ages ran from kindergarten to 5th grade. I really enjoyed trying to teach the kids about the importance of measurement. It is a challenge to present material to such a wide range of knowledge and experience but I think the 5 year olds were just as inquisitive as the 11 year olds.

Q: What was some of the feedback you got from this activity?

VH: The main feedback I received is that very few adults, let alone children, know what metrology is. I would stop about every 5 minutes and ask “what is metrology?” and by the end of the 45 minute period everyone would answer “THE SCIENCE OF MEASUREMENT!” It is also enlightening for people to realize everything they do or use can be measured.

Q: What outreach activities do you plan for the future?

VH: I am scheduled to speak to both of my son’s classes this spring. They are in 4th and 2nd grade at different elementary
schools. The second day of the Science Go Round is March 11, 2008.

Q: How can NCSLI help support your outreach activities?

VH: NCSLI can help by providing “freebies” to hand out at the schools. I wish they made a less expensive cubit. It would be great to leave one with the teacher when I’m finished. There are generic PowerPoint presentations out there that help guide the presenter. More tools like this would be helpful.

Q: What advice would you give to others contemplating outreach activities?

VH: Just do it! The more you speak, the more questions you can answer. Everything can be measured in some respect. I’m always looking for better ways to make measurements, and maybe someday a kid I spoke with may revolutionize the measurement community. I hope that I can raise awareness of metrology and further our field by encouraging future generations to make good measurements.

Q: What prompted you to start your outreach activities?

TW: While traveling around the World almost everyone asks: what do you do for a living? When I explained, no one knew what metrology was, and their first guess was ‘Weather Man.’ This prompted me to look at fitting together measurement science (Metrology) into the present science syllabus taught at schools, and achieve buy-in from teachers and students through the Metrology Ambassador Outreach program.

Q: What was one of the most interesting/rewarding outreach activities you were involved in?

TW: Talking to students and showing them what we do as metrologists.

Q: What was some of the feedback you got from this activity?

TW: EVERYONE was interested in measurement science because I informed them how we use measurements in our daily lives giving examples like: supermarket charges per pound of meat, vegetables, and how every item has a stated weight listed on products etc… (how accurate?)

Note: I was very enthusiastic about my profession, and they all remembered that!

Q: What outreach activities do you plan for the future?

TW: All the high schools in my area and locations where I plan to visit in the future.

Q: How can NCSLI help support your outreach activities?

TW: Support from NCSLI, such as: M&TE kit for show and tell for students, metrology ambassador badge with photo and name for identification when entering schools, complimentary coffee mug, hat, pen, pencil … etc, a lasting souvenir of our Metrology Outreach efforts and Metrology Outreach business cards from NCSLI for contact purpose on Metrology Outreach efforts for other classes or schools.

Q: What advice would you give to others contemplating outreach activities?

TW: Believe in what you do and add lots of energy, the reward is to PAY IT FORWARD. Make it a personal GOAL to mesh measurement science (metrology) into the science syllabus presently taught at schools. Get teachers and students to buy into the measurement science subject matter so metrology will be added to the science curriculum. Be a LEADER and get the word out. “We Don’t Do Weather” … “We Do Measurement Science”

I would like to thank our metrology ambassadors for their volunteer efforts in helping inform students and educators about the metrology profession. In sharing their outreach stories, our metrology ambassadors have given us all pause to consider how we can help stem the tide of an ever dwindling metrology workforce by getting involved and help spreading the word about the metrology profession to young folks. We know that there are many more of you reading this article who have invited teachers and students to your NCSLI section meetings, invited students on tours through your labs, and participated in many of the other things I suggested in my last article. World Metrology Day is coming up soon – maybe you have enough ideas to be an ambassador on a day we all will celebrate!

In our next article on metrology ambassadors, I hope to share information about tools and resources you can use while conducting ambassador activities. If you have ideas or stories to share, please feel free to contact me.

Only by the efforts of individuals and professional organizations can we hope to avert a potential metrology workforce crisis as baby boomers retire from the profession. Consider becoming a metrology ambassador.

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Thomas Weidmyer

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Optical fiber power meters (OFPMS) are one of the most common forms of test equipment for optical fiber communication networks, directly impacting every individual who makes a long distance phone call or uses the Internet. An OFPM is used to measure the optical power that exits an optical fiber. A typical OFPM consists of a sensor, a window, and a fiber adapter. Optical reflections among these components can introduce errors, which appear as offsets, into power measurements. (See Figure 1.) Common fiber connectors are shown in Figure 2.

We have measured OFPM offsets as high as 12 % when different fiber connectors are used to mate an OFPM and an optical fiber source or even when the same type of fiber connector, made by different vendors, is used to connect an OFPM and source. [1]. These offsets are due to multiple reflections from the OFPM window, detector and connector’s ferrule. (See Figure 1.) These reflections may produce interference effects that will lead to an OFPM reading that is higher than expected with an unconnectorized source. Often, adapters are used to connect an OFPM and a source with different fiber connectors. However, the junction between the fiber connector and the adapter can contribute up to 4 % offset in OFPM measurement. More seriously, the magnitude of the connector-induced offsets is a function of wavelength of optical source. Thus, substituting either a different type of fiber connector or another vendor’s connector for another can invalidate a calibration result.

To determine the magnitude of potential connector effects, NIST researchers conducted a study involving the calibration of OFPMs described in detail in [1]. Six popular connector types were selected for the study: FC/PC, biconic, SC, ST, FC/APC, and SMA (see Figure 2) from four vendors chosen randomly (the vendors are identified by letters A through D). These connectors were attached to single-mode fiber cables. Measurements were performed on four types of OFPMs (the meters are identified by numbers 1 through 4) at three wavelengths: 850, 1310, and 1550 nm. The four types of OFPMs were (a) Si and Ge remote sensors with angled window (OFP #1), (b) InGaAs fiber-pigtailed sensor (OFP #2), (c) Ge sensor with flat window (OFP #3), and (d) windowless Ge sensor (OFP #4).

**Same vendor, different connector type**

All of the connectors in the study had ceramic ferrules, except the metallic connector ferrules from vendor B and the SMA from all vendors. Table 1 documents the results of measurements taken with four OFPMs from four different vendors at 1550 nm. The difference...

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between the values of maximum and minimum offset (expressed in percent) shows the range of possible offsets when a vendor’s OFPM is used with different fiber connector type. The largest range of offsets was found for OFPM #3 when connectors of vendor B were used.

**Same connector type, different vendor**

Table 2 compares connectors of various vendors using a specific OFPM and connector type (biconic and ST). Table 2 shows the results of measurements taken with four OFPMs and compares the measurement results from three vendors to the reference connectors of vendor A at 1550 nm. The largest offsets at 1550 nm were found for OFPM #3 when ST connectors of vendor B were used.

**Free space versus fiber-coupled laser beam**

Table 3 documents results of measurements taken with both free space and fiber-coupled laser beams for three different OFPMs. The largest spans of offsets (from maximum to minimum) were found for OFPM #3 when various connectors of vendor B were used.

**Conclusion**

In conclusion, the only way to ensure accurate measurements of optical fiber power is to have your OFPM calibrated in the configuration that you intend to use it. Users must consider the fiber connectors and adapters that they will use as well as the optical wavelength and power. There is no consistent methodology for predicting the magnitude of the offsets that occur when different fiber connectors and/or adapters are used with a calibrated OFPM. In addition, users should not assume that the calibration results obtained from fiber-connectorized measurements will be the same as those obtained with free space laser beams. NIST offers a suite of measurements services for comprehensive characterization of OFPMs. For more information, please visit the NIST Optoelectronics Division calibration web page at www.boulder.nist.gov/div815/Calibrations/LPEC.htm.

**Reference**


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In 1947 and 1948 there existed within the American Institute of Electrical Engineers (AIEE) the AIEE Subcommittee on High Frequency Measurements, the parent committee being the AIEE Committee on Instruments and Measurements. Dr. Harold Lyons, Chief of the Microwave Standards Section of the CRPL, was a member of this subcommittee. It was an enthusiastic group that believed the time had come for a national conference relating primarily to measurements and instrumentation at high frequencies (above the audio range), including the microwave range (considered at the time to be from 300 MHz upwards to the millimeter wavelengths). This subcommittee met in New York City in the spring of 1948 to plan this national conference on high frequency measurements. The result was a joint effort of the AIEE, the Institute of Radio Engineers (IRE), and the National Bureau of Standards, with the AIEE Subcommittee assuming the leading role. Washington, D.C., was selected as the location of the conference, with Lyons in charge of the Local Arrangements Committee.

The 3-day meeting, called the “Conference on High Frequency Measurements,” was held in January 1949. It succeeded much beyond expectations. The quality of the technical program was high, and there were 549 registrants. Thus was initiated the first of a series of biennial conferences on precision electromagnetic measurements that continues to the present time.

The second Conference was planned well in advance with a somewhat different organizing structure than the first conference. The IRE Professional Group on Instrumentation had been organized in March 1950. Thereafter, a Joint AIEE/IRE Committee on High Frequency Measurements was organized consisting of the AIEE Subcommittee that functioned at the first conference. The IRE group of the Joint Committee was formed from the Professional Group on Instrumentation. Preparing for and conducting the second conference was a combined effort of the Joint Committee and NBS. The second conference was again held in Washington, with an attendance approximately the same as the first conference.

Attendance at the third conference [January 1953] proved to be greater than either the first or second, with a total of 669 registering for the 3-day meeting. The biennial event appeared to be firmly established, with Washington as the place of meeting. And again the conference was under the joint sponsorship of the AIEE, IRE, and NBS. For the first time an international touch was placed on the conference by the presence of Louis Essen of the National Physical Laboratory located at Teddington, England. Essen was invited to present a paper on the precise measurement of the velocity of electromagnetic waves.

The Fourth Conference was held in Washington in January (1955). However, conditions had changed. Personnel of NBS who had taken leading roles in staging the earlier conferences had been transferred to the new Boulder Laboratories in Colorado. As a result, the Fourth Conference was disappointing by comparison with the earlier conferences as measured by the registration. Rejuvenation would come 3-1/2 years later in Boulder, Colorado.

With a renewed interest, coming mainly from the Boulder Laboratories personnel, in restaging the High Frequency Conferences, steps were taken in 1957 and early 1958 to plan for a conference in the summer of 1958 in Boulder. A planning group met in January 1958 at the Boulder Laboratories and a General Arrangements Committee was organized with Bernard M. Oliver (Hewlett-Packard Co.) as chairman, representing the IRE Professional Group on Instrumentation. Ivan Easton (General Radio Co.) represented the AIEE and served as chairman of the Technical Program Committee. Once again it was a cooperative effort of the AIEE, the IRE, and NBS. A new name was selected: Conference on Electronic Standards and Measurements, and the conference would now cover a wide scope of research and the measurement art. The frequency range would be less restricted, beginning with direct current (zero frequency) and extending into the millimeter wavelengths of the electromagnetic spectrum.

The expected 400 registrants swelled to more than double, reaching 870. With families, the entire assemblage reached 1200. Combining a vacation with attendance at the conference.
drew many families to the Boulder meeting. The 3-day conference was held at the Boulder Laboratories in August 1958. The first morning was given over to the dedication ceremony for the new Electronic Calibration Center. The conference was a marked success and served to continue the four earlier conferences dating back to 1949.

Embodying the outstanding success of the 1958 Conference at Boulder, the next conference was held again at Boulder during June 1960. Again, sponsorship was a joint effort of the AIEE, the IRE, and NBS. Ivan Easton, representing the AIEE, was chairman of the General Arrangements Committee, and George E. Schafer, of the Radio Standards Laboratory, NBS, was chairman of the Technical Program Committee. Subject matter of the six technical sessions was much the same as the 1958 conference with at least one modification, that of scheduling a session titled, “Current and Future Problems in Standards and Electronic Measurements.” At this first session, Harvey W. Lance, chief of the Electronic Calibration Center at the Boulder Laboratories, presented a paper entitled, “The Nation’s Electronic Standardization Program: Where Do We Now Stand?” Most significant of the topics discussed by Lance in his paper, at least when viewed in the light of the passage of time, was his statement relating to “a serious need for an association of standards laboratories.” [Mr. Lance’s suggestion, of course, led to the formation of the NCSL.]

As a result of the two highly successful conferences held in Boulder, a permanent organizational committee was formed to organize future conferences. The committee consisted of the chairman of the AIEE Instrument Division, the IRE Professional Group on Instrumentation, the chief if the Radio Standards Laboratory (NBS), and the senior and junior past-chairmen of the 1960 Conference.

The 1962 Conference took on a new complexion, that of international participation. The name changed once again to: International Conference on Precision Electromagnetic Measurements. A dozen international papers were presented at the conference, coming from five countries. Partial support of the conference to provide the international participation came from a grant by the National Science Foundation. Appearing for the first time in the title of a technical session was the subject of “Quantum Electronics.” It would be a common subject at future conferences. For the 1962 Conference, as well as for the two previous conferences at Boulder, a well-organized and large-scale “Open House” of the Boulder Laboratories was staged. Demonstrations and explanations of measurement techniques were made available to the conference registrants and visitors in many rooms of the Radio Building and the Cryogenic Engineering Laboratory.

The 1964 Conference on Precision Electromagnetic Measurements [note the subtle name change, dropping ‘International’ in favor of the year] met in Boulder during June. By 1964, Boulder had become the accepted locale for the biennial event. For the first time since the 1949 Conference, sponsorship of the series of conferences changed. The Institute of Electrical and Electronics Engineers (IEEE) had formed by 1963 with the combination of the AIEE and the IRE, and the newly formed Professional Technical Group on Instrumentation and Measurement was now the organization interested in the affairs of the CPEM. Sponsorship of the 1964 Conference came from the IEEE, the NBS, and U.S. Commission I (Radio Measurement Methods and Standards) of the International Scientific Radio Union (URSI). At the 1964 Conference papers on lasers first appeared on the technical program.

The 1966 Conference was highlighted by the presence of Dr. J. Terrien, director of the International Bureau of Weights and Measures, Sevres, France, who gave the Keynote Address. Later he took part in an evening program of an informal panel discussion on the national measurement systems of various countries. The discussion was moderated by Harvey Lance of the Boulder Laboratories. Eleven participants representing nine countries took part on the panel. John Richardson, chief of the Radio Standards Laboratory, represented the United States. Each spoke on the national measurement system and the national laboratory of his respective country.

One evening was set aside at the 1968 Conference for a discussion on international comparisons of standards and measurements. The program was chaired by Dr. Chester H. Page, chief of the Electricity Division, NBS. Again, Dr. Terrien of the International Bureau of Weights and Measures took part in the meeting. Three countries were represented in this special program.

By the time of the 1972 Conference a cooperating sponsor had been added to the “old guard” of the IEE, the NBS (the Institute of Basic Standards), and the U.S. National Committee (formerly only U.S. Commission I) of URSI. Joining in sponsorship was the international organization of URSI, the Union Radio-Scientifique Internationale.

After eight conferences, held biennially in Boulder from 1958, and the four earlier conferences in Washington, D.C., the international step was taken to hold the 1974 Conference in London, England. Added to the sponsors of the 1972 Conference were: the Royal Society and the Institution of Electrical Engineers; plus three cooperating sponsors: the Institution of Electronic and Radio Engineers, the National Physical Laboratory, and the Scientific Instrument Manufacturers’ Association, all England-based organizations. Of a total of 136 papers presented at the conference, 38 came from the United States, with 11 each from NBS Washington and NBS Boulder. In all, papers came from a number of countries scattered around the world.

The 1976 Conference returned to Boulder, CO. with the salutatory theme:

“CPEM 76 Salutes NBS
National Standards – 75 Years of Progress”

The unexpected success of the First Conference, in 1949, held in Washington, has continued through 14 conferences to the present time. By 1960 a permanent committee, later to be called the Executive Committee, was organized in order to establish continuity and sound planning from one conference to the next. From the beginning NBS, and particularly the “radio” (and later the “electromagnetics”) personnel, have taken a prominent role in preparing for and staging the conferences. All but one had been within the environs of NBS, and 10 at the Boulder Laboratories. Throughout its existence the CPEM has been closely associated with NBS.
Advertising is a huge part of pop culture. Sure, we sometimes scoff at advertising and say that it doesn’t work, and often switch channels when commercials interrupt the program we are watching. I once knew an engineer who disliked advertising so much that he ripped all of the ads out of a magazine before he read it. Regardless of whether we like them or not, it’s amazing how many advertising slogans are embedded in our memory. Remember the poor guy in the bathrobe who said “I can’t believe I ate the whole thing” right before he downed an Alka-Seltzer? Or, how about the aggressive little old lady (played by Clara Peller) in the Wendy’s commercials who demanded: “Where’s the beef?” These slogans represent pop culture at its finest, and were once repeated all across America. Walter Mondale even asked “Where’s the beef?” when he ran against Ronald Reagan in the 1984 election — not that it did him much good.

Believe it or not, many ads contain information related to metrology. The ultimate goal of all ads, of course, is to get the audience to buy the product or service being advertised. Getting the audience to buy your product requires making them believe that it’s better than products offered by your competitors. Proving it is not necessary, you just have to make the audience believe it. Of course, there are lots of ways to attempt this, and some are a bit far-fetched. They might involve images of old guys with young wives sailing on yachts (so we believe we should listen to E. F. Hutton) or beautiful almost-naked people having fun on the beach (so we believe we should drink Mike’s Hard Lemonade). But at their core, most ads try to favorably compare their product’s specifications to their competitor’s product, often in very subtle ways. For example, when we hear “tastes great, less filling” we are being told that Miller Lite is “less filling” than some other unnamed beer, and we assume that somebody, somewhere must have done some type of measurement or survey to reach this conclusion. Product specifications are obtained by measurements, and the job of the ad writer is to distill measurement data into something simple that the average consumer can remember and understand. With that in mind, let’s look at some of the better known metrology-related ad slogans.

**Four out of five dentists recommend Trident sugarless gum for their patients who chew gum.**

— Ad for Trident sugarless gum that first appeared in the 1970s

**Connection to metrology:** coverage factor, confidence limits, outliers

**Comments:** This is probably my favorite ad slogan, because it was so much fun discussing what the “fifth dentist” wanted us to chew. I suppose that the fifth dentist favored a different brand of sugarless gum. But the cynics and comedians out there used to joke that the fifth dentist wanted us to chomp away on golf ball sized wads of sugar-filled “Dubble Bubble” until our jaws ached. The resulting gold fillings would allow dentists to send their kids to Ivy League schools and buy a summer house on the beach.

**Quality is Job One.**

— Ford Motor Company slogan, used for 17 years beginning in the mid-1980s

**Connection to metrology:** quality control, product testing

**Comments:** Ford introduced this slogan after American automakers had lost a massive amount of market share to the Japanese. They wanted to tell potential car buyers that Ford’s entire workforce was now committed to delivering a quality product. It was hard at first to make car buyers forget about a series of bad products, including Ford Pintos that literally caught fire, but the cars gradually got better and the campaign was a success.

**A silly millimeter longer.**

— Chesterfield cigarette ad slogan, late 1960s

**Connection to metrology:** SI units, dimensional measurements

**Comments:** If you are old enough, you’ll remember when cigarette ads dominated the airwaves. Those days ended in 1971 when Congress banned the advertising of cigarettes on radio and TV. A few years before the ban, several companies had intro-
duced extra-long 100 millimeter cigarettes. Chesterfield countered with its so-called 101 brand, which were 101 millimeters long, or one millimeter longer than their competitor’s offerings. The commercials featured a jingle sung to the tune of the Richie Valens hit "La Bamba:"

A silly millimeter longer, It isn’t much
But wait until you taste it, It’s one better

It’s interesting to note the use of an SI unit in these commercials, because America is still resisting the use of the metric system some 40 years later. To the copy writer, of course, “a silly millimeter” was undoubtedly catchier than “a silly 39/1000th of an inch.”

99 and 44/100% percent pure.
— Ivory Soap slogan that dates back to 1882

**Connection to metrology:** quality control, product testing, uncertainty

**Comments:** This ad was telling us that Ivory soap was really, really pure. But did you ever wonder what that other 0.56% of Ivory soap contains? Nuclear waste, maybe? No, the part of the mixture that was not pure soap consisted of 0.28% carbonates, 0.17% mineral matter, and 0.11% uncombined alkali. There was also air in the mixture that gave Ivory soap its most famous feature – it floats!

Rolaids consume 47 times its weight in excess stomach acid.
— Advertising slogans once used for Cadillac automobiles

**Connection to metrology:** Product testing, uncertainty analysis

**Comments:** I’ve popped a few Rolaids, but can’t say that I’ve ever weighed one. These ads were so popular, however, that many chemistry professors have since asked their students to test Rolaids’ advertising claim as a laboratory exercise, with most studies showing that “47 times” is actually conservative.

**Accuracy to seconds a month.**
— Advertising slogan for Pulsar watches

**Time changes everything. Except a Rado.**
— Advertising slogan for Rado watches

**Citizen. Beyond Precision.**
— Advertising slogan for Citizen watches

**Connection to metrology:** Accuracy, uncertainty analysis

**Comments:** Wristwatches are the only metrological instruments that most of us wear as part of our regular attire (unless you walk around the house with a tape measure on your belt or a thermometer in your pocket), so it makes sense that accuracy would be used as a selling point. But ironically, the best known watch ads touted reliability instead of accuracy. They featured the newsmen John Cameron Swayze, who told us that Timex watches “take a licking, and keep on ticking.” That campaign was incredibly successful. During the late fifties and early sixties one out of every three watches sold in America was a Timex.

**Creating a Higher Standard. Standard of the World.**
— Advertising slogans once used for Cadillac automobiles

**Connection to metrology:** Standards, references

**Comments:** Cadillac was awarded the Baldrige award for quality back in 1990, and their automobiles have long been considered the standard by which other American autos are judged, a point that the company has reinforced with its advertising. These slogans remind me of the scene in Donnie Brasco where Al Pacino argues that Cadillacs are better than Lincolns – “Ain’t no way you can say to me a Lincoln is better than a Cadillac. Fuhgetaboutit. Cadillac has got more acceleration, its got more power, its got better handling, its got what — its got more leg room for your legs ...”

I just saved a ton of money on my car insurance by switching to GEICO.
— Current slogan for GEICO insurance

**Connection to metrology:** None whatsoever.

**Comments:** Those commercials are so over the top that I had to mention them somehow!

All kidding aside, the subtle use of measurement data in advertising demonstrates that metrology can help sell products. Let’s close with perhaps the most memorable metrology related ad slogan, one that was once used to pitch Zenith televisions. Every metrologist who has performed a product test, reported calibration results, or assessed a laboratory can relate to this one:

**The quality goes in before the name goes on.**
Amen to that. ■

Do you know of any references to metrology in pop culture (from literature, movies, music, sports, advertising, television, theater, etc.)? If so, drop me a line at lombardi@nist.gov. We’ll try to include your reference in a future column, and if we do, we’ll give you credit for the suggestion.
One of these days, perhaps in 2011, the decision will be made to redefine the kilogram. When this happens, the unit of mass will no longer be derived from an artifact maintained and used at the International Bureau of Weights and Measures, putting an end to a remarkable 120-year history. Why has an artifact manufactured in the 19th century served so long, and why is it no longer deemed adequate by a number of measurement scientists? These are interesting questions that I hope to answer.

The artifact in question is known as the international prototype of the kilogram. It is a cylinder of platinum-iridium alloy. The present definition of the kilogram could not be more straightforward: a kilogram is equal to the mass of the international prototype. The idea is simple and the artifact is handsome. This is a definition based on Newtonian physics and, of course, predates the scientific revolutions of the 20th century. The very simplicity of the current definition of the kilogram makes it the paradigm for an SI unit definition that everyone immediately understands. As metrologists, we also readily understand why the international prototype (or indeed any artifact) can never be a perfect standard. The general public is often less discerning, leading to waves of sensationalized stories circulating in cyberspace and the print media.

Some proposed new definitions will be presented, along with their practical realizations. It seems clear that the new definition of the kilogram, whichever proposal is ultimately chosen, will have the following consequences: the definition will be understood by fewer people; sensationalized media stories will gradually disappear; the cost of realizing the new definition will exceed the cost of 1000 g of precious metal; the change will be invisible to all but a very few; and life will go on. A venerable SI definition will have been superseded but something quite valuable to metrology and metrologists will have taken its place.
As a writer, I subconsciously correct the mistakes in everything I read. One might call it an occupational hazard. When spell-checker debuted a number of years ago, I welcomed it as a way to make my job easier. While it does to some degree, it can also produce maddening moments when the software suggests corrections that are downright nonsensical. When this happens, I ignore them and move on.

What about the young people, however, who are coming of age surrounded by technology that not only offers to correct their mistakes but sometimes does so without their even knowing it. As you can see from the nearby GenTistic, employers are frustrated by the lack of reading and writing skills among the emerging generation. That’s no secret. But rather than add my rants to others, let’s talk solutions.

Too many of these Millennials have concluded that simply pressing the F7 button on the keyboard will take care of all their spelling and grammar issues. (For the uninitiated, F7 launches Spell and Grammar-Check in Microsoft Office.) I’m not here to pillory Microsoft. It is only human nature to take the easy way out. Thus the conundrum.

So what can an employer do to ensure that employees can read and write to a productive standard?

Begin by establishing what that standard should be. While reading anything other than safety instructions might be a luxury for front-liners on a construction site, it may be the critical skill for those in some professional environments.

Continue by developing a method for assessing the reading and writing skills of all serious applicants. There is no alternative here. This assessment should be designed in accordance with the reading and writing performed on the job. In fact, using samples from the job protects the firm from possible litigation. For a contractor, this might be the instructions on a can of WD-40. For a software firm, it might be reading and reviewing a passage from a manual or an industry journal. Remember, this is not just about literacy. It is about the employee’s ability to write and comprehend at the level required.

Next, decide the level at which the firm will enforce this. While it might be ideal to have all employees reading and writing at a 12th grade level, it is probably unrealistic if you are to hire enough people who possess the other qualifications required. Hiring someone who meets all the other requirements, but struggles with the reading/writing assessment leaves you with a choice. But at least you are aware of this limitation and can work with the person to improve, should you choose.

The process does not stop with selection, however. Establish clear expectations for written communication within the organization. With the emergence of a texting lexicon and the explosion of abbreviations, this becomes especially critical. Young people, in particular, need to practice a balance between communicating efficiently and effectively depending on whether they are texting, e-mailing, or drafting a letter on paper.

Finally, these expectations need to be enforced at all levels. In the haste of today’s business environment, it can be tempting for employees of all ages to rationalize sloppy writing. But with the competition in most industries, leaving a poor impression because of less-than-perfect communication can materially impact the bottom line over time.

If the firm’s productivity and reputation are to be maintained, the reading and writing that goes on inside is of paramount importance.

Robert W. Wendover is the Director of The Center for Generational Studies. Contact him at wendover@gentrends.com
T he early parts of 2007 offered great hope for US funding in science and metrology research, but in the final hours the situation took a major turn for the worse.

This past summer, Congress passed overwhelmingly a “Competes Act” that included even higher authorization levels of spending for research and related innovation areas. For the first time in many years the House and Senate had agreement on bolstering funding for the physical sciences (NSF, NIST, and DOE Office of Science). A number of other activities led to considerable optimism as Congress moved through the appropriations process.

Then in late December there was a “train wreck” as, from our perspective, the whole process unraveled quickly and funding effectively disappeared. NIST research funding received a budgetary increase of only 1.3%, well below the salary adjustments they had to make. The only alternative appears to cut needed research, and that does not bode well for any of us.

So in January NCSLI International sent letters to a number of people in Congress. (It is this committee’s responsibility to draft such letters.) These letters briefly outlined what we are, what the current situation is in the science funding, and potential impact of such a cut. We called for a restoration of the research funding to the levels previously approved by Congress and recommended by the President.

This effort will be more effective if member companies also petition Congress to take similar steps. Hopefully in February you received an email asking you and your company or organization to contact Congress in a similar response. If you have not, it is not too late.

Education Outreach

A very successful education outreach project was initiated between Florida Power and Light - Energy’s Seabrook Station Metrology Laboratory and a local high school in Rochester, New Hampshire. Two days of activities, beginning with in-school basic power plant fundamentals and hands-on activities with a collection of M&TE was followed by an entire day at the plant simulator and Metrology Laboratory. The education aspect of our industry is now a pivotal part of the organizations short and long-term goals and has been incorporated into the Utility Committee 2008 goals as well.

Education is an equally important aspect for our member’s career growth and enrichment as demonstrated by the dramatic increase in tutorial participation at the various conference venues. I was lucky enough to attend the south central section meeting in January that included an entire day of FREE tutorials. Section Chair Keith Scoggins demonstrated that it really can be done and with style. The Northeast Section has asked to work with the Utility Committee to explore possibilities of a comparable event in the Northeast. Additional information will be provided as discussions proceed.

Accredited Laboratories

Since the 2005 approval letter issued by the NRC (Nuclear Regulatory Commission) approving the Palo Verde Nuclear Generating station request to use ISO 17025 accredited calibration laboratories, questions surrounding the implementation of the process and variations in NRC documentation issued to subsequent utilities has made a clear approach difficult. Peter Buzzard, Vice President of Industrial Programs, has facilitated several attempts to obtain clarification regarding some of those questions. He requested the support of the Utility Committee Chair at a meeting on standards held at NIST headquarters in Gaithersburg, MD last fall. Participants included several members from the NRC. Peter initiated direct correspondence with the NRC subsequent to the meeting in a letter requesting clarification in the Commissions response to requests for reduction in commitment from various nuclear utilities. Questions include differences where one utility was authorized the use of laboratories accredited by NVLAP or A2LA exclusively while another was allowed to use laboratories accredited by these two bodies as well as any signatory to an MRA (Mutual Recognition Agreement). A recent request to the commission asked that the ACCLASS accrediting body be an approved entity along with NVLAP and A2LA. ACCLASS is an ANSI-ASQ National Accreditation Board Company.

The initial NRC approval to Palo Verde included the proviso that three criteria initially included in the ANSI Z540 document, but not included in ISO 17025, be included in procurement documentation presented to the vendor. The requirement to record as-found calibration data when an out of tolerance condition exists, listing the calibration standards and making traceability to NIST or other nationally recognized standard need to be imposed to ensure the spirit and intent behind the NUPIC checklist is maintained. A fourth requirement to list the quality program manual and revision level has been making inroads in many procurement documents. A preliminary meeting was held with Dana Leaman, Calibration Program Manager for A2LA, during the Board of Directors meeting in Providence, Rhode Island to discuss methods that would aid accredited laboratories and their customers in complying with the NRC requirements. A possible “Nuclear Module” that lists the additional criteria could be used to implement a standard approach to compliance for those vendors choosing to support the nuclear customers. This will become increasingly important as the nuclear industry works its way back into the industrial mainstream.

Utility Committee Forum

Hackers, crackers, black-hat hackers, script kiddies; regardless of what you call them, the Utility Committee Forum was again the target of one of these individuals who reduced our forum to a non-responsive screen shot. A hacker’s form of graffiti with an
Announcement to the world that we had been hacked, violated and humbled. Thankfully, NCSLI’s Larry Johnson was able to recover our forum using a previously saved snapshot of our forum content taken prior to the attack. In a back-hand tribute, the Utility Committee Forum is a favorite target because of the exposure and activity we enjoy and ultimately is a very visible platform for those with malicious intent.

The list of topics and postings continues to grow. I received a call recently from a Metrology Technician at a member utility and learned that the forum is proving to be an excellent tool. An auditing agency was visiting the site and had a question concerning FME (Foreign Material Exclusion) and M&TE. There was a topic with several responses that proved of value and the utility management is now requiring the Metrology Laboratory to participate in the upcoming conference to ensure continued networking and industry interactions. Well done.

A recent posting contained some strong opinions and resulted in a lot of excellent dialog as well as a commitment to investigate the management and oversight of the open forum concept. Open and honest communication is a hallmark of our forum and valuable contributions from participants ensures a vital and robust community. The results of the program review will be presented at the NCSLI Symposium this summer.

The Training Resources Committee has added several new training DVDs to the Training Aids Library Online System (TALOS). A short description of each new DVD is given below:

1. **Precision Dimensional Measurements**  
   *by WorkPlace Training*  
   This is a Level 1 course, and main topics include linear measurements standards, measuring instruments, gage blocks, how to make angular measurements, and optical instruments.

2. **Precision Flow Measurement**  
   *by WorkPlace Training*  
   This is a Level 1 course, and main topics include density principles and measurement corrections, specific gravity, fluid flow measurements, and discussion of many types of flow measurement devices.

3. **Precision Electrical Test, Measurement and Calibration**  
   *by WorkPlace Training*  
   This is a Level 1 refresher course for corporate metrology lab personnel, bench technicians, new hires and transfers into instrumentation, calibration or metrology departments. The course assumes a basic electrical background but no metrology experience. The main topics include basic DC and low frequency measurement, standards and traceability, practical considerations for precision electrical measurements, and sources of measurement error. Additional topics include environmental errors, technician observational random errors, instrumental errors, good laboratory practices and more.

4. **Precision Temperature Measurement**  
   *by WorkPlace Training*  
   This is a Level 1 course, and main topics include basics on heat and temperature, temperature scales, thermometers, related heat sensing and measuring instruments.

5. **AC-DC Calibration and Metrology**  
   *by WorkPlace Training*  
   This is a Level 2 course, and main topics include basic concepts, including power produced by voltage, using AC-DC transfer standards, inductance and capacitance, immittance and AC ratio.

6. **Infrared Temperature Measurement**  
   *by Insight Media*  
   This program describes surface temperature and radiation spectra and explains simple black body radiation theory, emissivity, optical pyrometry, infrared temperature sensors, and infrared thermal imaging systems.

7. **Introduction to Measurement**  
   *by Insight Media*  
   This program introduces basic measurement techniques and explores the principles that underlie standard measurement devices. It discusses stand-alone measurement, closed-loop control, estimation, precision, and dynamic range.

8. **Linear Measurement**  
   *by Insight Media*  
   This program introduces units of linear measurement. It discusses tolerances and examines such measuring devices as scales, rules, scribers, dividers, Bevel gages, calipers, and combination squares. The DVD also teaches how to read a vernier scale and use and read a micrometer.

9. **Mass, Force, Strain, Torque, and Pressure Measurement**  
   *by Insight Media*  
   This program examines the relationships among mass, force, strain, torque, and pressure. It shows how to use strain train gauges, load cells, manometers, diaphragms, low-cost pressure transducers, and ionization gauges.

10. **Measurement and Gaging**  
    *by Insight Media*  
    This program presents the core concepts and primary standards of measurement. It introduces a variety of measurement and gaging tools and shows how non-graduated tools and gages are used to transfer measurements to or from graduated measurement tools and as comparisons to standards.

11. **Measuring Dynamic Variables**  
    *by Insight Media*  
    This program teaches how to measure time-dependent processes. It covers such topics as equilibrium criteria, frequency response, bandwidth, response time, resonance, first and second order systems, vibration problems, lags, and compensation.

12. **Measuring Forces**  
    *by Insight Media*  
    Showing how to measure forces, this program explores how
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forces act; discusses combining forces, force and motion, and torque; introduces force-measuring and torque-measuring instruments; and covers force analysis.

by Insight Media
Introducing the fundamental mechanical theory related to heating, this program explores issues surrounding temperature and heat transfer. It discusses system components and their interrelated functions, safety procedures, tools, and equipment.

14. Measuring Tools
by Insight Media
This program discusses linear and angular measurements. It introduces the units of linear measurement, teaches how to properly use rulers and measuring tapes, examines calipers, shows how to use the micrometer, etc.

15. Metric Measurement
by Insight Media
Tracing the history of metric measurement, this program defines important measuring terms, including length, area, volume, mass, time, frequency, velocity, acceleration, force, weight, energy, and temperature. It teaches how to measure electrical current, light, and substance and shows how to use SI units.

16. Calibration, Accuracy, and Error
by Insight Media
This program defines error, precision, and accuracy; discusses target analogy and bias; explains miscalibration, invasiveness, spatial and temporal averaging, observer bias, and hysteresis; and considers physical issues related to measurement. It also covers such topics as random error, Gaussian distributions, and standard deviation.

17. Contact Temperature Measurement
by Insight Media
This DVD discusses common temperature scales, generic contact temperature measurements, and thermal expansion methods. It teaches how to use liquid-in-glass thermometers, resistive thermal devices, and thermistors and examines thermocouple theory, simple thermocouple circuits, and phase-change temperature methods.

18. Distance, Velocity, and Acceleration
by Insight Media
This program explores mechanical and time-of-flight distance measurements and examines acoustic, optical, and radar methods for obtaining measurements. It also discusses global positioning systems, mechanical velocity measurements, and inertial reference systems.

19. Fluid Quantity and Flow
by Insight Media
This DVD introduces basic fluid measurements and examines such sensors as float, optical, ultrasonic, and capacitive techniques. It discusses mass sensing, accounting methods, rotating cup anemometers, and such pressure-based flow sensors as pilot and venturi systems.

20. Nanotechnology Manufacturing
by Insight Media
In this program, Steve Fonash of the Penn State Nanofabrication Facility explains why experts have predicted that nanotechnology will be the progenitor of the second industrial revolution. The program assesses approaches to utilizing nanotechnology in manufacturing, considers their manufacturing advantages, and considers the feasibility of nanofabrication.

21. The Mechanical Universe and Beyond
by California Institute of Technology
This is a set of 12 DVDs. This series helps teachers demystify physics by showing students what it looks like. Field trips to hot-air balloon events, symphony concerts, bicycle shops, and other locales make complex concepts more accessible. Inventive computer graphics illustrate abstract concepts such as time, force, and capacitance, while historical reenactments of the studies of Newton, Leibniz, Maxwell, and others trace the evolution of theories. The Mechanical Universe helps meet different students’ needs, from the basic requirements of liberal arts students to the rigorous demands of science and engineering majors. This series is also valuable for teacher professional development.

In other news, Matthew Denslow from the Air Force Primary Standards Lab is now co-chairing this committee with Helga Alexander.

NCLSI members may borrow these training aids free of charge by following the sign-out procedure on the TAOS site.

If you would like to recommend other training aids to be added to the library, please contact Helga Alexander or Matthew Denslow.

Now it's easy to increase your IR temperature measurement accuracy with the new 4180/81 Precision Infrared Calibrators from Fluke’s Hart Scientific division. Their accredited radiometric calibrations ensure meaningful, consistent measurements. And the large 152 mm (6 in) target helps eliminate errors. You easily get fast, accurate results for temperature ranges from −15 °C to 120 °C (4180) or from 35 °C to 500 °C (4181).

Call (800-GET-HART) or go to www.hartscientific.com to find out more.

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he Rio Grande Valley Section recently held its semester meeting on December 6th, 2007 at the Wingate Inn, McAllen, Texas. Once again, the participation was outstanding! The attendees consisted of a good mix of new and repeat audience. Exhibitors such as Agilent, Fluke, WorkPlace Training, Metrica, A2LA, Weight Test Solutions and OneRedX returned to participate in the event alongside newcomers like T&M Instruments and Measurement Assurance Technology.

The meeting began with guest speaker, Adrian De Le Cerda from Weight Test Solutions. Mr. Cerda presented a very eloquent speech to an attentive audience, welcoming them in both English and Spanish. Impressed by the high turnout at the event, Mr. Cerda took advantage of this opportunity to announce the search for the new NCSLI section coordinator for the Rio Grande Valley. The current NCSLI-RGV section coordinator, Felipe Narcio, is currently President of Dynacal, which has recently synergized with Measurement Assurance Technology. Mr. Narcio will soon be taking his new position within the organization as Director of Operations – Mexico. His new role will be creating business opportunities and initiating NCSLI sectors in Guadalajara, Queretaro, and Mexico City, but will not afford him the time to commit to continuing his responsibilities as the section coordinator for NSCLI in the Rio Grande Valley. Mr. Cerda also announced the creation of a steering committee for the NCSLI-RGV, so if you are interested in participating, please contact nscl-rgv@dyna-cal.com. Announcements will be made as more information regarding the section coordinator and steering committee positions becomes available from the NCSLI.

After roll call was performed, Mr. Cerda introduced the first guest speaker, Mr. Roberto Benitez, NCSLI Coordinator-Mexico and owner of Metrica, an A2LA Accredited Calibration Laboratory located in Monterrey, Texas. Mr. Benitez presented to the audience the advantages of the Faro Arm vs the CMM. The attendees had found this discussion very informative, having asked many questions. In response to the growing need for Inspection Services in the Rio Grande Valley, Mr. Benitez has dedicated a Faro Arm for this region. Metrica has aligned with Dynacal/MAT to serve the Rio Grande Valley with this unique capability, not previously offered locally. If you’re company requires inspection services please contact www.metrica.com.mx/ and take advantage of this excellent opportunity.

Following Mr. Benitez, Mr. Raimundo Gil, an A2LA Assessor and Owner of Trikon Scientific, Inc. performed his two part series on “Specifications & Measurement Uncertainties-The Realities.” The second segment was presented in the final hour of the event, allowing for the audience to digest the information provided earlier. Mr. Gil’s informative speech, made it very clear to carefully review the specifications for hidden factors that influence the outcome of the value obtained.

After a short break, Floyd Kaminski of Agilent Technology introduced Steve Tenney, Senior Engineering Consultant for Agilent Technologies. Mr. Tenney’s provided his presentation on “Choosing the Appropriate Calibration Technique in Vector Network Analysis.” This was an eye opening experience; in understanding the complexity in assuring your measurements are accurate. Agilent has developed a new standard, ECal to ensure accuracies are obtained for this very sophisticated device. The ECal Module provides fast, single-connection SOLT electronic calibration. Its ease of use is provided through an intuitive graphical user interface and has accurate transfer standard with excellent repeatability. A must have for those calibrating Network Analyzers.

After Mr. Tenney’s presentation, lunch was provided by the exhibitors, served by Jason’s Deli.

The meeting resumed after lunch and commenced with Mr. Bill Byrom, RF Application Engineer for Tektronix, on the “Advances in Real-Time Spectrum Analysis.” If not already drained, from the previous topics, you definitely came away feeling foggy. Mr. Byrom provided a very detailed demonstration on the newest technologies Tektronix has developed, providing a complete measurement solution in spectrum analysis measurements. With today’s RF signals, Tektronix has developed the Real-Time Spectrum Analyzer to discover the unexpected with DPX, capture a seamless time of record of RF frequencies, trigger on transient signals and analyze complex RF signals with multi-domain time correlated measurements. This was cutting edge stuff!

After a much-needed break, the meeting resumed with the second part series on “Specifications & Measurement Uncertainties-The Realities.” The audience was surprisingly very attentive, asking many questions. Mr. Gil was able to bring the participants in, allowing for real-life situations to be addressed. This was a very interactive topic amongst the group!

The meeting was concluded with drawings for door prizes from exhibitors and much excitement about the next NCSLI Section meeting, scheduled for March, 2008 in Reynosa, Mexico. A very special thanks goes out to Mr. Adrian De La Cerda, for his support in facilitating the meeting agenda; and to Mr. Chris Grachanen, NCSLI-Central Coordinator, for his support in obtaining an excellent group of speakers. Without Chris’s support the event would not have materialized.
Regional News

Southern Ohio/Kentucky Section 1132
Matthew Denslow, Section Coordinator
Hosted By: Bionetics Corporation
November 14, 2007

The Mid-West Region Southern Ohio/Kentucky Section 1132 held its first meeting since 2005 on November 14, 2007 in the Concord Room of the Courtyard by Marriott in Newark, Ohio. Hosted by The Bionetics Corporation (operators of the Air Force Primary Standards Laboratory) the attendees were treated to breakfast and a full day of good information and fun.

The meeting was a success with 41 attendees from around the region. In special attendance were Mr. Peter Buzzard, NCSLI Division Vice President Northeastern US; Mr. Lloyd Baker, Regional Coordinator Mid-Western US; Ms. Karen Semer, Director, NCSLI Conference Technical Program; Dr. Klaus Jaeger, Jaeger Enterprises; Ms. Helga Alexander, Chair 161 Training Resources Committee and Mr. Mike Cadenhead, the new Chair for 142 Measurement Comparison Committee. The attendees were treated to a meeting program that included both management and measurement subjects.

Headlining the presentations was Mr. Buzzard who provided an update to the recent Board of Directors meeting. Mr. Baker provided the NCSLI appointment and introduced me as the new Southern Ohio/ Kentucky Section Coordinator.

Our program continued with Dr. Jaeger presenting tutorial results from the 2007 NCSLI Conference in St. Paul, MN. Next, Dr. Ron Jacobs from The Ohio State University’s Center on Education and Training for Employment presented “Developing Employee Expertise through Structured On-the-Job Training.” This topic stressed the importance of a properly documented training program to employee development.

Ms. Alexander then provided an update on the Training Resources committee which included an introduction to the Regional Training Event (RTE) concept. The goal of RTEs are to make high quality metrology training in the form of tutorial or seminar style courses available (1) at a more frequent basis than just the annual NCSLI conference, (2) at a more affordable cost (decreased travel costs), (3) to a larger number of individuals working in metrology, and to individuals who may not have the opportunity to travel to the annual conference, (4) covering topics that are of specific interest to NCSLI members in a particular geographic region.

Mr. Cadenhead presented the activities of the Measurement Comparison committee restating its goals and objectives. The committee is reviewing and updating NCSLI Recommended Practice 15 “Recommended Practices for Inter-Laboratory Comparisons.” He also solicited for participants.

During the technical portion of our meeting, Mr. Tom Hayden, Keithley Instruments, Inc. discussed making accurate low-level electrical measurements using Source Meters or SMUs.

We closed the meeting with a number of door prizes. The next section meeting is planned for April 2008; date and location to be determined.

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Atlanta Section 1221
Ron Kirstatter, Section Coordinator
Hosted by: Central Georgia Technical College
December 3, 2007

Carrying on the momentum of the Metrology Education and Training Outreach committee’s efforts from the 2007 NCSLI International Workshop and Symposium, on December 3rd the NCSLI Atlanta Section 1221 held a meeting hosted by Central Georgia Technical College in their Macon Campus College Center. Program Chair Tony Abel opened with a brief description of the campus and facilities available to students pursuing a certificate, diploma or degree in metrology.

Twenty seven attendees including three current students exchanged perspectives, opportunities and contact information throughout the day while taking in four presentations and a tour of the metrology classroom.

Ron Kirstatter Quality Assurance Manager and Atlanta Section Representative presented the NCSLI Board of Directors Meeting Highlights from Providence, RI containing conference highlights, board and committee activities, NIST news and upcoming events.
Randy Fowler Government Accounts Manager for Fluke Corporation presented Signal Sourcing Requirements for Spectrum Analyzer Calibration. Based on an analysis of calibration procedures for 15 models from 5 manufacturers, 80 different tests were described, 20 of which were performed on the majority of models. Isolating those 20 tests and evaluating the signal sourcing required to perform those tests a test setup commonality matrix was presented which correlated to a minimum equipment specification.

Micky Kilpatrick Senior Microwave Applications Specialist for Agilent Technologies presented Considerations of Measurement Uncertainty in Power Level Measurements For a New-Generation Measuring Receiver. Focusing on Agilent’s replacement for the highly popular but aging 8902 Measuring Receiver, Micky described the functionality of the N5531S and Agilent’s measurement uncertainty identification and calculations representing the specifications of the new box. Several of the attendees are current or anticipate replacing their 8902 with the new receiver.

Tony Abel presented the CGTC curriculum information also given at the Workshop & Symposium this year. Garnering one of the few degree programs in metrology in the United States, CGTC is the likely the only one that can be completed 100% online.

Randall Francis Instructor and key course developer for CGTC’s metrology program of Kay & Associates provided a tour of the metrology classroom and lab, a true representation of where some old and some new theories are needed to develop the next generation of metrologists.

Providing meeting support and door prizes were CGTC and Applied Technical Services.

Our next meeting is on the drawing board for April at Applied Technical Services in Marietta, GA. ■

ronald.kirstatter@usmc.mil

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The meeting was called to order January 29, 2008 at 9:00AM by Tim Cooke, Region Coordinator. In total, approximately 58 people were in attendance. The agenda was distributed with no change of content.

The first speaker was Kevin Bull of Veriteq, on the topic “Humidity Measurement – How Hard Could it be?” Kevin’s talk included applications as well as specific technologies.

Bob Brown of Agilent then spoke on “DC and Low Frequency Measurements.” Bob’s presentation included a very interesting audience participation segment.

Our afternoon speaker was Dick Dwyer of the Fluke Corporation who spoke on “The Art and Science of Infrared Temperature Measurement.” Many applications for this emerging and increasingly cost effective technology where demonstrated.

After the formal presentations, the various membership levels available within the NCSL were discussed, along with benefits.

Members present were asked to check with NCSLI to make sure contact information for members is correct and up to date, email addresses in particular.

A meeting survey was distributed, with the goal of assessing topics and speakers. All submitted responses indicated the presentations and content met or exceeded expectations.

We concluded the meeting by discussing the Conference in Florida. Members were encouraged to attend and participate.

Meeting adjourned at 2:05 PM. ■

tcooke@transcat.com
Our monthly meeting, hosted by Jim Dulac from TRS-RenTelco at DFW Airport, Texas, was an extremely informative and fun event. All the presenters were very entertaining and presented extremely useful and timely information.

First up was Greg McElyea from Agilent Technologies. Greg began the session with a presentation on the brief history of HP/Agilent. Greg’s main presentation was on MSO scopes, but began with an informational presentation on sampling techniques used by different scopes. The methods included Random, Sequenced, and Real-time sampling.

Gregg then changed the presentation to Logic Analyzers. After a brief overview of Logic Analyzers, he then presented the basic theory of “Nyquist” effects of sampling rate and anti-lasing. Probe selection and MatLab were also discussed. Greg concluded the section with a demonstration of serial vs parallel data transfers and the benefits of using Multi-GigaBit serialization techniques. The section concludes with a discussion of using Eye Diagrams for data transfer measurements such as masks and jitter.

Greg concluded the morning with benefits of using Mixed Signal Oscilloscopes (MSO) for better practical measurements requirements. A survey conducted by Agilent concluded that 71% of users measure both analog and digital signals with their Oscopes. This is why Agilent has spent a lot of development time refining the MSO’s capabilities. Greg demonstrated how difficult measurement like “CHIRP” measurements are easily attained with the MSO instrument.

Agilent kept the audience going with hand-propelled gifts during the presentation!

Lunch was then provided by TRS-RenTelco and featured Jason’s deli selections. General discussion on region issues provided great lunch dialog.

After lunch, Dave Van Zandt gave a “hands-on” presentation of Optical Fusion splicer’s. The audience was given a chance to perform a splice themselves and the quality of the splices were measured with various measuring equipment like the splicer itself for a quick measurement and with more rigorous test with instruments like the CMA4000 and Fluke Network’s OptiFiber Test Set.

The next presentation was on validation of software used in metrology. Gregg Shuman gave a PowerPoint presentation on the type steps to metrology life cycle development with best practices. The presentation was followed by a round-table discussion on the common practices used by the different laboratories in the region.

Door prizes donated by Fluke Instruments were then raffled off and the meeting was closed.

**Author’s note:** This was my last section meeting; I am stepping down due to lack of corporate support from my organization. I have enjoyed the last 4 and half years as section coordinator and wish to thank all the people who have made these meetings a success for not only NCSLI, but the local metrology community as well. Jim Johnson of Davis will be my replacement. A special thanks to Tina Brumley who really helped to regenerate interest in the meetings, Chris Grachanen, an outstanding Region Coordinator, and Jim Dulac and Craig Leong of their enduring support as members of the steering committee.

gregg.shuman@vizon.com
The NCSLI Gulf Coast Regional Meeting took place on 11/16/07 in building 8110 at NASA’s John C. Stennis Space Center. Kirk Foster presided over the meeting as he is the current NCSLI Gulf Coast Section Coordinator. It had been approximately three years since the last meeting, therefore, this gathering was used as a general “get acquainted” session. Many of those in attendance were prior attendees of the regional meetings; however, a few new faces were present.

The meeting began with the introductions of those present. A survey was handed out, and asked to be returned at the end of the session. The survey was designed to assist the interest of particular topics and potential course material to be disseminated at future meetings. A few of the general topics discussed were:

1. **How often should the group meet?**
   The consensus was semi-annual until such time that a more frequent interval is appropriate.

2. **What type of guests/speakers would you like present?**
   An interest was expressed to have vendors, NCSLI speakers/trainers, and if warranted, specific and targeted training seminars.

3. **Identified which facilities would be capable of hosting future regional meetings.**
   Also, it was asked of those in attendance to identify potential individuals/companies that might have interest in attending future meetings.

4. **What topics are of interest that you would like to see covered?**
   Suggestions included Measurement Uncertainty, new vendor product/technology demonstrations.

A brief discussion also took place on the state of metrology laboratories and the lack of trained personnel since the closing of most military metrology training facilities. Many have felt the impact of this issue at their own facilities and “threw out” ideas to be discussed at the next regional meeting. Some felt that universities, in conjunction with public and private industry, must put together some type of program that would introduce measure principles into engineering coursework at the university level. Perhaps NCSLI members could provide a presentation at the universities that would at a minimum raise the awareness of the impact of metrology within the engineering community.

Another topic presented was that of the ongoing emergence of Quality Standards. Since there are a number of them, a brief discussion of the following standards took place.

- ANSI/NCSL Z540.3-2006 Requirements for the Calibration of Measuring and Test Equipment
- ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories

At the conclusion of these topics, it was time for a quick group picture then on to lunch. The group split up and informal discussions took place. Following lunch, a quick laboratory tour took place where many different questions were asked regarding capability, document control, and technical training. It was a very informative regional meeting and it was decided that the next meeting would take place in May 2008.

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The DoD established the Joint Technical Coordinating Group for Calibration and Measurement Technology (JTCG-CMT) over 30 years ago to improve inter service coordination and cost reduction/avoidance of measurement technology and calibration operations throughout the Services. An organization chart for the JTCG-CMT is attached to this report. Work by the JTCG-CMT is progressing in the following areas.

1. Metrology Research and Development
   - The Engineering Working Group (EWG) of the Calibration Coordination Group (CCG) published the “Joint Service Metrology Research & Development Plan” FY 08 Edition (Volume II: Project Summaries). This Plan, commonly referred to as the “Brown Book”, documents the metrology and calibration requirement deficiencies identified by each Service, and identifies the estimated fiscal year when an individual project to correct this deficiency will be started. Distribution of the Plan is limited to U.S. government agencies.
   - An update of the executive summary of the Plan (Volume I) is scheduled for FY08.

2. JTCG-CMT Coordinated Projects at NIST
   - Initiated in FY07 or FY08

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
<th>TECHNOLOGY AREA</th>
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<tbody>
<tr>
<td>Complex Vector Uncertainty Analysis</td>
<td>Millimeter/Microwave</td>
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<td>Large Area Beta Source Characterization</td>
<td>Radiological</td>
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<tr>
<td>Standards for Traceability of Infrared Signature Measurements</td>
<td>Electro-Optics</td>
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<td>Upgrade of Detector Linearity System</td>
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<td>LBIR Cryo-FTS Integration</td>
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<td>Traceability for Night Vision Goggle Calibration</td>
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<td>Electrical/Electronic</td>
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<tr>
<td>Improved Measurement Capability for 100 A AC Current Shunts</td>
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<td>Chem/Bio Defense</td>
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<td>Bio Particle Standard</td>
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<td>IMS Standard</td>
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<td>1.06 um High Power Attenuator</td>
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<td>Electro-Optics</td>
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3. Current Joint Service Work on New Standards

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<tr>
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<td>Electro-Optics</td>
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<td>OTDR Calibrator upgrade for SM</td>
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<td>Vapor Generator Characterization</td>
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<td>PMT UV-Reliability Testing</td>
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<td>Joint Service Mask Leakage Tester (JSMLT) NIST Traceability</td>
<td>Chem/Bio Defense</td>
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<tr>
<td>JBPDS Standard Deployment</td>
<td>Chem/Bio Defense</td>
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</tbody>
</table>

4. Joint Service Interservice Support Group

Personnel from the Chem/Bio Support Working Group helped to establish the Chemical and Biological Defense Metrology Support Group (CBDMSG) within the Joint Program Executive Office for Chemical and Biological Defense. The CBDMSG is established “to act as a single body to give advice, assist and collaborate with the Joint Project Managers (JPM) concerning calibration requirements in the acquisition and sustainment of Chemical Biological Defense (CBD) Equipment” and will operate within the construct of the military services metrology programs. The charter for the CBDMSG was signed by all Services and is in for approval by General Steven V. Reeves, Joint Program Executive Officer for Chemical and Biological Defense. Once approved, the Joint Chemical/Biological Metrology Working Group within the JTCG-CMT will be disbanded.

arman.hovakemian@navy.mil
Math Question

**Q:** You have two standard weights. The larger one (L) is 60 grams heavier than the smaller weight (S). Their combined weight equals 100 grams. What is the nominal weight of the standards?

Math Solution on Page 46

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Sudoku

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New Training Concept in Coordinate Metrology  
First Course Launched in South Africa  
at the National Laboratory Association (NLA) 

by Georgia Harris

Coordinate metrology plays a crucial role within quality assurance. For producing reliable measuring results, users need appropriate education in coordinate metrology. Up to now, education in coordinate metrology has been offered by machine manufacturers mainly. In these trainings, the focus is mainly on how to deal with hardware and software but generally, no basics in manufacturing metrology are taught. Therefore, manufacturer dependent training does not in most cases fulfill the requirements of industry to have a comprehensive education.

With EUKOM – a new comprehensive training concept developed in Europe for training in coordinate metrology, the requirements of industry can be met, and has had great success in the European market for the past two years. This new training concept with harmonised learning content enables industry to have a common and accepted standard for a manufacturer independent education in coordinate metrology.

The National Laboratory Association (NLA) launched the first EUKOM course level 1 for South African industry in Pretoria after its very successful Test & Measurement Conference 19-21 November. The training is conducted, in close cooperation with the National Metrology Institute South Africa (NMISA) where the practical workshops at the coordinate measuring machines will be performed as well as in close cooperation with the NTB, University of Applied Sciences of Technology Buchs, Switzerland whose tutors have extensive experience in tutoring EUKOM courses.

The students of this first course in South Africa are recruited out of the fields as do the automotive industry, aircraft industry, rocket industry and other machine companies using coordinate measuring machines. Continuously supported by tutors, the participants study the basic knowledge of coordinate metrology theory and its background with the online-based learning system over a period of 8 weeks in the learning group and closely coupled to their practical work.

After this learning period, the learners will attend a two-day practical workshop in small groups of 4-6 participants at the NMISA where they will apply and extend their knowledge gained. With the passed exam at the end of the workshop, they will be certified as EUKOM CMM-Users. After some further practical experience with their own devices and measuring tasks back in their companies, the participants can attend the level 2 courses to the EUKOM CMM – Operator certification and consecutively to the EUKOM CMM – Expert certification later in the next step.

In the long-term it is hoped that this training for coordinate metrology will have a big impact on the mechanical industry in South Africa and will contribute to the competitiveness of the country. For the dates of the next training course or detailed information of the courses, please contact the National Laboratory Association (NLA), Steve Sidney, steves@nla.co.za.

The students of the first EUKOM training in coordinate metrology, taking place at the National Laboratory Association (NLA), Pretoria, South Africa in cooperation with the National Metrology Institute South Africa (NMISA) and the NTB, University of Applied Sciences of Technology Buchs, Switzerland.
As metrologists, we know that measurements are an important aspect of decision making, communicating technical information, establishing scientific facts, monitoring manufacturing processes and maintaining human and environmental health and safety. Industries and governments spend billions of dollars annually to acquire, install and maintain measurement and test equipment (MTE).

The more critical the application, the greater the need for measurement quality assurance. MTE accuracy is a key aspect of measurement quality. However, the overall uncertainty encountered during the MTE calibration process is not often assessed and controlled. Indeed, assessment of measurement uncertainty during calibration provides vital information needed to determine if an MTE parameter is in-tolerance or out-of-tolerance.

The assessment and control of measurement uncertainty presupposes the ability to develop reliable uncertainty estimates. Compliance with ISO/IEC 17025, as well as other applicable standards, has also elevated the importance of estimating and reporting measurement uncertainty to the forefront of requirements for testing and calibration organizations.

A Consensus Guide

The ISO/IEC Guide 98:1995 Guide to the Expression of Uncertainty in Measurement (GUM) was developed to provide an international consensus for the expression of uncertainty in measurements. This entailed the development of an unambiguous definition of measurement uncertainty and the application of rigorous mathematical methods for uncertainty estimation. ANSI/NCSL Z540-2-1997 is the U.S. adoption of the GUM.

While the GUM provides general rules for analyzing and communicating measurement uncertainty, it does not focus on providing clear-cut procedures for evaluating measurement processes. Consequently, testing and calibration personnel often find it difficult or confusing to apply these rules in the workplace.

Conflicting and Misguided Approaches

Added to this confusion are the various uncertainty analysis standards, guides and books that have been published by engineering organizations. Many of these uncertainty analysis references have been updated or reaffirmed in recent years, but the methods they espouse are distinctly different from those presented in the GUM. Consequently, a consensus approach is not yet being applied across technical organizations and disciplines.

Even worse are the misguided attempts to develop short-cuts and over-simplified “rules-of-thumb” for estimating measurement uncertainty so that “everyone can do it.” Unfortunately, these efforts do not promote important best practices that are vital to improving products and services and competing in the international marketplace. These “dumbed down” approaches also undermine the importance and competitive advantage of having qualified, competent personnel conduct uncertainty analyses and perform other measurement quality assurance functions.

NCSLI RP-12

For those unfamiliar with the history of this NCSLI Recommended Practice, RP-12 Determining and Reporting Measurement Uncertainty was initially released in February 1994. The original purpose of RP-12 was to “provide further discussion and examples to augment the International Organization for Standardization (ISO) Guide to the Expression of Uncertainty in Measurement.”

RP-12 contained a very brief discussion of the methods used to determine measurement uncertainty and readers were referred to the GUM for details. Four example analyses were included as an appendix. A revised edition was released in April 1995 containing minor corrections and the inclusion of NIST Technical Note 1297 Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results as a second appendix.

In 2004, NCSLI’s 173 Metrology Practices Committee was assigned the task of updating RP-12. The 173.5 Uncertainty Analysis Subcommittee was formed and, during initial meetings, it was determined that a major re-write of RP-12 was needed to provide a recommended practice that:

1. Clearly explains key concepts and methods.
2. Incorporates new methods that enhance the methodology of the GUM.
3. Provides real-world analysis examples for all major measurement areas.

The revised document (RP-12-2008) has been developed with these requirements in mind. In addition to key uncertainty analysis concepts and methods, topics include:

- Interpreting and applying equipment specifications
- Estimating uncertainty
  - for direct measurements
  - multivariate measurements
- measurement systems
- alternative calibration scenarios
- a range of values
- Statistical analysis of sampled data
- Estimating Type B degrees of freedom
- Uncertainty growth
- Uncertainty and traceability
- Using uncertainty estimates
- Using Bayesian analysis to refine bias estimates
- Implementing the methodology

As seen from these topics, RP-12-2008 is not intended to be just another book on measurement uncertainty analysis. Emphasis has also been given to creating a highly readable document that promotes the consistent application of current best practices.

In addition, the analysis examples contained within RP-12-2008 will provide structured, step-by-step procedures and illus-
New Guidance for Documenting Metrology

Education and Training RP-17

by Gloria Neely

One constant found in calibration and testing laboratories is the need for continual training of all personnel, regardless of their job duties or level of expertise. The requirement for training becomes more critical as changes in personnel, technology, equipment, and procedures occur. One of the common attributes of any successful training program is the accurate documentation of all training. Without accurate documentation, the true extent of laboratory training needs, career progression, and succession planning may be ambiguous. In addition, unnecessary or redundant training may become a needless expense.

The amount and frequency of education and training required of technical personnel depends on many factors, including laboratory workload, number of personnel, and measurement scope requirements. Training is often obtained through a combination of formal training courses and on-the-job training (OJT). Continuing education is often sought to develop new skills as well as maintain proficiency in previously certified measurement areas. It is imperative that education and training documentation is maintained and archived for future reference. Documentation should focus on identifying each type of training, including technical, safety, audit, and mandatory organization training.

National and International Standard Requirements

Laboratories operating within the standards of ISO/IEC 17025, ANSI/NCSL Z540.3, or ANSI/ISO/ASQ Q9001 require documentation of personnel qualifications, competence, and training. For other laboratories, it just makes good business sense. The aforementioned standards specify that training be documented, but the actual process of how this documentation takes place is left to the discretion of the laboratory.

ISO/IEC 17025:2005, General Requirements for Competence of Testing and Calibration Laboratories, clearly states the requirement for the documentation of training in paragraph 5.2.5:

“...The laboratory shall maintain records of the relevant authorization(s), competence, educational and professional qualifications, training, skills and experience of all technical personnel, including contracted personnel. This information shall be readily available and shall include the date on which authorization and/or competence is confirmed.”

ANSI/NCSL Z540.3:2006, Requirements for the Calibration of Measuring and Test Equipment, also clearly identifies the requirement for the documentation of training and qualifications in paragraph 4.3.2 and 4.4.2:

“Records of training activities shall be maintained. The effectiveness of the training shall be evaluated and recorded.”

“Records shall include: ...personnel qualifications.”

ANSI/ISO/ASQ Q9001-2000, Quality Management Systems – Requirements, also has a specific requirement for the documentation of training and qualifications in paragraph 6.2.2e:

2 ANSI/NCSL Z540.3:2006, Requirements for the Calibration of Measuring and Test Equipment
4 ISO/IEC 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories page 12, paragraph 5.2.5
5 ANSI/NCSL Z540.3:2006, Requirements for the Calibration of Measuring and Test Equipment, page 3, paragraph 4.3.2
6 ANSI/NCSL Z540.3:2006, Requirements for the Calibration of Measuring and Test Equipment, page 4, paragraph 4.4.2

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Schedule for Release

The 173.5 subcommittee completed its second pass review of the core document and most of the appendices in January 2008. A final draft of RP-12-2008 is scheduled for peer review in April 2008. Peer review and feedback will be an on-line input process conducted via a special portal established on the NCSLI website. The procedure for submitting comments and suggested changes will follow the ISO/IEC guidelines for international documents.

Comments and suggested changes will be collated and addressed by the subcommittee in May 2008. All input will be carefully considered and the subcommittee will determine which changes to include in RP-12-2008. The results of this process, including subcommittee comments on all peer review input, will be posted on the NCSLI website.

The revised RP-12-2008 document will be submitted the NCSLI Board of Directors for approval in June 2008. The official document will be issued once approval has been obtained.

Upon release of RP-12-2008, a Technical Advisory Group (TAG) will be formed to solicit and review uncertainty analysis examples for inclusion in a searchable database on the NCSLI website. The TAG will consist of measurement experts from various industries and disciplines. The intent is to have TAG participation evolve over time as the uncertainty analysis knowledge base grows.

For more information regarding RP-12-2008 and the status of the 173.5 subcommittee efforts, contact Suzanne Castrup.
Document All Laboratory Education and Training

The new Recommended Practice for Documenting Metrology Education, Training, and On-the-Job Training, NCSLI RP-17:2007, prepared by NCSLI Committee 163 (Workplace and Professional Training), provides a method by which metrology education, training, and OJT can be documented in the metrology laboratory. Formal education includes courses, seminars, and classroom training sessions presented by reputable providers, such as a National Measurement Institute (e.g., NIST, CENAM, NRC), or national or international professional organizations (e.g., NCSLI, Instrument Society of America, ISA). On-the-job training may occur on both management systems and technical procedures and may include individual instruction, assigned readings, group instructional sections provided by persons familiar with (a) methods and procedures, practice on each test and/or calibration, and (b) the assessment of the test or calibration results through proficiency testing methods. Professional development training may improve skills used in a laboratory, such as software systems, budgeting, strategic planning, conflict management, technical writing, communication, and security/safety.

The process detailed in RP-17 is designed to ensure that laboratory training documentation demonstrates compliance to the aforementioned national and international standards, as well as facilitates universal acceptance of metrology education, training, and OJT records by future employers. RP-17 focuses on several challenging and frequently asked training questions:

1. “Where do we need to be?” - Determining organizational training needs;
2. “Where are we?” - Assessing current skills and training; and
3. “How did we get here?” - Documentation or record keeping.

Training records can be documented and maintained by various means. Examples found in RP-17 include Technical and Measurement Training Checklists (Figure 1 and 2), an OJT Training Worksheet (Figure 3), and Education, Training, and Development Plans (Figure 4). When coupled with these tools, spreadsheets can serve as simple and very effective databases to organize various training program documentation elements. It is important to remember that care must be taken to ensure that confidential personal information, such as that maintained in personnel files, is maintained separately whenever possible so that training records can then be made available to management, staff, and assessors during laboratory audits.

Benefits of Comprehensive Documentation

RP-17 recognizes that personnel and management have an obligation to accept learning as a lifelong process. Professional development benefits not only the employee but the employer as well. While personnel should strive to achieve goals in professional development, management should encourage and facilitate these goals. A partnership between management and personnel would help to guarantee that required training would be identified and accomplished. Training record review for the entire staff can provide an effective tool for identifying training deficiencies and projecting future laboratory training requirements. An added benefit for both management and personnel is that training records become portable, following a technician if he changes employment and providing a permanent record of the training received and the areas in which he is qualified to work. Maintaining good records also leads to increased confidence that the employee is competent to perform the duties of the position he is filling.

In addition, thorough documentation of personnel training will greatly facilitate the laboratory when undergoing external accreditation or internal assessment. Through these records it should be evident that all personnel are cognizant of quality standards and guidelines. They will show that all personnel possess the skills and knowledge necessary to perform quality calibrations or tests and demonstrate that office personnel understand and effectively execute their support functions.

For a laboratory to be successful in documenting training, the method utilized must be tailored to meet the requirements of that laboratory. RP-17 includes a listing of several training resources that provide additional helpful information to management who are developing a comprehensive training program. Documenting laboratory personnel education and training is often considered a daunting task, but it doesn’t have to be. The tools and strategies provided in the RP-17 can be used to help establish new laboratory training documentation as well as fine tune current methods being used within your laboratory management system.

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**Math Solution**

**A:** The answer is: Standard ‘L’ weighs 80 grams, and standard ‘S’ weighs 20 grams is the correct answer.

**Solution:**

Thus, ‘L’ weighs 60 grams more than ‘S’ and their combined weight is 100 grams as per the problem requirements.

The common mistake is to quickly jump to the conclusion that ‘L’ weighs 60 grams and ‘S’ weighs 40 grams. However, that does not meet the requirement of the problem that ‘L’ is 60 grams more than ‘S’.

**Alternative Solution through Equations:**

Let ‘L’ be the large standard’s weight, and ‘S’ be the small standard’s weight.

Then,

\[ L - S = 60 \text{ g}; \quad L + S = 100 \text{ g}. \]

On solving the above two equations, we get:

\[ 2L = (100 \text{ g} + 60 \text{ g}) \]

\[ L = (100 \text{ g} + 60 \text{ g})/2 \]

\[ L = 160 \text{ g}/2 \]

\[ L = 80 \text{ g} \]
The field of metrology, the science of measurement, offers many rewarding career opportunities for those with an interest in science and technology. Cutting edge, state of the art, technologies used in engineering, applied research, material analysis, telecommunications, avionics, biomedical, etc., have their foundations built upon metrological principles and practices. These technologies depend on the work of professional metrology practitioners to ensure accuracy of measurements. Persons working in the field of metrology support functions such as manufacturing and new product development, the mission of governmental agencies (U.S. Armed Services, NASA, U.S. Dept. of Energy, U.S. Dept. of Commerce, FCC etc.) as well as the service sector such as health care. If something can be measured, it’s a good bet that metrology practitioners are measuring it right now, or they are creating the technology to measure it in the future.

Metrology practitioners routinely use mathematics, physics, science principles and engineering techniques in performing their jobs. Depending on personal interests and work requirements, metrology practitioners have taken courses in engineering, computer science, biology, chemistry, physics and mathematics. Topics of study may include sound, light and lasers, temperature, vibration, mass and force, acceleration and electronics, just to name a few. Education credentials for metrology positions range from technical trade and military school certificates to associates through doctoral degrees. Some common metrology job titles are: calibration technician, instrumentation specialist, measurement technologist, calibration engineer, metrology engineer and metrologist. Metrology practitioners obtain their skill sets by performing physical measurements as part of a technical curriculum, participating in hands-on instructional courses, and via on the job training sessions.

What kind of tasks do metrology practitioners perform? Many are involved in calibrating and maintaining inspection, measurement and test equipment (IM&TE) in calibration laboratories and at customer locations. Troubleshooting, repairing and inspection may also be part of their duties. Whether it is a device for measuring infrared radiation, sound pressure, relative humidity, or a thousandth of a millimeter, metrology practitioners use sophisticated calibration standards and diagnostic tools to ensure IM&TE is operating correctly. Other tasks for metrology practitioners may include software programming, technical writing, analyzing measurement data, developing measurement systems and calibration procedures, designing test fixtures and new instrumentation, measurement consulting and training, quality administration, process evaluations and maintaining calibration standards just to name a few.

Metrology practitioners may choose to specialize in one particular support area such as environmental parameters or precision electrical, or they may want to become versed in multiple areas. The opportunity to learn new technologies and master new skill sets is always present for those working in the metrology field.

Job openings for qualified metrology practitioners can be found all over the world. Chances are good that there are employment opportunities in a location near you, or a place where you would like to move to. Wages for metrology practitioners are very competitive when compared with technical positions for other vocations having similar job responsibilities. The metrology field offers individuals challenging career opportunities that are in demand by industry and government agencies. If you like science and have a knack for technology, metrology may be just the vocation for you.
NCSL International Membership Application

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For Associate Membership, Include the Parent Organization Membership Number Here:

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Student Applicants, please provide the name of the school, contact name, and contact phone number:

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<td>$ 200</td>
<td></td>
</tr>
<tr>
<td>Three Years</td>
<td>$ 1,050</td>
<td>$ 600</td>
<td>$ 300</td>
<td></td>
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<tr>
<td>Four Years</td>
<td>$ 1,375</td>
<td>$ 800</td>
<td>$ 400</td>
<td></td>
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<tr>
<td>Five Years</td>
<td>$ 1,700</td>
<td>$ 1,000</td>
<td>$ 500</td>
<td></td>
</tr>
</tbody>
</table>

1 Includes one-time $75 setup fee.  2 Membership is January thru December of current year.

Please remit the proper amount from the table above (in U.S. funds). Make checks payable to: NCSL International

Or charge your:  _____ Visa  _____ MasterCard  _____ American Express  _____ Discover

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Why should you become a member of NCSL International?

NCSL International is a unique organization that offers a wide variety of benefits to all its members. As a professional involved in the practice of metrology, calibration, quality management, or any other related field, you should not miss out on the benefits of being an NCSL International member.

You will improve your professional abilities, learn about new and changing trends in the metrology field, and contribute to the development of new standards and practices. Whether you are the organizational head of metrology or quality, or functioning as lab manager, a member of a lab’s technical team, or even simply an independent professional, both you and your organization stand to gain through NCSL International membership. In return, both the NCSL International organization and our profession gain from your participation!

As a member, you will regularly receive the renowned NCSL International measure, a science journal packed with carefully selected papers regarding new and valuable information about the field of metrology and the science of measurement. Also, you can access a wide library of various resources intended to assist your professional needs. Of course, you can participate in the annual International Conference which features presentations and discussion forums on a wide range of subjects. You will be in contact with a diverse international group of professionals unmatched in our field. Finally, on a local/regional basis, attending the periodic meetings throughout the year will help you network with other professionals in your geographic area.

Beyond attending such activities, your opportunity to contribute to a wide variety of operating committees lets you influence the standards and practices that form our day-to-day routine in professional metrology.

Simply stated, membership in NCSL International is not just membership in an organization of laboratories. It is membership in a network of thousands of other similar professionals which gives you a foundation for both better understanding of, and the ability to contribute to, the standards, practices, and policies of professional metrology that affect you everyday. Without any doubt, NCSL International will help you be a better professional in a field of similar professionals.

Organization Membership is intended for a company or organization at the same physical location.

Associate Membership is for individuals (additional lab managers, engineers, or technicians) within an organization membership at the same physical site. A current/active organization membership account is required to apply for this category. Associate memberships will receive products and services directly without having to depend on the member delegate of the organization to share them.

Individual Membership is for professionals within the metrology industry interested in staying abreast of what is going on in the world of measurement.

Student Membership is for students enrolled in a degree program at an accredited school. Available at a discount.

Benefit/Deliverable

- Stakeholder and voting rights on NCSL International issues
- Member organization and capability is listed on Directory of Standards Labs database
- NCSL International’s quarterly journal measure
- Members only may advertise in the journal measure
- Members may announce new products and services in the journal measure at no charge
- Receives the quarterly NCSL Metrologist Worldwide News
- NCSL International publications on CD with 2 device licenses and 5 prints
- Annual updates of NCSL International publications with dues renewal
- May participate on NCSL International sponsored committees
- Discount on NCSL International documents (RP, RISPs, LMs)
- Discount on NCSL International Standards
- Discount on NCSL International conference
- Discount on NCSL International logo items
- “Help Wanted” posted on NCSL International website
- Post resume on NCSL International website
- Member’s training/education programs listed on NCSL International website at no charge
- Discount on use of NCSL International training facility

For more information visit www.ncsli.org or call the Business Office at 303-440-3339.
Metrology's Impact on Business

Why should your business have an interest in metrology? If the goal of your business is to make a quality product or service, and ultimately a profit, then metrology has a direct impact on your business. Metrology is the science of measurement, and measurements are critical to any business. Both in the products and services it provides and in the products and services it uses.

The quality of measurements made during design and manufacturing will directly affect the quality of a product. Poor measurements may even mean scrapping products entirely. Conversely, precision measurements and state-of-the-art capabilities may lead to patents and superior products, giving one company an edge over its competition. Poor measurements or lack of metrology in any process can be very costly. From research and development to shipping and receiving, measurements matter to business.

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