VOL 29 NO 1, JAN 1989

NCSL Newsletter

NATIONAL CONFERENCE OF STANDARDS LABORATORIES

PRESIDENT'S MESSAGE

PLANNING FOR CHANGE . . .

NCSL LONG RANGE PLAN

During Pete England's tour as NCSL President, a recommitment to long range planning for the NCSL organization was made to assure that NCSL's products and services to its member organizations continued to improve and keep up with these changing times. This planning has resulted in constructive actions and results with Congress, government agencies and educational organizations as well as producing new and updated Recommended Practices.

The principal drivers for the current planning activities include the growth and changing needs of our membership, increased attendance at our annual conference and section meetings, and international emphasis on quality, productivity and competitiveness. During 1988, the Board increased its emphasis on long range planning to address these needs. Using Gary Davidson's 1988-1992 plan as an excellent basis, the Board instituted a series of workshops and activities that involved over 60 member delegates and others to develop the foundation for the 1989-1993 long range plan and to implement some needed organizational changes.

The key initiatives which provided the foundation for the 1989-1993 long range plan are included on page 40 for your consideration. I know that the Board would welcome your comments on these initiatives and your participation in the long range planning process.

BOARD REORGANIZATION

During our October 1988 NCSL Board meeting, the Board voted to increase the number of NCSL vice president positions to six, effective 1 January 1989. This action allowed a realignment of Officer functions to increase attention to the planning and development of our annual conference, increase emphasis on the technical aspects of metrology, and to increase support to our committee activities.

This realignment is shown in detail in the roster at the end of this Newsletter, thanks to the responsive and detailed work of Dean Brungart and John Minck. Briefly, the positions will focus on the areas of: Operations and Marketing; Calibration Systems Management; Industrial Programs; Education and Training; Measurement Science and technology; and Conference Management.

My personal thanks to all those who contributed so much to the long range planning and reorganization efforts and to those who are working to make the changes successful and contributing to NCSL's future.

ACCOLADES

Three Board officers are stepping down at the end of the year: Bob Weber, Vice President Operations; Ed Nemeroff, Past President; and John Martin, Vice President Education and Training. Bob, Ed, and John have served NCSL and other organizations in many capacities over the years. Each have given much of their own time to these organizations and made significant contributions toward improving the application of metrology in the aerospace, measurement standards and educational fields. Our thanks to each of you for your service on the Board and we look forward to your continued involvement in NCSL!

(Continued on page 8)

NCSL NEWSLETTER
VOL 29 NO 1, Jan. 1989
ISSN 0194-5149
USPS 469-030

Publisher:
National Conference of
Standards Laboratories
Suite 305B
1800 30th St.
Boulder, CO 80301
(303) 440-3339

Editor:
John L. Minck, NCSL Editor
Hewlett-Packard Co., Bldg. 5U
P.O. Box 10151
Palo Alto, CA 94303-0889
(415) 857-2060
FAX (415) 494-1379

Associate Editors:
Jeff Reid, Unidynamics/Phoenix
(602) 932-8957
Nancy Thomas Hewlett-Packard
(415) 857-5197
Frank E. Jones (301) 340-7147

The NCSL Newsletter is published quarterly in Boulder, Colo., by the National Conference of Standards Laboratories. It is sent to NCSL-member organizations and to a special listing of activities and key personnel whose work is closely related to that of NCSL. The subscription price of $25 is included in the annual dues. (3 copies per issue) Non-NCSL member subscriptions are available for $15 per year. Make remittance to the NCSL Secretariat.

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

NCSL Electronic Bulletin Board
(213) 814-3239
Character format: TTY using 8,N,1
System Operator Tom McGovney
(213) 821-1389

CHANGE OF ADDRESS:
Send old and new address to NCSL Secretariat, Suite 305B, 1800 30th St, Boulder, CO 80301. Postmaster: Please send Form 3579 to NCSL Secretariat, Suite 305B, 1800 30th St., Boulder, CO 80301.

Second class postage paid at Boulder, CO 80303 or at additional mailing office at Palo Alto, CA 94303.

TABLE OF CONTENTS

****

COME TO THE 1989 MEASUREMENT SCIENCE CONFERENCE

Anaheim Marriott
Anaheim, CA
January 25-27, 1989

You're almost too late!! Act now!!
Theme: "Measurement Quality, the Competitive Edge"
Call: Chet Crane, (213) 822-8229 ext. 2449

****

EDITOR'S MESSAGE:

THE WORLD OF FAX

You'll notice that I've started to list facsimile phone numbers for the members of the roster at the end of the newsletter. Even with HP's electronic mail with 60,000 people on line, sending documents by FAX has become a way of life around our company, and for inter-company mail, its even better. So if any of you have material for the newsletter, you can send it to me by FAX. And if your name is in the Roster, send me your FAX number.

THANKS, DON EDMUNDS

I ran a story in the last issue on attitudes in service organizations, written by Don Edmunds. Trouble was, I thought the paper had been presented at the Region 6 meeting since the words accompanied the meeting minutes. But, in fact, Bob Willett had merely attached Don's paper from some previous publication. But it was a timely message, so thanks Don.

RP-3 IS HERE

And speaking of Bob Willett again, I just have a copy of RP-3, and recalled that getting the guideline written, approved and published has almost amounted to a lifetime job for Bob. Only he will remember when it all started, but it could have been around my Presidency which was circa 1978. Thanks Bob, good job, well done.

John L. Minck, Editor

HIGHLIGHTS OF THE NCSL BOARD MEETING

The Eldorado Hotel, Santa Fe, New Mexico
Oct. 24-26, 1988

PRESIDENT'S REPORT – GARY DAVIDSON

Met with Del Caldwell and Bob Smith to discuss the organizational structure of the NCSL and the long range plan.

EXECUTIVE VICE PRESIDENT'S REPORT – DEL CALDWELL

Dave Mednick, of the Defense Logistics Agency, has the final version of MIL-HDBK 52() with a release date of January 1, 1989. The Department of Defense committee, which is reviewing this handbook, consists of Del Caldwell, U.S. Navy, Dave Mednick, Defense Logistics Agency, and Frank Flynn, U.S. Air Force.

NCSL Long Range Plan.

Del Caldwell provided the opening remarks, the background and purpose of the Long Range Plan and the progress made to date. A general discussion was held over the NCSL mission. There appears to be a need to modify this statement to include the new NCSL directions such as the Equipment Management Forum.

Del Caldwell outlined the Long Range Plan drivers and Bob Smith provided an overview of the Organizational Planing Meeting. A discussion was held on whether a Conference Development Vice President is required to provide continuity from one Conference to the next. Under this Vice President would fall the Conference Directors and the Site Selection Committee.

The Equipment Management Forum and the Metrology Program was discussed. There was a discussion about having locally elected Regional Directors sitting on the Board. A straw vote was taken and the results were in favor. A two hour time block will be set aside at the January Board meeting for further discussion.

A motion was made by Bob Smith to increase the number of Vice Presidents by one. Seconded by Chet Crane. Motion carries.

An action was given to all Regional Directors to poll their regions on the election of Directors by region concept.

TREASURER'S REPORT – ROLAND VAVKEN

An action item was given to Roland Vavken to send a copy of the necessary paperwork regarding the dies for the Wildhack awards to Ken Armstrong to be place in the safety deposit box along with the Wildhack medallions.

NIST REPRESENTATIVES REPORT – JOE SIMMONS

The FY89 NIST budget appropriation has seen acted on by the House and Senate and the Conference Committee to reconcile the differences. The President's budget requested $158 million for NIST and the final Conference mark was $159 million.

SECRETARIAT'S REPORT – KEN ARMSTRONG

Added 30 new members during the 3rd Quarter; thus bringing the current membership 875 as of October 1, 1988. This number reflects those members who were dropped from the roster for non-payment of dues.

Continued to have a substantial number of requests for the video tape training aids. Joe Corege, Hewlett Packard, informed the Secretariat of a new computer based training course for calibration technicians. Distributed this information to the Education Committee for action

An action item was given to Ken Armstrong to obtain the information on the Computer Based Training program and forward this information to the Vice President of Education in January 1989 after elected.

Making final preparation for the printing of the 1988-1989 NCSL Directory. Have decided to print 1500 copies, 1000 for the current membership, 300 for new members over the next two years and 200 for sale and other distribution.

OPERATIONS V.P. REPORT – BOB WEBER

BUSINESS SYSTEMS REPORT – TOM McGOVNEY

The Business system is currently going through some refinement to increase update and printing speed by condensing multi-step procedures to a single step. Have tasked Ken Armstrong to come up with a list of enhancements he would like to see integrated into the Business System. Once prioritized, we will schedule the work for 1989.

The Electronic Bulletin Board was discussed. Several key points were given, namely, lack of education on the user's part, lack of equipment, corporate restrictions over the access through internal systems and costs of telephone calls. The conclusion was that the Electronic Bulletin Board will remain operational until after the 1989 Conference.

An action item was given to Tom McGovney to evaluate the potential use of and provide justification for the purchase of a facsimile machine for use in the NCSL business office.

MEETINGS AND PROGRAMS COMMITTEE – DAVE GOODHEAD

Request continued attention be given to the NCSL "Meetings and Programs" calendar and reminds all Directors and Regional Coordinators to submit a detailed schedule for calendar year 1989 prior November 1988.

PUBLICATIONS COMMITTEE – TOM KNOWLES

The following list of documents will require development/revision and publication at an approximate cost of $17 to $19 thousand:

RP1 – Establishment and Adjustment of Calibration Intervals.

RP6 – Medical Products and Pharmaceutical Industry Calibration Control System.

RP7 – Laboratory Design.

RP8 – Individual Equipment Evaluation Guide.

RP9 – Proposed: Laboratory Capabilities.

RP10 – Proposed: Glossary of Terms

The National Measurement Requirements Survey.

The NCSL Directory

MARKETING V.P. REPORT – BILL SIMMONS

Attended the ISA/IMEKO Conference and Exposition in Houston, Texas. I observed the ISA Conference operation to assimilate information for the NCSL conferences. Talked with the ISA President and several Past Presidents.

Reviewed "Establishment and Adjustment of Calibration Intervals" and "An Individual Equipment Evaluation Guide" and provided comments as appropriate.

Tony Anderson presented the new brochure to the Board for comments and review. A general discussion arose over the format and number of brochures to be printed. A motion was made by Ed Nemeroff to commit $9,000.00 for the FY89 budget to produce 25,000 copies of the new brochure. Seconded by Dave Duff. Motion carries.

NEWSLETTER COMMITTEE REPORT – JOHN MINCK

The last issue of the Newsletter announced a new column to answer questions regarding MIL STD 45662A. Dave Mednick of the Army Material Command Headquarters will be the contributing editor of the new column.

PUBLICITY COMMITTEE REPORT – AL HERMAN

An action item was given to Al Herman to update or ensure that the NCSL is included in the various electronic publications and anything dealing with measurements.

LAB MANAGEMENT V.P. REPORT – BOB SMITH

MEASUREMENT ASSURANCE COMMITTEE REPORT – ARNO EHMAN

Gave a brief overview on the Measurement Assurance Committee's activities during the September Regional Meeting in Anahiem, Ca.

CALIBRATION INTERVAL COMMITTEE REPORT – HOWARD CASTRUP

The effort of develop a compilation of publication abstracts on calibration interval analysis had been suspended in order to concentrate on developing RP#1. The first draft of RP#1 was distributed for review at the August Board meeting. Some feedback has been provided with mixed reaction regarding the technical level of treatment. This RP is currently being revised to accommodate reviewer comments and recommendations.

EQUIP. MGMT. FORUM COMMITTEE REPORT – CHARLIE SIDES

The second 1988 Equipment Management Forum was held September 29 and 30 in Atlanta, Georgia.

The Recommended Practice "An Individual Equipment Evaluation Guide" was submitted to the Board for approval by Ken Pierce on August 17, 1988. A motion was made by Bob Smith to accept the "Individual Equipment Evaluation Guide" as presented. Seconded by Del Caldwell. Motion carries.

A discussion arose over the distribution of the new RP-8 and if it should also be mailed to the EMF members. The general consensus was that it should be mailed to the EMF members since it is targeted at their operations.

The Equipment Managers Handbook should be completed in draft form by year's end.

A point paper will be developed by Chuck Van Winkle Automated Standards Subcommittee Chairman, based on the material that he has acquired during the various workshops.

A new EMF Steering Committee position of Forum Facilitator was established. Randy Seefeldt has accepted this

position in addition to his existing position of Financial Director.

INSTRINSIC/DERIVED STANDARDS COMM. RPT. – KLAUS JAEGER

Formed the Instrinsic/Derived Standards Committee which consists of three individuals for industry, two from NIST, one from DOE, three from DOD and one from NASA. The main goal presently is to develop and write a guideline document which would allow the committee members to work alone without further guidance from the Committee Chair.

INDUSTRIAL TECHNOLOGY V.P. REPORT – JIM INGRAM

Sent computer programs and data base files to Bob Smith for the 1989 Conference. This programs are used by the Conference Program Chairman. Also included were form letters that are sent to speakers during the Conference preparation process.

A discussion arose over metrology programs within the hospital community and if the NCSL should place increase emphasis in this area.

BIOMED. & PHARMACEUTICAL METROLOGY COM. – DOUGLAS SMITH

The Biomedical & Pharmaceutical Metrology Committee will be holding a two day meeting in Chicago In November 1988. This is being held in conjunction with a major drug industry conference and should draw a good attendance.

AUTO. TEST & CALIBRATION COMMITTEE REPORT – KEN LANDIS

This Committee has absorbed the Software Standardization Ad Hoc Committee and Ken Landis has accepted the task of defining the standardization on format for calibration software. A committee meeting will be held in Southern California in November of 1988. Future projects will be lined up at this meeting.

UTILITIES COMMITTEE REPORT – RAYMOND DiSANDRO

The Utilities Committee is holding an NCSL Specialty Conference for the utilities industry at the Duke Power Plant in North Carolina. The committee is working on a draft Recommended Practice for operating a laboratory in the utilities industry. The expected completion date for this effort is the end of 1989.

FACILITIES COMMITTEE – RAY PERHAM (TENTATIVE)

This committee will expanding RP-7 as well as reviewing and updating the existing sections as required.

GLOSSARY OF TERMS – STAN CRANDON

The Glossary Committee has gotten off to a good start. A sign-up sheet was sent to the committee members to indicate in which areas they would search for existing glossaries.

EDUCATION VICE PRESIDENT'S REPORT – JOHN MARTIN

Several committee reports were not on file. President Gary Davidson presented the available reports since John Martin was not present at the Board meeting.

TRAINING INFO. & DIRECTORY COM. REPORT – DAVE LORENZEN

The 1989 edition of the Training Information Directory is in circulation, several company inputs were late & will be printed in the Newsletter.

REGION 1 COORDINATOR'S REPORT – HARRY HAYMES

The next regional meeting will be held on November 2nd at the Days Inn in Woburn, Ma.

REGION 11 COORDINATOR'S REPORT – JOHN BUCK

Three very successful sectional meeting were held in October with a total of 108 attendees.

DIRECTOR FOR REGIONS 2 & 5 REPORT – DAVE DUFF

Max Green provided his sectional meeting dates for November 1988, 1989 and 1990.

Steve Stahley is the new Indiana Section Leader.

Followed up with John Schultz in Fort Wayne on starting a new section.

REGION 2 COORDINATOR'S REPORT – WILLIAM BRENANT

A discussion arose over the possibility of dividing Region 2 into 2 sections. One in New York and the other in Pennsylvania.

DIRECTOR FOR REGIONS 3 & 4 REPORT – ANTHONY ANDERSON

The new Region 3 Coordinator is Wayne Zimmerman, Central Marketing Associates.

There has been no activity in Region 4 since the last Board meeting. The central Florida section meeting is scheduled for October 26th in Titusville.

The meeting dates for Regions 3 and 4 for 1989 have been provided to Dave Goodhead.

DIRECTOR FOR REGIONS 6 & 8 REPORT – CHET CRANE

Region 6 has 100 paid members and was represented at the National Conference by 46 persons. Have not completed reviewing the non-member companies that attended the Conference.

Region 8 has 133 paid members and had 68 at the National Conference.

REGION 6 COORDINATOR'S REPORT – BOB WILLETT

Continued the discussions in regards to the "West Section" centered in the Denver Colorado area. A final decision to whether a new section should be formed is pending future conversations with various personnel.

A discussion arose over an article from the Electronic Manufacturing magazine which listed various technical societies and trade associations and which the NCSL was not listed. The general consensus was that Marketing should endeavor to reach as many of these magazines as possible so that the NCSL is included.

REGION 8 COORDINATOR'S REPORT – ROLF SCHUMACHER

The Orange County Section of Region 8 held a meeting on September 20th. Ken Landis had an excellent program and very good attendance.

REGION 9 COORDINATOR'S REPORT – ROGER FISHER

A discussion arose over dividing the Region 9 into two sections, one East and West of the mountains. There are very few new members in the region.

INTERNATIONAL DIRECTOR'S REPORT – GRAHAM CAMERON

A position paper on International Traceability is in the process of being written. Graham Cameron, Klaus Jaeger are the co-leaders with Joe Simmons, Del Caldwell, Tony Anderson and Don Dalton will undertake this project.

Communications with the Ontario Ministry of Skills Development continue with a view to secure funding for the "Needs Survey". Indications of support from the Ontario Ministry of Colleges and University have been conveyed to the committee.

The invitation from the American Embassy in Kuala Lumpar which was discussed at the International Regional Meeting has resulted in certain NCSL organizations making contact with the scientific Officer.

As discussed at the August Board meeting and by telephone, Graham Cameron will work with the Past President on the initiation of other international sections.

A discussion arose over memberships from communist block nations. The general consensus of the Board was not to follow this matter any further due to the potential problems that could develop over the transfer of technology and security.

PMA LIAISON DELEGATES REPORT – GLEN RASMUSSEN

The annual meeting of PMA membership was hosted by the Orange Section on September 14, 1988 at Buena Park California. The Orange County Section of the PMA won the John Quincy Adams award for having earned the most points in competition between sections.

The PMA currently has a membership of 638 members.

Steve William, Central Colorado Section, has been named to succeed Bob Couture as regular editor of the PMA Newsnotes.

MSC LIAISON DELEGATES REPORT – CHET CRANE

Preparations for the Conference to be held January 26 & 27 are proceeding as scheduled. The program is complete and the final brochure is in process of being mailed.

A2LA LIAISON DELEGATES REPORT – PETE UNGER

Sent A2LA information to Carl Quinn for his committee's review to recommend how the NCSL might provide technical input to the A2LA.

The A2LA Criteria Council Chairman, Carl Miller, is planning to communicate with Carl Quinn regarding the NCSL participation in further development of specific criteria for metrology laboratory accreditation.

The A2LA Directory of accredited Laboratories - 1988 was adopted on August 26, 1988 and is approved for use by the Department of Defense

ANSI LIAISON DELEGATES REPORT – ROLF SCHUMACHER

The second draft of the proposed ANSI/ASQC Standard Q4 has been awaiting it's first review since August 1988. In the interest of avoiding unnecessary duplications and conflicts in procurement, the DOD is exploring the use of industry and international standards.

CPEM LIAISON DELEGATES REPORT – ART McCOUBREY

The plans for CPEM '90 are progressing well as reported by Conference Chairman Dr. Jacques Vanier. A preliminary announcement has been sent out and the budget is established.

CPEM '90 will be held June 11 – 14, 1990 at the Westin Hotel in Ottawa Canada.

ISA LIAISON DELEGATES REPORT – MIKE SURACI

The missing ISA booth that was exhibited at the NCSL Conference was located and forwarded to the ISA Headquarters. Attended the ISA Conference held in Houston Texas. The turnout was outstanding.

WECC LIAISON DELEGATES REPORT – GRAHAM CAMERON

A letter has gone forward to the WECC Secretary in respect to the current project on international traceability issues related to the MIL-STD-45662A in order to benefit from the European experiences.

Graham Cameron presented a brief organizational structure and operation of the WECC.

IEEE LIAISON DELEGATES REPORT – JERRY HAYES

An update to the IEEE specification on test equipment control in nuclear power applications has been initiated by the IEEE Standards Board. I have requested to become a reviewer of the document so that the NCSL interests can be considered.

CORM LIAISON DELEGATES REPORT – BILL SIMMONS

Bill Simmons presented to the Board the organizational structure of the organization and a brief overview of their operations.

IMEKO LIAISON DELEGATES REPORT – MIKE SURACI

A discussion arose over whether or not the NCSL should continue to have a liaison with this organization due to the length of time between conferences. Mike Surraci will develop a recommendation on this and present it to the Board.

AIA LIAISON DELEGATES REPORT – BOB WILLETT

The WSC #1 committee met last in June 1987. The new chairman, Luis Diaz is contemplating a meeting before the first of the year.

Nothing to report on the Treaded Fastener except that the interim uncoordinated revision to two military standard documents of April 1988 is still out but the coordination review activity has not happen yet. 3 A discussion arose over the topic of the Threaded Fastener and what impact it is having on some of the various companies.

CONFERENCE EVALUATOR REPORT – CHET CRANE

The location of future conferences were varied with more than 100 wanting it to remain close to the NIST but the 1990 Conference to be held else where.

1989 CONFERENCE REPORT – VAL GERSBACH

EXHIBITS – DEAN BRUNGART

Dean Brungart briefed the Board on the current exhibit status and a overview of the 1989 Conference plans. There will be 98 exhibit spaces at the 1989 Conference. This reflects 15% increase over the 1988 Conference.

PROGRAM CHAIRMAN – BOB SMITH

Bob Smith provided an overview of the Programs progress to date.

A discussion arose over the NIST tour coordination. Joe Simmons suggested that someone should contact NIST quickly to set the arrangements.

Five applications to present papers and/or be on a panel discussion at the 1989 NCSL Conference have been received to date. Several others have expressed their desires. However, the application have not been received.

AD HOC COMMITTEE REPORTS – GARY DAVIDSON

PERSONNEL QUALIFICATIONS COMM. – RICHARD HYMAN

Committee background, purpose and method information was summarized.

The committee's problem is to provide a qualification package that can be adapted to all of the differences between users and still retain its usefulness.

CHANGE IN THE NIST UNIT OF MASS – RICHARD DAVIS

The first committee meeting was held on August 18, 1988. This committee reach a consensus that the NIST working standards of mass are systematically offset from the international standards. The committee decided to draft several documents aimed at the various audiences to explain the changes and their consequences.

The next meeting is scheduled to coincide with the Measurement Science Conference in January 1989.

A discussion was held on the effects of the unit of mass offset would have on the measurement community. Very few customers would notice the difference at all due to the small amount of offset.

ATTENDEES

Gary Davidson	TRW
Del Caldwell	Dept. of Navy
Jim Ingram	Lockheed MSC
Robert Smith	Ford Aerospace
Bill Simmons	Sverdrup Technology
Bob Weber	Lockheed MSC
Roland Vavken	Rockwell Intl.
Bill Doyle	U.S. Inst. Rentals
Joe Simmons	NIST
Ed Nemeroff	EN Instruments
Tony Anderson	Guildline Instruments
Ralph Bertermann	G.D. Searle & Co.
Chet Crane	Teledyne Microelect.
Dave Duff	Eli Lilly & Co.
Graham Cameron	Dept.. of Nat. Def.
Bill Brenant	Loral Electronics
John Buck	Unisys Corp.
Roger Fisher	Boeing Aerospace
Woody Tramel	EG&G Florida, Inc.
Bob Willett	Rockwell Intl.
Steve Stahley	Datron/Wavetek
Dean Brungart	Teledyne System
Klaus Jaeger	Lockheed MSC
Tom McGovney	TRW
Charlie Sides	Boeing Aerospace
Rich Davis	NIST
Rich Hyman	Dept. of the Navy
Mike Suraci	Lockheed MSC
Ken Armstrong	Speedwell Intl.
Pete England	General Dynamics
Hartwell Keith	

PRESIDENT'S MESSAGE

(Continued from page 1)

Our thanks also to Gary Davidson for his hard work and many contributions as President of NCSL during 1988. Gary's unwavering leadership, his considered actions and subtle humor kept the Board on course and NCSL productive during 1988! His record testimony to Congress early last year, including his in-depth responses to their many questions, demonstrated both his depth of knowledge and his commitment to the field of metrology. Thanks, Gary!

WELCOME

Let's extend a warm welcome to the 1989 Board of Directors and its new members: Past President, Gary Davidson; Executive Vice President, Bill Simmons; Secretary, Bill Doyle; Treasurer, Roland Vavken; NIST Representative, Joe Simmons; Vice President, Operations and Marketing, Tony Anderson; Calibration Systems Management, Bob Smith; Industrial Programs, Jim Ingram; Education and Training, Chet Crane; Measurement Science and technology, Klaus Jaeger; Conference Management, Val Gersbach; Director (1/11), Ralph Bertermann; Director (2/5), Dave Duff; Director (3/4), Bill Brenant; Director (6/8), Bob Willett; Director (7/9), Dave Goodhead; and, Director for the International Region, Graham Cameron.

Each member of this team has served NCSL in many capacities and I know each will work hard in the coming years to assure NCSL's continued growth and support to its member organizations.

MIL-STD 45662A

I know John Minck will tease me about editorializing, but be sure to read Dave Mednick's column with comments and answers to questions on the MIL-STD. This column is a joint NCSL and DOD effort to continue to improve communications and mutual understanding of the MIL-STD and its application to calibration systems and programs. Drop Dave a line with any questions and comments you have on the MIL-STD and the column.

Del Caldwell, President

GAS FLOWRATE METROLOGY

G.E. Mattingly
Fluid Flow Group
Chemical Process Metrology Division
Center for Chemical Engineering
National Engineering Laboratory
National Bureau of Standards
Gaithersburg, MD 20899, U.S.A

1988 ANNUAL
CONFERENCE
RUNNER-UP PAPER

ABSTRACT

Increased concerns for improved gas flowrate measurements exist today in our nation's marketplaces, in our continuous process industries, and in the technologies which impact public safety and our national defense. To respond to these concerns, improvements are being sought in fluid measurements in existing installations and in fluid meters which are being retrofitted into flow systems where none previously existed. For all of these reasons, the NBS-Gaithersburg calibration facilities for gas flow should be known, accessible, and adequate to expressed needs. The NBS-Gaithersburg calibration techniques, facilities, ranges and levels of performance are briefly described for gas flowrate.

INTRODUCTION

Properly assured fluid measurements in practical metering installations require adequate credibility for acceptance. To establish the basis for credible acceptance, national systems of measurement are arranged and traceability chains are set up to obtain the desired acceptance, see [1]. For gas flowrate and related measurement systems, NBS has established and maintains a number of facilities with which to perform calibrations and to provide traceability over a range of fluids (mainly air), flowrates, and parameters. These conditions can be found in NBS Special Publication 250 [2].

CALIBRATION PRINCIPLE

Flow calibrations are usually performed using a system that includes a source of flow, the instrument being calibrated, connecting conduits, and a scheme for determining the fluid flowrate. When the calibration is based upon the bulk flowrate, i.e., time rates of fluid volume or mass, the scheme for determining the fluid flowrate, in a highly accurate manner, is generally a timed-collection technique, see [3-7]. For each of these schemes, the error budget should be known and maintained so that overall performance levels are as quoted.

A typical system for determining bulk flowrate is illustrated in Fig. 1. Control volumes, see [8], a, b, c are shown for a meter, connecting piping and calibrator volumes, respectively. The inlet piping to the metering element should be specified and should provide the appropriate flow pattern at the inlet to the metering element. The meter and its downstream piping is considered herein as a part of the meter and volume a. Depending on the type of calibrator, control surface 4 of volume c may be a moving piston, the stationary end of a tank, etc. Conservation of mass principles for the flow in such a system indicates

$$0 = \frac{\partial}{\partial t}\int_V \rho dV + \int_A \rho \bar{v} \cdot d\bar{A} \qquad (1)$$

Where ρ is the fluid density, $\partial/\partial t$ is the partial derivative with time, V is the control volume, which is comprised of all the sub-volumes in Figure 1. A is the area enclosing the control volume, V. The quantity $\bar{v}$ is the vector velocity of the fluid and $d\bar{A}$ is the vectorial control surface element of area with direction taken outward and normal to the surface. Applications of Eq. (1) to the control volume and surfaces shown in Figure 1 gives

$$\dot{m} = \int_{A_1} \rho_1 \, v_{1n} \, dA_1 = \frac{\partial m_c}{\partial t} - \int_{A_4} \rho_4 \, v_{4n} \, dA_4 + \int_{V_a} \frac{\partial \rho_a}{\partial t} \, dV_a + \int_{V_b} \frac{\partial \rho_b}{\partial t} \, dV_b \qquad (2)$$

where m is the mass flow rate through the 1 surface and $\partial m_c/\partial t$ is the rate of fluid mass collected in volume c. Subscripts n refer to vector components normal to the numbered surfaces; integer subscripts refer to surfaces, lettered subscripts refer to volumes.

Performance levels for bulk flowrate calibration facilities can be assessed using the above principles. In what follows, these principles will be applied to the bulk flowrate calibration facilities at NBS for air. A summary of these facilities is given in Table 1.

Table 1. Air Flow Rate Calibration Facilities and Capabilities at NBS-Gaithersburg

Nominal Flow Rate Range	Capabilities	Flow Determination System
Low	Up to 0.15 m^3/min (5 SCFM)	Mercury Sealed Piston Devices
Medium	Up to 3.0 m^3/min (100 SCFM)	Bell Provers
High	Up to 83 m^3/min (3000 SCFM)	Pressure, volume, temp. and time (P,V,T,t) techniques with sonic nozzles

AIR FLOWRATE – LOW RATES

Technique. Mercury sealed piston displacement techniques are currently used at NBS to calibrate fluid meters flowing air at low rates; a sketch is shown in Fig. 2. This system is termed a dynamic one in that the fluid collection is initiated and terminated by the moving piston passing between specially characterized light beams arranged through the cylinder across the piston's path. The cylinder is a precision-bore glass tube; the piston is plastic (PVC) with a horizontal groove retaining the mercury which forms the seal between piston and cylinder.

Operation. To make a flowmeter calibration measurement, flow is produced and equilibrated through the meter and its adjacent piping. The calibration is performed by diverting this flow into the prover so that the piston rises, attains a constant velocity, and then passes through the collection interval where the timing is done. The pressures and temperatures of the flow through the meter and the flow in the prover are measured during each "run", i.e., the timed collection interval.

The device can be operated in reverse fashion by arranging the piston to fall under its own or added weights. In such a mode of operation the flow direction arrow in Fig. 2 is reversed. The error analysis given below would apply to either of these cases.

Analysis. Applying the above described conservation of mass considerations to the piston prover operation gives

$$\dot{m} = (\rho + \Delta\rho)\frac{\Delta V_c}{\Delta t} + (V_a + V_b)\frac{\Delta\rho}{\Delta t} + \rho\frac{(\Delta V_a + \Delta V_b)}{\Delta t} + \dot{m}_4 \qquad (3)$$

Here ΔVc is the cylindrical collection volume produced via the piston stroke during the collection time, Δt. The density ρ of the gas is that determined via temperature and pressure measured as the piston begins this stroke; the change in density $\Delta\rho$ is a variation in ρ determined via changes measured in temperature and pressure during the collection time, Δt. The volume $(V_a + V_b)$ which is often termed the "inventory volume" is that in the connecting piping between the meter and the prover in which the gas density change rate is $\Delta\rho/\Delta t$ over the time interval of the piston stroke. The volume V_a includes the volume of the flowmeter, including any manometry, the volume V_b includes associated piping, the tare volume in the prover, and any other manometry. The term $\rho\Delta(V_a + V_b)/\Delta t$ is the mass rate through the meter that is due to any increase in the inventory volume over the interval of the piston stroke. The term m_4, which should be zero or negligible, represents any mass rate of gas due to leakage.

Sources of Uncertainty. The first term on the right side of Eq (3) is usually the largest contribution to the mass rate $\dot{m}$ and represents the uncorrected mass collection rate in the cylindrical volume of the prover. It is subject to potential errors in the determination of: (1) the collection volume ΔV_c, (2) the timing interval, and (3) the gas density ρ. Errors in ρ can result from uncertainties in the measurement of atmospheric and gage pressures and temperature.

The second and third terms on the right side of Eq (3) can become error sources if a change, $\Delta\rho$, in density occurs during the piston stroke. This can result from changes in pressures and temperatures which go undetected or, if detected, are not properly taken into account. It is noted that the inventory volume $(V_a + V_b)$ can be a significant fraction of ΔV_c for these types of provers so that density changes can be significant. Changes in inventory volume $\Delta(V_a + V_b)$ are generally zero or very small and hence can be neglected. Similarly, leakage in the system can and should be checked and, if found, eliminated so that this error source is zero.

Summary of Uncertainties – Piston Provers. Typical values for the components of uncertainty on the determination of mass flowrate using the NBS piston provers are tabulated as follows:

Source of Uncertainty	Uncertainty, %
1. Collection Volume	
a) Cylinder area	0.023
b) Piston stroke length	0.001
c) Piston rocking	0.012
d) Thermal expansion	0.003
2. "Standard" Air Density	0.020
3. Pressure	
a) Barometric	0.100
b) "Gage" readings (on density)	0.002
c) Changes in piping	0.001
4. Temperature Effect on Density	
5. Timing	
a) Device	0.007
b) Actuation	0.014

The uncertainties are considered to be those for three (3) standard deviations of the respective measurements.

For the case of the NBS piston prover facilities, experience shows that only the first term on the right side of Eq. (3) contributes to the measurement. Therefore, the flowrate uncertainty that can be obtained from a root-sum-square combination of these uncertainties is 0.15%. Largest effects

are noted to be due to the (conservative) values placed upon pressure and temperature effects. Thus, it is concluded that efforts to improve the above described facility are best placed in obtaining increased accuracy and reliability in these component measurement systems.

The above description of the NBS piston prover facilities pertains to the "in-house" uncertainties. Since there does not exist an "identity" standard for air flow measurement, it is required to conduct "round robin" testing programs to estimate the systematic errors that may separate true values from laboratory results [3, 9, 10]. Until these "round robin" tests are conducted, it is the practice at NBS to estimate systematic error levels for the piston provers at 0.1%. When this value is added to the above described "in-house" uncertainty, this produces an overall accuracy quote for these systems at $\pm$ 0.25%.

AIR FLOWRATE – MEDIUM RATES

Technique. Bell prover techniques are currently used at NBS to calibrate fluid meters flowing air in the medium flowrate range, see Table 1. A sketch of the configuration of the device is shown in Fig. 3. This system is also termed a dynamic one in that the fluid collection is initiated and terminated by the moving bell passing through a specially characterized vertical path length. The device consists of a cylindrical tank open at the top, with a central "dry-well" forming an annulus that is nearly filled with a sealing oil. Into this annulus is placed an inverted cylindrical tank – the bell – which is open at the bottom and having a dome-shaped top. Its weight and support chain are balanced by counterweights so that it can be raised or lowered at constant velocity with a pressure slightly larger than ambient so as to collect or discharge a measurable volume of gas. A smaller counterweight is mounted on a cam so that it compensates for the buoyancy effects as the bell immersion changes. Rollers and guide rods provide lateral stability.

Operation. To make a calibration measurement, flow is established and equilibrated in the flowmeter and adjacent piping with the bypass valve, see Fig. 3, so that the bell is just "floated' off its bottom support. To initiate the calibration, this valve is closed so that all the flow is diverted into the bell. Following a brief period in which accelerations, pressure transients, etc. subside, the bell attains constant velocity with steady state conditions during which it passes through its stroke length and the corresponding time is measured. During each "run" or bell stroke, (1) the temperature is measured with a thermocouple inserted into the bell, (2) the collected air pressure is measured with a barometer and a water manometer connected to the inlet piping, and 3) the timing is done using precision switching and an electronic timer.

Sources of Uncertainty. As with the piston prover technique described above, the first term on the right side of Eq. (3) is the basic uncorrected collection rate. It is subject to potential errors in the geometrical determination of ΔV_c – i.e., bell-strapping and stroke length measurements, the timing interval, Δt, and in the density determination, the latter stemming from uncertainties in the measurements of barometric and gage pressures and temperature.

The first and second terms on the right side of Eq. (3) become error sources if a gas density change, $\Delta\rho$ occurs in the bell during the collection period and is either undetected or, if detected, not properly accounted for in the computations. It is again noted here that $(V_a + V_b)$ can be a substantial term relative to ΔV_c so that considerable amplification of the $\Delta\rho$ effect is possible.

In this type of prover, the third term on the right side of Eq. (3) – specifically the ΔV_b term has a significant contribution due to the oil displacement and level changes with bell stroke. This change in volume is taken into account in the computations and so it is not in itself an error source. However, changes in the inner sealing-liquid level can also be caused by changes in bell pressure (relative to ambient) during the collection and, depending on the relative surface areas of the sealing liquid inside and outside of the bell, by the adherence of a liquid film to the bell surfaces. The leakage term, m_4 in Eq. (3) is kept zero or negligible by leak checking through monitoring the constancy of the vertical position of the raised bell for an extended time period.

Summary of Uncertainties – Bell Provers. Typical values for the components of uncertainty on the determination of mass flowrate using the NBS bell provers are tabulated as follows:

Source of Uncertainty	Uncertainty, %
1. Bell Volume	
a) Bell strapping	0.026
b) Bell wall thickness	0.007
c) Bell stroke length	0.001
d) Thermal expansion	0.005
e) Oil film adherence	0.013
2. "Standard" Air Density	0.020
3. Pressure	
a) Barometric	0.100
b) "Gage" readings	0.002
c) Changes in piping	0.002
d) Effect on "constant" density	0.010
e) Effect on density change	0.010
f) Rise effect on oil level	0.066
4. Temperature Effect on Density	0.017
5. Timing	
a) Switching	0.006
b) Bell motion	0.040

The uncertainty values are considered to be three standard deviations of the respective measurements.

The error-propagation equation based on Eq. (3) is, including only the non-negligible terms

$$\frac{d\dot{m}}{\rho \Delta V_c / \Delta t} = \frac{d\rho}{\rho} + \frac{d(\Delta V_c)}{\Delta V_c} + \frac{d(\Delta t)}{\Delta t} + \frac{d(\Delta V_a + \Delta V_b)}{\Delta V_c} \quad (4)$$

The $d\rho/\rho$ uncertainty in Eq. (4) is composed of items 2, 3a, 3b, and 4 listed above which when summed in quadrature and added to 3c gives 0.105%. The $d(\Delta V_c/\Delta V_c$ term consists of items 1b, 1c, 1d which when summed in quadrature and added to item 1a gives 0.035%. The $d(\Delta t)\Delta t$ term is composed of items 5a and 5b – a total inquadrature of 0.0400%. The $d(\Delta V_a + \Delta V_b)/\Delta V_c$ term consists of items 3f and 1e. These terms can be shown to be of opposite signs, so the larger 0.066% is selected as the bound. Finally, the $\Delta\rho$ terms, i.e., 3d and 3e are treated as errors; they have the same sign and their total is 0.020%.

The sum, in quadrature, of the foregoing yields a total system uncertainty of 0.14%. It is clear that the major contributor to the total is the barometric pressure determination. Therefore, to reduce the uncertainty of the air flowrate measurement, improved barometric pressure instrumentation, or more detailed calibration of existing devices would be effective. Adding an estimated systematic uncertainty in the amount of 0.1% produces an accuracy quote of +0.24%.

AIR FLOW RATE- HIGH RATES

Techniques. Pressure, volume, temperature and time techniques with some nozzle transfer standards are currently used at NBS for calibrating meters that flow air at high flowrates, see Table 1. The system is sketched in Fig. 4; the tank and associated hardware that forms the primary basis for measuring flowrate is shown in Fig. 5. Filtered, dry air is used in this system which has a designed flowmeter range up to 85 m_3/min. The collection tank shown in Fig. 5 contains approximately 28 m_3 and is used to measure air flowrates via the temporal increase in the mass of collected gas. These measurements are "dynamic" for the initial mass in the tank and "static" for the final mass in the tank. Additional dynamics are involved in opening and closing motions of the diversion valving which are timed to determine the collection interval.

The thermodynamic conditions of the collected gas are determined using pressure (manometry) and temperature (thermistors) instrumentation. The manometry is arranged to operate between a vacuum and the tank as shown in Fig. 5. The thermistors – ten in number – are positioned in a vertical and horizontal array so that stratification effects are monitored to produce an accurate estimate of the average temperature. These thermistors are calibrated against a platinum resistance thermometer that receives calibration from NBS' Temperature and Pressure Division.

The volume of the tank is determined via weighting techniques. Double substitution mass comparison methods are used to accurately measure the mass of gas discharged into the tank [11]. Temperature and pressure measurements, before and after the gas discharges enable calculation of the tank volume using iterative techniques, see [23, 13].

The diverter error associated with the fluid flow, the valve opening characteristics, and the switch arrangements for starting and stopping the timing device is analogous to the diverter error produced in static gravimetric calibration systems, [3, 4, 5, 12]. To determine this diverter error and its dependence upon flowrate, a modification of the conventional gravimetric procedure has been developed and used to simultaneously determine both the discharge coefficient for the sonic nozzle and the diverter error for a specific flowrate, see [12 and 13].

Operation. Using this P, V, T, t facility, NBS sonic nozzles, see [13], are calibrated and then used as transfer standards to calibrate meters flowing air. Applying conservation of mass principles to this tank system, Eq. (3) becomes

$$\dot{m}_1 = \frac{\Delta(\rho_c V_c)}{\Delta t} + \dot{m}_4 + \frac{\Delta\rho_a}{\Delta t} V_a + \frac{\Delta\rho_b}{\Delta t} V_b \quad (5)$$

The first term on the right side of Eq. (5) expresses the time rate of mass collected in the tank. The second term is the leakage term which should be zero or negligible. The third and fourth terms express the rate of mass change in the meter and connecting piping volumes V_a and V_b in which the pressure increases over the collection interval as it does in the collection tank, V_c.

Summary of Uncertainties – P, V, T, t and Sonic Nozzles. The uncertainties involved in determining the discharge coefficients for the NBS sonic nozzles are listed as follows:

Source of Uncertainty	Uncertainty, %
1. Collection Volume	
a) Tank	0.008
b) Inventory (associated piping)	0.001
2. "Standard" Air Density	0.020
3. Pressure Effect on Density	0.025
4. Temperature Effect on Density	0.017

5. Timing

a) Device	0.001
b) Switching	0.029

When these standard deviation uncertainties are summed in quadrature to produce, for the example of a sonic nozzle having a nominal throat diameter of 1-1/8 inch (28.6 mm) an overall uncertainty of $\pm$0.047%. The addition of an estimated systematic uncertainty of 0.1% therefore produces an accuracy quotation of $\pm$0.15%.

FLOW MEASUREMENT TRACEABILITY

To establish realistic flow measurement traceability, a test program must be devised for "round robin" tests so that, see [3, 10, 14-17]:

1. high confidence can be placed in the artifact package – the meters assembled and the specifics of the procedures, check-points, responses to anticipated anomalies, etc.,
2. the data base produced is adequate to the task of clearly evaluating the significant components of the systems that participate, and
3. the algorithm for processing the data and producing the results is an unbiased and clear procedure that is adequate to this task.

Artifact confidence is established via calibration testing over an extended period of time for the kinds of conditions that will be used in the round robin. This testing should occur in the initiating laboratory and it should establish a credible background data base for the units being tested. Specifically, high competence can be attained by calibrating two (2) meters in series according to tightly specified conditions. This type of configuration is shown in Fig. 6. Pre-testing of these configurations gives expected values for the respective meter factors as well as for the relative performance of the meters – i.e., the ratio of their outputs.

Adequacy of the data base is established by specifying the number of repeat calibrations done for each flowrate and meter configuration. These results should produce sufficient data so that statistical significance can be generated to exhibit the quality of measurement performance – (1) how this varies for successive calibrations done for the same conditions over short periods of time – i.e., repeatability, and (2) how this varies from day to day for conditions that may vary slightly – i.e., reproducibility. It is recommended here that the data base be generated efficiently and for the expressed purpose of testing laboratory performance. To do this, a minimum number of flowrates are used and sufficient tests at each are done. An alternative approach might be to use numerous flowrates and minimal replications at each. However, this alternative approach tends, undesirably, to place emphasis on meter characteristics, as opposed to test laboratory characteristics.

The algorithm for data processing should be well established. This attribute is achieved when it is (has been) used for a number of MAPs for other measurement systems, i.e., the procedures produced by W. J. Youden and co-workers, see [14, 17].

By testing in both configurations shown in Fig. 6 the upstream data (and the downstream data), individually, have the statistical independence requirement that is needed to apply the Youden procedure, etc. The "SFC" unit shown in Fig. 6 is a "super flow conditioner" placed between the tandem meters, see [14-16]. It is intended to isolate the downstream meter from flow profile (or other anomalies) that might exist in the laboratory pipeline that connects to the upstream meter. Thus, the tandem meter configuration affords one the opportunity of generating data both without and with pipe-flow profile effects because downstream meter and upstream meter performances can be treated separately. The resulting comparisons can give unique global insights into laboratory pipe-flow phenomena without having to measure these distributions.

The types of flowmeters for this type of laboratory testing should be selected according to the experiences of the participating laboratories. This consensus selection should produce the type of meter, the size, manufacture, associated instrumentation, etc. This selection process should be extended to include the fluid conditions, the flowrates, etc. as well as the tolerances to be used in arranging these.

The data generated via the round robin testing program is analyzed for each of the flowrates selected and for each of the meter positions. For each of these conditions, plots are produced of the respective meter performance characteristics; i.e., meter factor, discharge coefficient, see [14-17].

Individual results, or averages thereof, can be plotted. Each point represents the combined results for both meters for each laboratory.

The data processing procedures consist of determining median values for the respective sets of data for the meters. By drawing horizontal and vertical lines through these median points, the plot is divided into four Cartesian quadrants. The origin of this Cartesian system is, according to the available data, the best estimate of the true values of the meter factors for the two meters tested according to the specified conditions, see Fig. 7. In the northeast Cartesian quadrant, the data can be considered systematically inaccurate in that points are each higher than those of the origin. Similarly in the southwest quadrant, points are lower. Thus, the degree to which data is distributed in these quadrants is a measure of the systematic off-sets prevailing in the laboratory data.

In the northwest and southeast quadrants the data can be considered inconsistent or random in that one value is low while the other is high. Therefore, the degree to which the

data is distributed in a northwest to southeast manner about the median intersection is a measure of the random variation in the data.

The preferred result indicating good control would be to find that the measurement of systematic distribution (northeast to southwest) is equal to the random distribution (northwest to southeast) and that these measures are acceptably small. The respective levels of uncertainty can be quantified.

Where, as is usually the case, the two meters are identical, a procedure for quantifying the respective random and systematic levels of the data can be used as follows, see [15-17]. A line of slope +1 is drawn through the intersection of medians on Fig. 7. The data is then projected perpendicular to and parallel along this diagonal line. The respective projections are then used to produce standard deviations:

$$\sigma_r = [\frac{1}{N-1} \sum_{i=1}^{N} N_i^2]^{1/2} \qquad (6)$$

$$\sigma_s = [\frac{1}{N-1} \sum_{i=1}^{N} P_i^2]^{1/2} \qquad (7)$$

where N_i and P_i are the normal and parallel components of the data projected to the diagonal line. The ratio of these quantities produces the degree of ellipticity of the data:

$$e = \sigma_s / \sigma_r \qquad (8)$$

When this ratio is larger than unity, the interpretation is that systematic variations prevail among the labs; this is quantified by the magnitude of e. Analogous conclusions can be drawn for $e < 1$.

Depending upon the results obtained for ellipticity, a number of reactions can occur. If e is large and this is produced by one or more laboratories, then the reaction should be to examine the components of their flow measurement processes to find systematic causes, etc. If e is small and this is produced by one or more laboratories, the reaction should be to examine the components of their processes with respect to their precision. If e is near unity but the levels of uncertainty are considered too large, then the appropriate response would be for the labs responsible to search and repair the pertinent components.

When such search and repair efforts are completed, the round of tests should be repeated for the same conditions so that improvements can be quantified. Even when such search and repair efforts are not needed, repeat testing is needed to produce the continuous data record desired to substantiate realistic traceability.

SUMMARY AND CONCLUSIONS

Descriptions are given for NBS' facilities for calibrating meters flowing air. Methods of operation are given together with the levels of performance based upon error propagation techniques or experienced judgments in conservatively estimating systematic errors. However, it remains for testing activities – such as "round robins" to be carried out to evaluate the systematic or bias errors to be estimated before "true accuracy" assessments can be made.

Round robin tests need to be carried out for widely ranging conditions, so that the normal and routinely used procedures, facilities, personnel, and computer capabilities in both the NBS labs and in other similar companies, institutions, labs, and countries can be evaluated. Techniques are given through which this may be carried out and data analysis methods are described to better determine laboratory performances. Depending upon these determinations, either assured measurements can be better guaranteed or improving modifications can be undertaken. In either case, improved practical, gas flowrate should result for the benefit of all.

ACKNOWLEDGEMENT

The author gratefully acknowledges his NBS co-workers involved with gas flowrate measurement services, notably K.R. Benson, G.P. Baumgarten, J.D. Melvin, N.E. Mease, and J. M. Hall. As well, he is grateful to Secretary G.M. Kline for her diligence in typing the manuscript.

REFERENCES

[1] Haight, W.C., et. al., *The National Measurement System for Fluid Flow*, NBSIR 75-930 (1976).

[2] Uriano, G.A., editor, *NBS Calibration Services – Users Guide* 1986-88, July 1986.

[3] Mattingly, G.E., Gas Flow Measurement: Calibration Facilities and Fluid Metering Traceability at the National Bureau of Standards, Proceedings Inst. for Gas Technology Conference on Natural Gas Energy Measurement, Chicago, IL, Apr. 30 - May 2, 1986.

[4] Olsen, L.O., *Introduction to Liquid Flow Metering and Calibration of Liquid Flowmeters*, NBS TN 831, June 1974.

[5] Shafer, M.R. and Ruegg, F. W. *Liquid Flowmeter Calibration Techniques,* Transactions ASME, Vol. 80, No. 7, Oct. 1958.

[6] Ruegg, F. W. and Shafer, M.R., Flow Measurement: Procedures and Facilities at NBS, Proceedings Semi-Annual ASHRAE Meeting, San Francisco, CA 1970.

[7] Scott, R.W.W., *Developments in Flow Measurement – I*, Applied Science Publishers, Englewood, NF, 1982

[8] Li, W. H. and Lam, S.H., *Principles of Fluid Mechanics*, Addison-Wesley Publishing Co., Inc. Reading, MA, 1964.

[9] Belanger, B., *Measurement Assurance Programs, Part I: General Introduction*, NBS Special Publication 676-I, May 1984.

[10] Croarkin, M.C., *Measurement Assurance Programs, Part II: Development and Implementation*, NBS Special Publication 676-II, April 1985.

[11] Almer, H.E., *Method of Calibrating Weights for Piston Gages*, NBS TN 577, May 1971.

[12] Benson, K.R., et al, *NBS Primary Calibration Facilities for Air Flowrate, Air Speed, and Slurry Flow*, AGA International Symposium on Fluid Flow Measurement, Nov., 1986, published by the American Gas Assoc., Arlington, VA 22209.

[13] Olsen, L. and Baumgarten, G.P., *Gas Flow Measurement by Collection Time and Density in a Constant Volume*, Proceedings Symposium on Flow – Its Measurement and Control in Science and Industry, Pittsburgh, PA, 1971.

[14] Mattingly, G.E. and Spencer, E.A., *Steps Toward an Ideal Flow Transfer Standard*, FLOMEKO Symposium, Groningen, The Netherlands, 1978, published by North Holland Publ. Co., Amsterdam, NL.

[15] Mattingly, C.E., Dynamic Traceability of Flow Measurements, Invited Lecture, IMEKO Tokyo Flow Symposium, 1979, Society of Instrument and Control Engineers, Tokyo, Japan.

[16] Mattingly, G.E., An Interlaboratory Round Robin Flowmeter Test Using Turbine Meters Flowing Water, in preparation as a NBSIR.

[17] Youden, W.J., *Graphical Diagrams of Interlaboratory Test Results*, Journ. of Industrial Quality Control, Vol. 15, No. 11, pp. 133-37, May 1959.

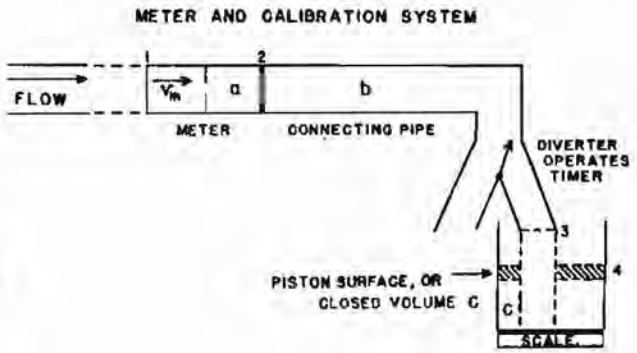


Figure 1. Typical flowrate calibration facility.

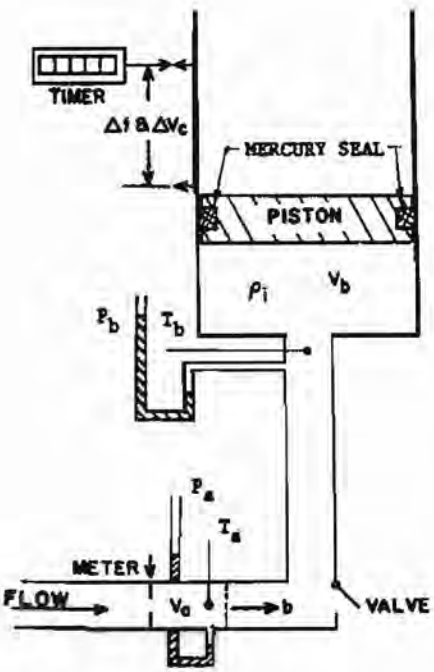


Figure 2. Typical piston prover arrangement.

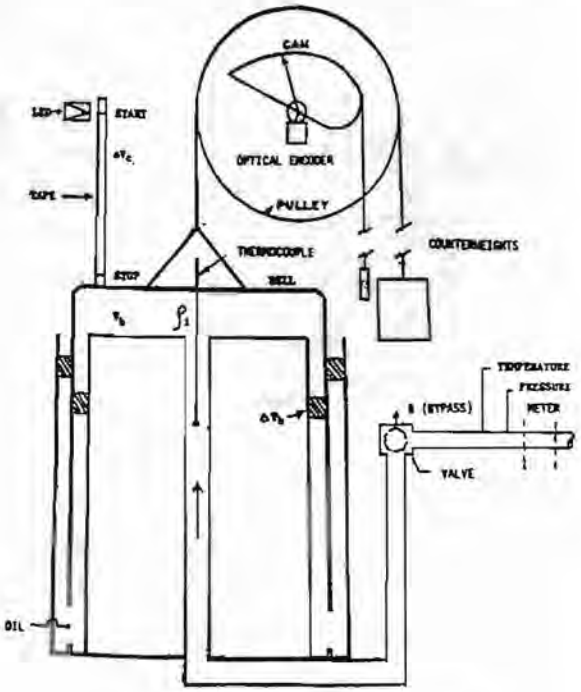


Figure 3. Typical bell prover arrangement.

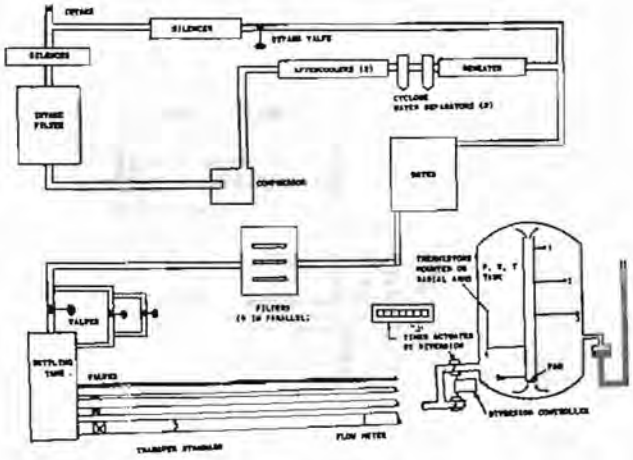


Figure 4. Sketch of NBS' large airflow facility.

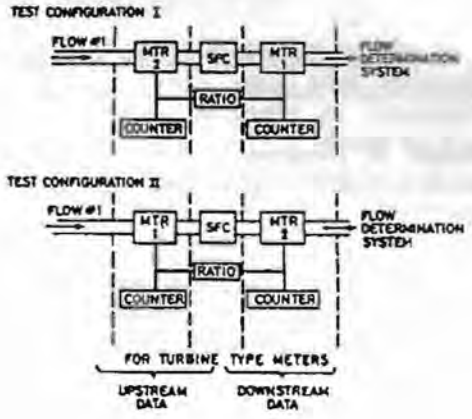


Figure 6. Sketch of tandem meter configurations.

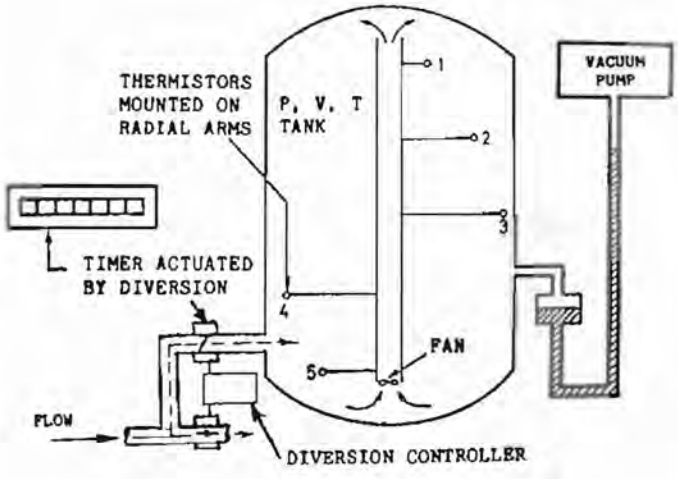


Figure 5. Sketch of NBS' P, V, T, t tank system.

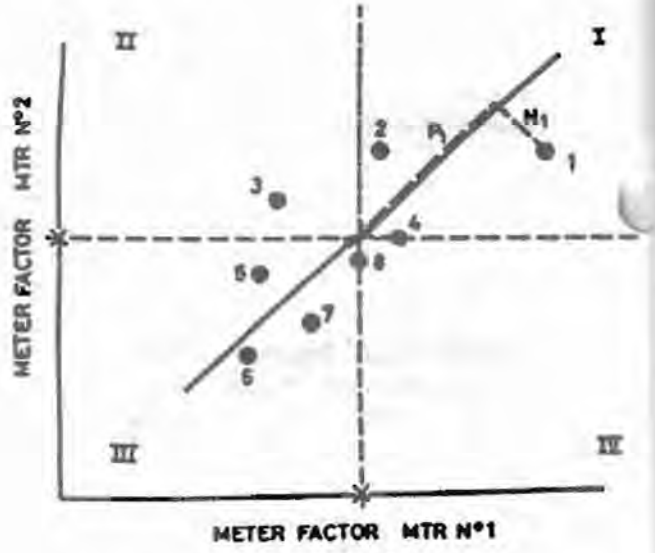


FIGURE 7

MIL-STD-45662A NEWS

Dave Mednick

SUBJECT: INFORMATION COLUMN FOR MIL-STD 45662A

Since distribution of the "Advance Copy" of MIL-STD 45662A the most frequently asked question has been "when will Military Handbook-52A (Evaluation of Contractor's Calibration System) be revised?" To date, a draft revision to the MIL-HDBK has been distributed to the Services (Army, Navy, and Air Force) for their review and comments. A target date of the end of this calendar year has been informally established for the Services to have completed their review and provide recommended changes. Once a final draft to the MIL-HDBK has been completed, a copy will be forwarded to the Ad Hoc group of the NCSL and Defense Logistics Agency for their comments. At the completion of all staffmg actions, it is anticipated that an "Advance Copy" of the MIL-HDBK, similar to what was provided for the MIL-STD, will be available for distribution in early 1989.

In the past quarter, the two most frequently asked questions of MIL-STD 45662A, have been for a definition of the terms "collective uncertainty of the measurement standards" (para 5.2), and "calibration results" (para 4.2.3 and 5.9). The adequacy of a measurement standard is determined by comparing its accuracy, stability, range, and resolution to the tolerances of the instrument characteristics being calibrated. The collective uncertainty of the measurement standards are typically expressed as the combination of the inherent accuracy, including stability and resolution of each measurement standard used to establish the desired calibration parameter. Collective uncertainty does not include other possible sources of errors, such as those that may be introduced by the technician. Methods for combining uncertainties to determine the collective uncertainty of a measurement standard or group of standards include simple arithmetic addition, root sum of squares, use of partial derivatives, distribution analysis, or a combination of these or other methods.

With regards to "calibration results," although this term is not new to the MIL-STD, there seems to be some confusion concerning the DOD intent. Calibration results refer to the condition of the M&TE or measurement standard discovered during the calibration process e.g., in- or out-of-tolerance. This information is used in determining instrument reliability and the need for any information is used in determining instrument reliability and the need for any adjustment to the calibration interval. Calibration results may include the performance condition of the M&TE or measurement standard when returned to the user: calibration status, special use requirements, limitations assigned values or other data required to use the instrument.

The contractor's calibration record should indicate the calibration actions taken necessary to bring a non-conforming instrument into specification, such as any adjustments or corrective actions e.g., parts adjusted, repairs performed, or parts replaced. "Calibration results" or "calibration actions taken" are not requirements to record all in-tolerance readings for every instrument which makes up the contractor's calibration system. There are provisions, within the MIL-STD, to record actual reading when this information is essential to achieving accuracy control of the measurement standard. If additional information is needed beyond the above, the requirement should be identified to specific equipment and addressed separately in the contract. To require detailed or discrete data for all M&TE would be cost prohibitive to DOD. Albeit rather simplified explanations, I believe this information should assist in easing any confusion concerning DOD intent. The revision to the MIL-HDBK will address these issues in greater detail.

David Mednick
Army Agent for MIL-STD 45662A
Office for TMDE Management

TRAINING INFORMATION

ELECTRICAL MAP WORKSHOP – April 2-7, 1988

The next Electrical Measurement Assurance Programs Workshop is planned for April 2-7, 1989 at the Marriott City Center in downtown Minneapolis, Minnesota. As in the past, it consists of four and one-half days of lectures and computer-aided workshops designed to equip the participant with the knowledge necessary to use MAP techniques to establish a viable quality-control system for measurements performed in standards or calibration laboratories. The requisite ideas are presented using dc voltage standards, both standard cells and solid-state references, as working examples. However, the concepts presented are readily applied to other areas of electrical measurements, and other measurements as well. The workshop concludes with morning of lectures on the application of MAP techniques by N.I.S.T. in the resistance and capacitance areas. An optional, informal discussion of statistics for those inexperienced in its use will be held on the Sunday preceding the Workshop if there is a sufficient level of interest expressed.

The workshop is designed for professional and senior technical personnel, particularly those working in the electrical measurements area. The emphasis is on concepts and their application rather than on procedures; the intent is to impart knowledge and experience as opposed to honing skills. Ideas will be illustrated from the experiences of the instructors.

Mrs. M. Carroll Croarkin and Dr. Dominic Vecchia of the N.I.S.T. Statistical Engineering Division, Dr. Bruce F. Field and Mr. Norman B. Belecki of the Electricity Division will be the instructors. Local arrangements are being made by the Twin Cities Section and Region 11 of the NCSL, with Georgia Harris and John Buck as the respective coordinators.

The fee of $875 for the workshop includes a full lunch each day, coffee breaks each morning and afternoon, and reference material consisting of a book of lecture notes, two bound volumes of relevant technical papers, a short text by Youden on measurement statistics, and a copy of NBS Handbook 91 on "Experimental Statistics" by M. Natrella. I might mention that the fee is on the low side for week-long seminars

Early registration is encouraged for two reasons. The workshop will be limited to 40 participants to encourage discussion by individuals of their problems and experiences. Secondly, the workshop is not allowed to run at a loss. Accordingly a minimum registration level has been set and the workshop will have to be cancelled if registration does not exceed the minimum by March 10, 1989.

Questions on the content of the workshop should be directed to:

Mr. Norman B. Belecki	(301) 975-4223, or
Dr. Bruce F. Field	(301) 975-4230

For information on registration call:

Mrs. Sharon Fromm	(301) 975-4222

TRAINING DIRECTORY ADDENDUM

Ed. Note: These courses arrived too late for publication in the training directory.

Course:
Number: CEA4-64000BA

Name: HP 64000-UX New Product Service Update

Type: Maintenance & Repair

Objective:
This course is designed to provide the latest service information on the HP 64000-UX (HP UNIX) products.

Length: Please call

Tuition: Please Call

Schedules: March 20, 1989

Contact:
Bill Furch (303) 590-5780
Logic Systems Division
Hewlett-Packard
8245 N. Union, Colorado Springs, CO 80918

Course
Number: CEA4-64000A

Name: HP 64000 System Blue-Stripe Seminar

Type: Maintenance & Repair

Objective:
This course is designed to provide a background knowledge in 64000 troubleshooting and repair.

Length: Please Call

Tuition: Please Call

Schedules: Mar. 3, 1989; July 10, 1989

Contact:
Bill Furch (303) 590-5780

Logic Systems Division
Hewlett-Packard
8245 N. Union
Colorado Springs, CO 80918

Course:
Number: NA

Name:
HP 5061B Cesium Beam Frequency Standard Service Seminar.

Type: Maintenance & Repair

Objective:
This course is designed to provide an in-depth knowledge of a Cesium Standard; an understanding of the controls; and familiarity with malfunctions and probable causes.

Length: 4 & 1/2 days

Tuition: $1500

Schedules: Feb. 27 – Mar. 3, 1989; Sep. 18 – Sep. 22, 1989

Contact:
Jerrie Scriven (408) 553-2430
Fran Groat (408) 553-2307

Santa Clara Division
Hewlett-Packard
5301 Stevens Creek Blvd.
Santa Clara, CA 95051

Course
Number: CEA4-3065A (44633T)

Name:
HP 3065H/HL/HX/CS/CL Board Test System Maintenance

Type: Maintenance & Repair

Objective:
This course is designed to provide the HP 3065H/HL/HX BTS troubleshooting and repair fundamentals. The course includes lectures on system theory of operation to a functional block level, service strategy, and troubleshooting theory. It includes exercises designed to give real-life experience in troubleshooting to the assembly level.

Length: 8 days

Tuition: $3,820 (Subject to change w/o notice)

Schedules: Mar. 13, 1989; Jul. 31, 1989; Sep. 11, 1989

Contact:
Marge Shaffer (303) 667-5000
Manufacturing Test Division
Hewlett-Packard
815 SW 14th Street
Loveland, Colorado 80537

Course
Number: HP 50036A

Name: HP ATS 1000 Service Training Type

Type: Maintenance and Repair

Objective:
This course is designed to provide a fundamental knowledge in ATS 1000 system troubleshooting and repair to the board level.

The following products are specifically covered in the class: HP 9411B, HP 9414A, and HP 9415A.

Length: Please Call

Tuition: Please Call

Schedule: Please Call

Contact:
Sunita Gupta (408) 746-5797
Advanced Manufacturing Systems Operations
Hewlett-Packard
1266 Kifer Road
Sunnyvale, CA 94086

Course
Number: BEM4-8656B

Name:HP 8656A/B/HP 8657A Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 4 days

Tuition: $750

Schedules: Oct. 16-19, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: BEM4-8640B

Name: HP 8640A/B Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 2 days

Tuition: $500

Schedules: Sep. 28-29, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: BEM4-8660D

Name: HP 8660A/B/C/D Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 2 days

Tuition: $500

Schedules: Oct. 3-4, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: CEM4-8642B

Name: HP 8642A/B Module Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 2 days

Tuition: $500

Schedules: Oct. 5-6, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: BEM4-8642B

Name: HP 8642A/B Computer Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 5 days

Tuition: $1,000
Schedules: Oct. 9-13, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: CEM-3048A

Name: HP 3047/HP3048 Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram, and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 3 days

Tuition: $750

Schedules: Sep 25-27, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: BEM-866A

Name: HP 8662A/HP 8663A Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram, and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 3 days

Tuition: $750

Schedules: Sep 20-22, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: BEM-8903A

Name: HP 8903A/B/E Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram, and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 2 days

Tuition: $500

Schedules: Sep 18-19, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Number: BEM4-8902X

Name: HP 8901/2/3 Maintenance Training

Type: Maintenance & Repair

Objective:
This class is designed to teach the student the block diagram, and assembly level theory to allow equipment troubleshooting to the assembly and sub-assembly level.

Length: 5 days

Tuition: $1,250

Schedules: Sep 11-15, 1989

Contact:
Barbara Asbury (509) 927-3331
Spokane Division
Hewlett-Packard
24001 E. Mission
Liberty Lake, WA 99019

Course
Title: Precision Thermometry Seminar

Description:
The seminar will consist of integrated instruction in platinum resistance thermometry, liquid in glass themometry, thermocouple thermometry, and thermistor thermometry to be given over a five day period on the dates given. Material to be covered includes the international practical temperature scale of 1968, its use

in the laboratory; thermometers and instrumentation, including automatic data acquisition; the treatment of calibration data; and innovations in thermometry. Time will be split between lecture sessions and hands on measurements in the laboratory. Intended for calibration laboratory personnel who should possess undergraduate training in physics or engineering and should have some laboratory experience in meterology.

Sponsor:
National Institute of Standards and Technology (formerly National Bureau of Standards) Gaitersburg, MD 20899

Contact: Ana Salazar or Sylvia Ramboz; (301) 975-4801

Length: 5 days

Cost: $600

Dates: March 1989, October, 1989

Course
Title: Calibration and Use of Piston Gages

Description:

These seminars are held to help industrial and other users attain the highest possible accuracy in pressure measurements with piston gages. The seminar is directed at engineers and senior technicians. The two-day seminar presents information on the theory of piston gages, elastic distortion, design and types, calibration of controlled clearance piston gages, calibration by cross-float, error analysis, computer programs. The seminar closes with a tour of the laboratory, and a discussion of research and development work in the field of pressure measurements.

Sponsor:
National Institute of Standards and Technology (formerly National Bureau of Standards) Gaithersburg, MD 20899

Contact:
Bernard E. Welch or James W. Behrens, (301) 975-4826

Length: 2 days (attendance will be limited to 12)

Cost: $300

Dates: April 20-21, 1989

Course
Title: Vacuum Calibration Using the Molecular Drag Gauge

Description:

This course includes discussion of general vacuum calibration procedures, brief discussion of ionization gauges and controllers, and the theory and behavior of molecular drag (or spinning rotor) gauges. One and one-half days are spent in the laboratory using molecular drag gauges to calibrate ionization gauges. This course is intended for senior technicians and standards laboratory personnel.

Sponsor:
National Institute of Standards and Technology (formerly National Bureau of Standards), Gaithersburg, MD 20899

Contact:
Registration Information (301) 975-4840;
Sharrill Dittmann (Technical Information) (301) 975-4838

Length: 2-1/2 days

Cost: $500 Pre-payment, $600 Invoicing

Dates: Spring, 1989

Reminder–

MEASUREMENT SYSTEM COURSES OFFERED

Phoenix, Arizona – Two Short Courses: Measurement Systems Engineering, April 3-7, 1989, and Measurement Systems Dynamics, April 10-14, 1989, are being offered for the 28th year. The latest developments in electrical measurements of mechanical thermal quantities will be presented by a lecturing staff of extensive industrial experience and academic background.

Registration is open to March 25, 1989; fees, $1900 for both, $1025 each course. Brochure and details from: Peter Stein, Director, 5602 E. Monte Rosa, Phoenix, AZ, 85018-4646 USA. Telephone: (602) 945-4603 (see full course description in Oct. 88 issue of the Newsletter).

LATEST SCHEDULE UPDATE FOR SCHUMACHER UNCERTAINTY COURSES

Jan 30 – Feb 3, 1989 Anaheim, CA

April 17-21, Phoenix, AZ

June 5-9, 1989 Ottawa, Ontario, Canada.

Course description $ other information is in the July '88 issue of the Newsletter.

In-House courses are also available to organizations at dates and on premises of their choice. For more details, please contact Marlene Chandler, COAST Quality Metrology Systems, Inc. 35 Vista del Ponto, San Clemente, CA 92672-3122, (714) 492-6321.

THE UNITED STATES NATIONAL MEASUREMENT SYSTEM AN INDUSTRY VIEWPOINT

Edward Nemeroff
Datron Instruments, USA

Presented at the Conference on Precision Electromagnetic Measurements, June 1988, Tsukuba, Japan

ABSTRACT

The U.S. National Measurement System starts with the National Bureau of Standards. The NBS was established in 1901 by an act of t he U.S. Congress.

At the present time the United States does not have a third party accredition system such as the British Calibration Service (BCS) or the Japan Electric Meters Inspection Corporation (JEMIC). Thus dissemination of electrical standards, and others are carried out by the National Bureau of Standards. This is the first step that is used by U.S. industry to establish "Traceability".

INTRODUCTION

The NBS offers over 300 different calibration services, and performs about 7,000 calibrations each year for more than 1,500 customers. In addition NBS sells about 40,000 SRM units to over 10,000 customers. The customers of NBS's calibration services are using these services in order to establish traceability to national standards and to ensure product reliability. The ideas and concept of traceability are ancient. The demand and requirement for procedures by which measurement can be made on a factory production line with a high degree of confidence and consistent with an established reference standard are increasing annually.

Unfortunately, there is no international or national accepted definition of the word traceability. There are differences of opinion and many possible definitions of traceability. In the United States the purpose and use of traceability are agreed upon. The majority of corporations and organizations that desire traceability are doing it because they are contractually required to by a Government Agency such as the Department of Defense.

The DOD has written clauses into its procurement contracts that require the contractor to be able to demonstrate traceability. In conjunction with this, the DOD has written a Military Specification, MIL-STD-45662, Calibration Systems Requirements" which defines traceability as follows.

TRACEABILITY

The ability to relate individual measurement results through an unbroken chain of calibrations to one or more of the following:

1. U.S. National Standards maintained by the U.S. National Bureau of Standards, epoch time maintained by the Naval Observatory
2. accepted values of natural constants
3. Ratio type of calibration techniques
4. comparison to consensus standards.

Dispures between DOD and its suppliers over what this section as well as other mean are frequent. At the present time the MIL-STD is being rewritten. U.S. industry is directly involved with DOD in the new version.

In 1962 a new organization was formed in the U.S. – The National Conference of Standards Laboratories. The NCSL is an organization of organizations, with its membership primarily made up of over 900 organizations, corporations from academia, industry, government agencies, uses of instruments-manufactures of instruments, all of which have a common interest in Metrology and related activities. I had the honor of being president of NCSL in 1986 and 1987.

NCSL established an ad-hoc committee to work with DOD on the MIL-Spec and has recently submitted our recommendation to DOD which included our concern of the definition of traceability. The NCSL felt that it is imperative that the ability to use laboratories of other countries to establish traceability be included in the MIL-STD.

NBS-US INDUSTRY COOPERATION

In 1982, the NCSL established a committee called the National Measurement Requirement committee. The aim of this group was to identify those calibration services for which "adequate calibration support was not available from NBS".

The initial report identified some 90 areas where industry felt new and improved calibration service was required. This report submitted in 1983 to NBS not only highlighted these technical requirements but also estimated the financial and manufacturing impact if these requirements were not supplied. Some of the identified areas included:

1. AC/DC transfer improved accuracy at high and lower frequencies
2. RF-microwave capability above 26 GHz
3. AC resistors a new service

Since the original report was submitted in 1982 and updated in 1986, the National Bureau of Standards has maintained a line of communication with U.S. industry through NCSL and has responded to industry needs.

To date:
1. 30 of the identified areas have been satisfied
2. 30 are still active
3. 30 have not been started.

CONCLUSION

There is close collaboration between U.S. industry and the NBS. This will continue, and will result in improving the U.S. position in international competitive market.

Author's note: Since the presentation of this paper in Japan, the MIL-STD has been revised and completed. With the contributions by John Lee, Chairman of the NCSL Government Affairs Committee and the committee, and Dave Mednick of DOD we have the new MIL-STD 45662A. The entire NCSL membership should be very proud of the impact that we had on the final document.

NCSL ITEMS FOR SALE

In response to popular demand, the following items are available from the NCSL Secretariat, postpaid, at the prices indicated.

Item	Price
* Training & Information Directory (annual)	$10.00
* NCSL Directory of Standards Labs (biennial)	25.00
* Calibration Lab Managers' Guidebook	5.00
* NCSL Newsletter (single copy)	5.00
* One-year Newsletter Subscription	15.00
* Duplicate or Replacement Plaques	50.00
* NCSL Lapel Pins (sterling silver)	15.00
* NCLS 2" 3-ring Binder (info manual)	5.00
* Tabbed Index Dividers for Binder (set of 6)	1.00
* Information Manual Fillers (without Recommended Practices)	10.00
* 1985 NCSL Workshop & Symposium Proceedings	25.00
* 1986 NCSL Workshop & Symposium Proceedings	25.00
* NCSL Recommended Practice:	
RP-1 "Establishment and Adjustment of Calibration Intervals"	10.00
RP-2 "Evaluation of Measurement Control Systems and Calibration Laboratories" Evaluation Worksheet Attachment 1	10.00
RP-3 "Calibration Procedures"	10.00
RP-4 Calibration System Specification	10.00
RP-5 "Preparation of Specifications"	10.00
RP-6 "Medical Products and Pharmaceutical Industry Calibration Control System Guide"	10.00
RP-7 "Laboratory Design"	20.00
All RP's 1-7 inclusive	50.00

Delegates of new members receive all except the NCSL Lapel Pin as part of the new-member information package. Updated material, e.g., Training Information Directory and Directory of Standards Labs are automatically forwarded to member delegates as they are published. Additional items are available at prices indicated. Conference Proceedings orders are accepted as long as limited supply lasts. Make checks payable to NCSL, and send your order and check to the NCSL Secretariat, 1800 30th Street, Suite 305B, Boulder, Colorado 80301.

METROLOGY CALENDAR

BOARD OF DIRECTORS MEETING DATES

Jan. 30-31, 1989
Tucson, Arizona

April 24-26, 1989

July 13-14, 1989
Denver, Colorado

Oct. 2-4, 1989
Jackson Hole, Wyoming

Jan. 26-27, 1989
1989 Measurement Science Conference (MSC), to be held at the Anaheim Marriott, Anaheim, CA. For more information contact: Frank Mendoza, Conference Chairman, TRW S&D, One Space Park, MS S-2470, Redondo Beach, CA 90278.

REGIONAL MEETINGS SCHEDULE

REGION 1.

April 26, 1989	Nashua, NH
October 25, 1989	North Andover, MA

REGION 2.

April 5, 1989	New York
October 15,1989	New Jersey

REGION 3.

April 5, 1989	NIST
October 25, 1989	TBA

REGION 4.

February 23, 1989	Atlanta, @ Gwinnett Marriott
April 12, 1989	Orlando, FL, @ Holiday Inn
Sept. 14, 1989	Atlanta, @ Gwinnett Marriott
Sept. 20, 1989	Clearwater, FL, @ Holliday Inn

REGION 5.

November 1, 1988	Yellow Springs, OH-Joint
November 7, 1989	Daytron-Indpls., IN
December 1, 1988	Consumer's Bank-Jackson, MI
March 17, 1989	Indiana, TBA
March 21, 1989	Dayton, TBA
March 28, 1989	Cleveland, TBA
April 4, 1989	Michigan, TBA
October 17, 1989	Indiana, TBA
October 24, 1989	Dayton, TBA
October 31, 1989	Cleveland, TBA
November 7, 1989	Michigan, TBA
April 5, 1990	Indiana, TBA
April 12, 1990	Dayton, TBA
April 19, 1990	Cleveland, TBA
April 26, 1990	Michigan, TBA
October 4, 1990	Indiana, TBA
October 11, 1990	Dayton, TBA
October 18, 1990	Cleveland, TBA
October 25, 1990	Michigan, TBA

REGION 6.

November 9, 1988	Tektronix
April 5, 1989	Fluke
November 8, 1989	Hewlett-Packard
April 4, 1990	Tektronix
November 7, 1990	Fluke
April 10, 1991	Hewlett-Packard

REGION 7.

February 3, 1989	TBA
June 1, 1989	TBA
October 12, 1989	TBA

REGION 8.

Jan. 26-27, 1989	Measurement Science Conference
Jan. 30-31, 1989	NCSL Board Meeting, Tucson, AZ
February-2nd half	Los Angeles/Valley, San Fernando Valley
March 22, 1989	Los Angeles/Orange County, Anaheim-Costra Messa-Irvine area
April 24-26, 1989	NCSL Noard meeting, Toronto, ON
April 27, 1989	NCSL Phoenix/Tuscon, Phoenix, AZ
May 8-10, 1989	Annual Quality Congress, Toronto, ON
May-2nd half	Los Angeles/Orange County, Anaheim-Costa Mesa-Irvine area
October 4-6, 1989	NCSL Board Meeting, Jackson Hole, WY
October 5, 1989	Phoenix/Tucson, Tucson, AZ
November-1st half	Los Angeles/Valley, San Fernando Valley
December-1st half	NCSL San Diego Sec, San Diego

REGION 9.

February, 1989	TBA
September, 1989	TBA

REGION 10. (INTERNATIONAL)

REGION 11.

March 10, 1989	St. Louis Sec, St. Louis, MO
April 6, 1989	Chicago Sec, Braidwood Nuclear Power Station, Braidwood, IL
April 11, 1989	Twin Cities Sec, Minneapolis/St. Paul
October 12, 1989	Chicago Sec, Naperville, IL
October 17, 1989	Twin Cities Sec, Minneapolis/St. Paul
October 27, 1989	St. Louis Sec, Kansas City, MO

EQUIPMENT MANAGEMENT FORUM

SUMMARY OF MEETING #5 SEPTEMBER 29-30, 1988

Atlanta, Georgia was the scene of the EQUIPMENT MANAGEMENT FORUM #5, September 29/30, 1988. It was another great forum and was hosted this time by Don Norman of AT&T Technologies.

Following some late at-the-door registrations and a coffee and doughnut social, Don introduced Mr. Richard Iaffaldano of AT&T. Mr. Iaffaldano welcomed the EMF to Atlanta with an introduction to the AT&T Atlanta works. He presented, along with some history of AT&T's cable manufacturing facilities, a very interesting video of the wire and fiber optic cable manufacturing processes employed at the Atlanta works.

Following Mr. Iaffaladano's welcome and a few logistics announcements by our host, Charlie Sides of Boeing Acrospace presented the Chairman's Report. Charlie spoke briefly about the year in review: where the EMF had been and some of the highlights of where he expects the EMF to go. "Its potential has only begun to be developed", he noted.

You must know how that old saying goes about "The best laid plans of mice and men. . .". Well, those of you who received early or preliminary copies of our Atlanta agenda may have had a little difficulty recognizing the final thing. No, not even the one we mailed out survived. But, thanks to Don Norman and his willing and capable staff, we did indeed end up with a keeper, rewritten, retyped and recopied at the 11th hour, or maybe it was the 11th and a half. (It turns out that sometimes things come up at the job that just have to take priority over outside activities. But all that many at the same time? I guess that's life.) A swell bunch of people responded to a couple of panic telephone calls and were "Johnny on the spot" when we needed them. And the show went on!!

Charlie Motzko of Electro Rents was one of the Gracious Gang who responded when called at the 11th hour. Charlie spoke on "UTILIZATION: WHAT DOES IT REALLY MEASURE?" This paper was a repeat of a very well developed case history of the institution of an Equipment Management function at Yokoita Air Force Base, Japan. Charlie originally presented this work the previous year at Forum #3 in St. Louis. It was a good review for those of us who were in St. Louis and fresh meat for the many first-timers in Atlanta. Anyone interested in a copy of this paper can contact Valerie Condemi at: (818) - 1221 x49.

After a refreshment break and in keeping with the opening theme, Ken Pierce of Motorola presented a workshop on "EQUIPMENT UTILIZATION (Techniques, Definitions and Applications)". Ken tells us that he has recently been given a special assignment at Motorola to develop relevant criteria for measuring utilization of equipment. His workshop was a practical approach toward that end. Summary conditions given were:

* 20,000 items evenly distributed between 2 sites, 10 miles apart
* $40,000,000 Acquisition cost
* $20,000,000 Remaining Book Value
* 5 year average age
* $4,000,000 Annual Budget (buy/lease/rent)

After dividing the group into teams, Ken posed the problem what would you do to optimize utilization (deployment) of these 20,000 pieces of electronic test equipment to stay within or under planned budget? OVERALL MISSION SUPPORT CANNOT BE IMPAIRED! Anyone interested in a summary of this workshop can contact Ken at:

Motorola Government Electronics Group,
Electronics Group,
P.O. Box 1417
Scottsdale, AZ 85252
M/S H1179

As the morning progressed, we kept a close vigil on the changing schedule of the DISCOVERY Shuttle launch. Don Norman had arranged for two large TVs in our meeting room, and every one had a perfect view of the liftoff.

After a beautiful lunch, Paul Chong of TRW presented the TRW Story, "INTEGRATED TEST EQUIPMENT MANAGEMENT". In this paper, author Gary Davidson gives an overview of the successful implementation of a very sophisticated Equipment Management system. Two key elements are the unique charge-back system and the living flexible data base around which the whole system is built. Copies of the paper or further information can be obtained from:

Gary Davidson
TRW Space & Defense
One Space Park
M/S S/2767
Redondo Beach, CA 90278

Charlie Sides of Boeing Aerospace gave a short pitch and a preliminary sketch of Forum #6, the first ANNUAL Forum to be held in the fall of 1989. Current plans are for several major changes including vendor display booths, a 2/1/2 to 3 day format and possibly some side activities for guests of the attendees. Next on the afternoon schedule, Dale Kemper of McDonnell Douglas Helicopter Company, our newly appointed Exhibits Chairman, briefed the Forum attendees on

plans and considerations relating to inviting exhibitors to our 1989 Forum.

He led a discussion and shared some previously voiced pros and cons. Dale then passed out worksheets asking for recommendations of vendors that attendees would like to see at Forum #6. Over 125 vendors were identified.

Following a break and photo session, Dale again took the floor and opened his brainstorm/workshop "EQUIPMENT MANAGEMENT JOB DESCRIPTIONS". This workshop dealt with identifying functions, skills, responsibilities, authority, education and experience required of various Equipment Management personnel.

After working together in teams until late into the afternoon, Charlie Sides then gave a first Day wrap-up for the Forum along with the Next Day Particulars. He then extended an invitation to the Chairman's Reception for all registered attendees and their guests.

Friday morning saw the usual huddle around the calorie cart and coffee pot until Charlie called the meeting to session again and turned the floor back to Dale Kemper to wrap up his "EQUIPMENT MANAGEMENT" workshop. The collected input will be compiled and summarized into a format that could be useful in developing job descriptions as may be needed in staffing an Equipment Management organization. For more information, contact Dale Kemper at:

M/S 541/F118
McDonnell Douglas Helicopter Company
Mesa, AZ 85203

Following our mid-morning break, David Nitz of U.S. Instrument Rentals presented his paper, "THE STELLAR SYSTEM (Equipment Management at USIR)". In his paper, Mr. Nitz discussed the design and implementation of an automated business environment. The application is designed to select and configure electronic test and measurement equipment quickly and accurately to satisfy user needs as communicated to a Configurer, frequently via telephone. By end of 1988, the Stellar System should contain knowledge (data) to configure over 5000 equipment types from a broad range of manufacturers. It will be installed at eight locations in North America in 1988 and will be in use in U.K. and continental Europe some time in 1989.

We wrapped up the formal Forum presentations with my workshop called "WHAT IS EQUIPMENT MANAGEMENT?". This workshop was designed to stimulate some thought around some of the less obvious but often important and even controversial issues that frequently surface in the Equipment Management world. This phenomenon is especially common in new or developing programs.

Charlie Sides then formally wrapped up Forum #5 and reminded everyone to begin preparing for Forum #6 in Los Angeles in October of '89.

Another great Forum put to bed but not without my personal thank you and commendation to Don Norman and AT&T Technologies for not only hosting the EMF in Atlanta, but for doing a darn good job of it, too. And to Don's two lovely capable and very willing assistants, thanks again.

And to Bard Dunkleberger of ESL for the fine job of OFFICIAL EMF PHOTOGRAPHER, thanks again, Bard. They sure beat my Instamatic by a bunch.

Ray Barrett, Tektronix, EMF Newsletter Chair

Attendees at EMF #5 held in Atlanta, Ga. on Sept. 29-30, 1988, at the Atlanta Marriott-Gwinnett Place

EMF Steering Committee and AT&T Host at Atlanta Steering Committee held Sept. 28, 1988

Forum conducted with seating configured into the open box format – partly visible

Forum attendees hitting it hard on the "utilization" workshop

NEWSLETTER EDITORIAL SCHEDULE FOR 1989

Issue Date	In Mail	To Printer	Last Editorial to Editor
Apr. 89	1 Apr. 89	15 Mar. 89	1 Mar. 89
July 89	1 Jul. 89	15 Jun. 89	1 May 89
Oct. 89	1 Oct. 89	15 Sept. 89	1 Sept. 89
Jan. 90	1 Jan. 90	15 Dec. 89	25 Nov. 89

EDITOR'S NOTE

This schedule is for guidance for anyone who needs to submit material for publication in the Newsletter. You can understand that in a purely voluntary function like this, the Newsletter must be secondary to my regular job. I try to stay on schedule, but there is zero backup, so if I must travel on company business or other, nothing gets done.

NIST News

(Continued from page 35)

defense, specifically rocketry. The secret to the system, which took 10 years to design, develop, construct, and make operational, is extremely rapid measurements, taken in microseconds (millionths of a second). The rationale is that if you conduct the experiment in a very, very short time, many measurement problems associated with hostile environments, while still present, are minimized.

CONTACT: John Makulwich, (301) 975-2762

MODIFICATIONS IMPROVE NIST GAS FLOW FACILITY

Sellers and buyers of natural gas and other gas products will have greater confidence in their transactions as the result of improvements to NIST's gas flow measurement facility at its Boulder, Colo., laboratories. The facility, first put into operation in 1979, measures the performance of flowmeters that assure the accuracy of transactions between sellers and buyers. As a result of the improvements, variability in gas temperature has been decreased by a factor of five and the precision of performance data on flowmeters has improved by a factor of two. "This increased precision has make the facility much more useful and capable of performing a wide variety of research," says a recent report on the improvements. Major changes were made to the gas flow loop, calibration lines, and the regulator for the gas supply to the pneumatic controllers. In addition, a new minicomputer replaced three small computers to improve data-analysis capability, and an additional cooling line was installed to supply extra liquid nitrogen to the main heat exchanger, improving temperature control. A copy of the paper outlining the improvements is available from Fred McGehan, Public Affairs Office, NIST, Boulder, Colo., 80303. More information on the facility is available from Susan E. McFaddin, Chemical Engineering Science Division, NIST, Boulder, Colo., 80303

COMMITTEE NEWS

To: All Members of Laboratory Management Committees and NCSL Member Delegates and Friends

From: Robert R. Smith, Vice President Laboratory Management

Subject: Recognition of 1988 Performance

On behalf of the Board of Directors of NCSL I would like to formally recognize and thank the people who have served ad worked on the Lab Management committees. I would much rather meet and personally express my gratitude to each of you but that is not possible. It would also not let the rest of NCSL know who you are. I think it is important for all of NCSL to know who is doing the behind-the-scenes work. NCSL wouldn't enjoy the status that it has today without the efforts of people like the following in addition to the backing of their companies:

CALIBRATION SYSTEMS MANAGEMENT

Selden McKnight, Consultant
Howard Hopkins, Newark Air Force Station
John Buck, Unisys Corp.
Phil McRury, Batelle Memorial Institute
Woody Tramel, EG & G
Max Green, Technology Applications, Inc.
Jim Ryan, McDonnell Douglas Electronics

MEASUREMENT ASSURANCE

Arno Elman, Beckman Instruments, Inc.
Jack Edison, Beckman Instruments, Inc.

NATIONAL MEASUREMENT REQUIREMENTS

Laurie Baker, Rockwell International
Don Dalton, John Fluke Mfg. Co., Inc.
Chu-Min Fu, Lockheed Missiles & Space Co.
Les Huntley, John Fluke Mfg. Co., Inc.
Brian Moore, U.S. Army TMDE Support Group
Richard Semer, Newark Air Force Station
Tom Short, Bonneville Power Admistration
Ray Wade, Ford Aerospace
Norm Belecki, NIST (NBS)
Keith Lentner, NIST (NBS)
Bahman Radjabi, Lockheed Missiles & Space Co.
Neal Bone, McDonnell Douglas Co.,
Lou Bowling, U.S. Army TMDE Support Group
Dave Hopping, Hewlett-Packard
Frank Koide, Koide International Consultants
Norm Leck, Newark Air Force Station
Mario Maury, Jr., Maury Microwave Corp.
Pat Nolan, Lockheed Missiles & Space Co.
Rick Patino, Naval Weapons Station
Marty Quass, Rockwell International
Paul Roberts, Hughes Aircraft Co.
Charles Miller, NIST (NBS)
Tomas Larason, Naval Weapons Station
Andy Bradshaw, Rockwell International
John Gerhard, Rockwell International
Robert Hinebaugh, Newark Air Force Station
Carroll Hughes, Westinghouse
James MacKinnon, North Island NAS
John Lee, Machine Vision Concept Tech.
Kas Rangan, Lockheed Missiles & Space Co.
Don McSparron, NIST (NBS)
Arron Sanders, NIST (NBS)
Frank Garcia, Sandia National Laboratories
William Jasper, Yellow Springs Instrument Co.
Ted Held, Abbott Laboratories
Henry Sostman, Yellow Springs Instrument Co.
Brian Rennex, NIST (NBS)
Robert Soulen, NIST (NBS)
Robert Tobias, TRW
Curtis Ashford, Rockwell International
George Haldane, Naval Weapons Station
Terrelle Wilson, Martin Marietta Aerospace
David Workman, Martin Marietta Aerospace
Roman Serbyn, NIST (NBS)
Montgomery Gee, Naval Weapons Station
Gary Olson, Rockwell International
George Mattingly, NIST (NBS)

LABORATORY EVALUATION

Carl Quinn, Simco Electronics

CALIBRATION INTERVALS

Howard Castrup, SAIC
Anthony Adams, General Dynamics
Frank Butz, General Electric Co.
John Ferling, Claremont McKenna College
Jerry Hayes, Hayes Technolgoy
John Larsen, Navy Fleet Analysis Center,
Ray Kletke, John Fluke Mfg. Co., Inc.
Alex Macarevich, General Electric Co.
Gerry Riesenberg, General Electric Co.
Jim Ryan, McDonnell Douglas Electronics
Rolf Schumacher, Rockwell International
Mack Van Wyk, Boeing Aerospace Co.

EQUIPMENT MANAGEMENT FORUM

Charlie Sides, Boeing Aerospace Co.
Jim Bergstrand, Northrup Corp.
Randy Seefeldt, Navy Primary Standards Lab
Bill Martin, Lockheed Missiles & Space Co.

Ron Groom, AT&T
Arnie Doll, Boeing Aerospace Co.
Ken Pierce, Motorola
Tom McGovney, TRW Space & Defense
Ray Barrett, Tektronix
Ben Brown, McDonnell Douglas Co.
Chuck Van Winkle, Delfi Inc.
Dale Kemper, McDonnell Douglas Co.

INTRINSIC & DERIVED STANDARDS

(New standing committee created in 1988)
Klaus Jaeger, Lockheed Missiles & Space Co.
Les Huntley, John Fluke Mfg. Co., Inc.
Joe Simmons, NIST (NBS)
Robert Judish, NIST (NBS)
Rchard Pettit, Sandia National Laboratories
Frank Flynn, Newark Air Force Station
John Ball, U.S. Army TMDE Support Group
Harold Glick, Navy Fleet Analysis Center
John Rile, NASA

If you are involved in NCSL and have occasion to see one of these people, express your appreciation to them for the efforts they have made.

Again a THANK YOU to all committe members. If I have missed someone I apologize and would like to hear from you.

I would like to also extend a special word of appreciation to Selden McKnight, chairperson of the Calibration Systems Management committee. Selden has had to resign from this position since he is no longer involved in the field of metrologoy. His committee has been responsible for many good sessions at the annual conferences. They also have gotten a good start on the recommended pracctice for expressing laboratory capability. Thanks, Selden, for your years of service. Good luck in your future activities.

Mr. Dennis Pinnecker has been appointed chairperson of the Calibration Systems Management Committee, following in Selden's footsteps. Dennis is employed at Rockwell International in Anaheim, CA. and brings a number of years of leadership positions in association with the Measurement Science Conference.

Bob Smith, Vice President Laboratory Management

VP LAB MANAGEMENT, 1989 MEETING SCHEDULE

41.0 Calibration Systems Management
- a. 01/25/89 – MSC
- b. 07/14?89 – NCSL Conference

42.0 Measurement Assurance
- a. 01/25/89 – MSC]
- b. 07/14/89 – NCSL Conference

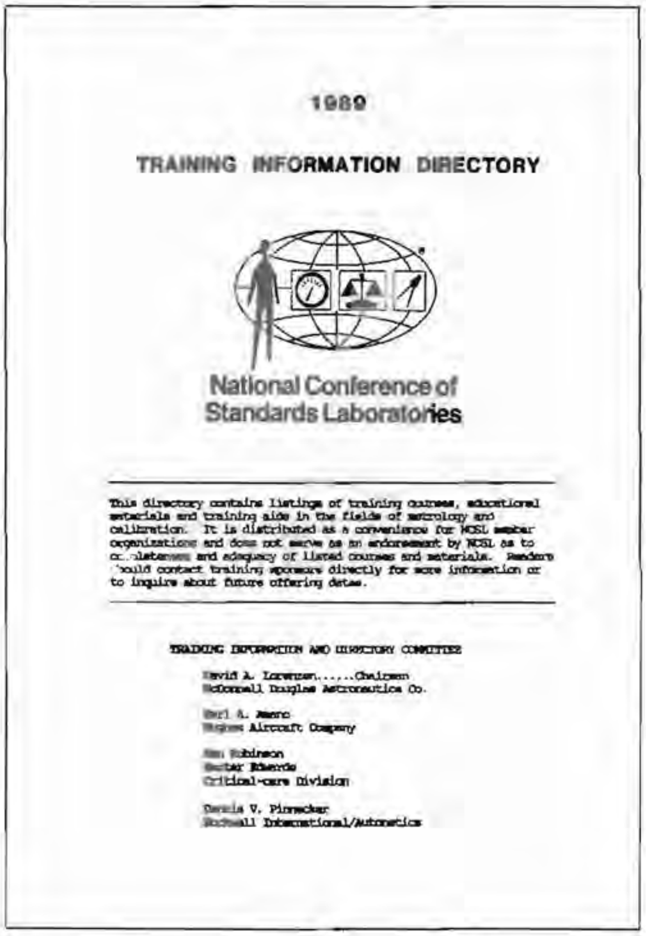
43.0 National Measurements Requirements
- a. 01/25/89 – MSC
- b. 07/14/89 – NCSL Conference

44.0 Laboratory Evaluation
- a. 02/25/89 – MSC
- b. 07/14/89 – NCSL Conference

45.0 Calibration Intervals
- a. 01/25/89 – MSC
- b. 07/14/89 – NCSL Conference

46.0 EMF
- a. 01/25/89 – MSC
- b. 07/14/89 – NCSL Conference
- c. Week of Oct. 16-20, EMF in LA Area

47.0 Intrinsic & Derived Standards
- a. 01/25/89 – MSC
- b. 07/14/89 – NCSL Conference


1989

TRAINING INFORMATION DIRECTORY

National Conference of Standards Laboratories

Training Directories were mailed to delegates during the last week in Nov. If you didn't get your copy, call the NCSL business office.

NIST NEWS

Sept 30, 1988

Dear NCSL Board Member,

Please note the official name change of the National Bureau of Standards to the National Institute of Standards and Technology.

On August 23, 1988, the President of the United States signed into law the Omnibus Trade and Competitiveness Act of 1988, including the Technology Competitiveness Act. The Act has created the National Institute of Standards and Technology (NIST) from the National Bureau of Standards (NBS). Our new name reflects the increased responsibility assigned to our agency to support and enhance the technological competitiveness of U.S. industry, as well as our traditional function of providing measurements, calibrations and quality assurance standards vital to U.S. industry.

The new law has provided a challenge as well as innovative mechanisms for NIST to aid U.S. industry. The Institute is instructed to create a series of "Regional Centers for the Transfer of Manufacturing Technology" that will be affiliated with non-profit institutions or organizations. NIST is also to create a program to provide assistance and make federal technology available to state and local technology programs and technology extension services. An "Advanced Technology Program" will be established to encourage the commecialization of high technology products. NIST will also support a Department of Commerce Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation, providing technical and analytical help to state and local officials making decisions on technology policy. Not all of these functions, however, are currently funded.

Those services and research areas for which NBS has been known in the past will continue under NIST. In particular, our Standard Reference Materials, Standard Reference Data programs, and calibration services will continue to serve the needs of American industry and science.

Joe D. Simmons
Acting Chief
Office of Physical Measurement Services

IMPROVEMENTS ON NIST AC-DC DIFFERENCE CALIBRATION SERVICES FOR THERMAL CONVERTERS

The NIST Electricity Division announces that calibration uncertainties have been reduced for ac-dc differences of thermal voltage converters (TVC's) at several voltages and frequencies. The most significant reductions are in the following areas:

* for frequencies above 100 kHz and up through 1 MHz, 70 ppm is now offered on coaxial, single-range TVC's,

* 5 ppm is now offered as a special calibration on many types of TVC's from 2 to 10 V,

* almost all uncertainties for multi-range TVC's have been reduced.

The complete matrix of the current ac-dc difference calibration uncertainties is given on next page. Inquiries regarding special calibrations or reduced uncertainties should be directed to Joseph R. Kinard, Electricity Division, NIST, (301) 975-4250.

PRESIDENT REAGAN SIGNS NIST FY 89 AUTHORIZATION BILL

The President signed the bill H.R. 4477, the "National Institute of Standards and Technology Authorization Act for FY 89." The bill authorizes $158,039,000 for NIST in fiscal year 1989. The bill also creates a Technology Administration in the Department of Commerce to be headed by an Under Secretary of Technology which would include the National Institute of Standards and Technology, the National Technical Information Service, and a policy analysis office to be known as the Office of Technology Policy.

CONTACT: Esther Cassidy, (301) 975-3080

HOCKEN LEAVES NIST FOR UNCC

Dr. Robert J. Hocken is leaving NIST in December to occupy a chair as Professor of Precision Engineering at the University of North Carolina at Charlotte. Hocken graduated *Summa Cum Laude* from the Oregon State University and earned a Ph.D. in December to occupy a chair as Professor of Physics at the State University of New York at Stony Brook. He came to NIST (then NBS) as an NBS-NRC Postdoctorate Fellow in 1973.

At NBS/NIST he advanced from Chief, Dimensional Technology Section, to Group Leader, Dimensional Metrology; Chief, Automated Production Technology Division; and Chief, Precision Engineering Division.

His best-known and probably most influential accomplishment is his conception and development of the Automated Manufacturing Research (AMRF) program. The program is

(Continued on page 33)

AC-DC DIFFERENCE CALIBRATION SERVICE

Frequency:	2-5 Hz	5-20 Hz	20-20k Hz	20-50 Hz	50-100 kHz	0.1-1.0 ~~0.1-0.5~~ (Old) MHz	~~0.5~~ MHz
Voltage Limits(V)	50	100	1000	1000	1000	100	~~100~~
Current Limits(A)	0.05	0.05	18[a]	16			

UNCERTAINTY (parts per million)[b]

Multirange TVC's

			30	50	70			
> 100 V			~~50~~	~~70~~	~~100~~	(Old)		
			20	30	50	100		
≤ 100 V	200	100	~~30~~	~~50~~	~~70~~	~~100~~	~~200~~	(Old)

Coax Single Range

TVC's > 100 V			20	30	50			
≤ 100 V						70		
~~5 < X ≤ 100 V~~	200	100	15[c]	25	40	~~100~~	~~200~~	(Old)
~~< 5 V~~	~~200~~	~~100~~	~~20~~	~~30~~	~~50~~	~~100~~	~~200~~	(Old)

Special[d]

10 V < X ≤ 100 V	10	
~~5 V ≤ X ≤ 100 V (Old)~~	~~10~~	
2 V ≤ x ≤ 10 V	5 (New)	

TCC's

> 5 A			100	150
50 mA < x ≤ 5 A			50	70
≤ 50 mA	200	100	50	70

[a] 5 A at 20 Hz, increasing to 18 A from 100 Hz to 5 kHz; 16 A above 5 kHz. 20 A shunts are calibrated at less than rated current.

[b] The lower uncertainty applies at the crossover frequencies. Uncertainties may be increased if the ac-dc differences are large or affected by selfheating or other instability.

[c] 20 ppm from 20 Hz to 100 Hz, 15 ppm at 100 Hz and above.

[d] Normally available by prearrangement for coaxial, single range TVC's between 100 Hz and 20 kHz. An additional cost and a longer turnaround time at NBS are required.

Ed Note: Previous data lined through for reference

directed toward the complete automation of the batch manufacturing of piece parts and development of the metrology and interface standards for the ready transfer of this technology to American industry. The facility compares multiple metal removal machine tools, material transport systems, inspection systems, and a sophisticated distributed control system. He obtained donations of over $1,000,000 worth of equipment from private sponsors for the AMRF, including machining centers, turning centers, coordinate measuring machines, and robots. Hocken completed a report on the state-of-the-art on machine tool accuracy worldwide and obtained contracts with many major private companies (Hewlett-Packard, General Dynamics, John Deere, Valeron, Hardings, Kennametas, Monarch, Brown and Sharpe, to name a few) and other government agencies, including the U.S. Navy, Air Force, Army, DARPA, and the Department of Energy.

His many honors and awards include an NSF Fellowship, the F.W. Taylor Medal of the International Institute for Production Engineering Research in 1979, the F.W. Taylor International Research Award (Medal) of the Society for Manufacturing Engineers in 1985, four IR 100 awards, the NBS Applied Science Award, and the Gold Medal and the Silver Medal of the Department of Commerce. He is a Charter Fellow of the Society for Manufacturing Engineers, President of the CIRP Scientific Technical Committee, member of the Editorial Boards of three technical journal, and a member of the CIDMAC Advisory Committee at Purdue University. He has extensive international contacts in manufacturing engineering; has considerable personal experience with American, Japanese, and European automated and precision manufacturing; and extensive personal contacts (too many to mention) with the American manufacturing community. He is also an accomplished and very active public speaker.

In a very real sense, Bob is "graduating" *Summa Cum Laude* from NIST. His many friends and colleagues will miss him and his lovely wife, Dene.

AUTOMATED MANUFACTURING RESEARCH FACILITY HODS SECOND OPEN HOUSE

The Automated Manufacturing Research Facility hosted over 500 visitors from government, industry, and academia at this year's October Open House of its Automation Program. Attendees saw a test run of the Automated Manufacturing Research Facility (AMRF) and were bused to related research laboratories and calibration activities for presentations on the automation technology in use there. The technology seen at this year's Open House represents only a part of what will be transferred to American factories through the Regional Centers for the Transfer of Manufacturing Technology.

CONTACT: Phillip Nanzetta, (301) 975-3414

INTEGRATED MANUFACTURING DATA ADMINISTRATION SYSTEM ON VIDEOTAPE

The operation of Integrated Manufacturing Data Administration System (IMDAS) in the NIST Automated Manufacturing Research Facility is illustrated in a new 8 1/2-minute videotape tutorial. The program was produced for the Factory Automation System Division by the Public Information Division.

CONTACT: Don Libes, (301) 975-3535; Ron Meininger, (301) 975-2758

NIST RECEIVES FIVE R&D 100 AWARDS

Five research projects in instrumentation and measurement technology received R&D 100 awards this year, bringing to 62 the number of awards earned by NIST personnel since the competition began in 1973. The awards are presented annually by *Research & Development* magazine to honor the 100 most significant new technical products of the preceding year. This year's awards went to:

William L. McLaughlin with Branislav Radak, a guest scientist from the Boris Kidrec Institute in Yugoslavia – versatile ionizing radiation dosimeter around the concept of radiation-sensitive dyes;

Vytensis Babrauskas and William Twilley – apparatus which provided the data critical to predicting the fire hazard of a product from a small sample of material;

Yung Chi Wu, Kenneth W. Pratt, and William F. Koch – device that determines the "absolute" electrical conductivity of aqueous solutions and which can be used as a primary standard against which other instruments my be compared;

Robert J. Carpenter, John W. Roberts, and Alan Mink – tools to help measure the performance of multiprocessors;

Edward F. Kelly – pioneering photographic "time machine" which, when used with a high-speed camera, permits photographing events which occurred before the camera's shutter is opened.

CONTACT: Sharon Shaffer, (301) 975-2762

RESEARCH ASSOCIATE PROGRAM VIDEOTAPE COMPLETED

The NIST Research Associate Program is the subject of a recently completed 13-minute videotape, *Research Associated Program: Making Technology Transfer Work*. The videotape describes the program as an effective and cost-efficient way for federal laboratories and industry to work together on projects of mutual interest. It includes examples of successful

research agreements with a variety of companies, associations, and other federal agencies. The program was produced for the Office of Research and Technology Applications by the Public Information Division. Dave Edgerly, head of the Office, served as technical advisor for the project.

CONTACT: Mat Heyman, (301) 975-2762; Ron Meininger, (301) 975-2758

SEMICONDUCTOR ELECTRONICS DIVISION ESTABLISHING MBE FACILITY, PROGRAM

The CEEE's Semiconductor Electronics Division is developing a facility for growing III-V compound semiconductors by molecular beam epitaxy (MBE) as part of a program to provide to industry methods needed to characterize these materials and devices. The ability to deposit ultrathin epitaxial layers has led to the recent emergence of fundamentally new and novel materials and device concepts. The controlled growth aspects of MBE allow the fabrication of structures having dimensions in the interatomic-distance range in the direction normal to the layers. The resulting ultrathin layers and superlattice-based structures represent a new class of artificial semiconductor materials having novel electronic and optical properties which do not exist in bulk form. The Division plans a highly coordinated and integrated MBE program to address issues such as kinetics, materials characterization, device physics modeling, and device performance. These plans take into account the need to separate materials-related problems from processing-related effects.

CONTACT: James Comas, (301) 975-2061

GROUP ON PRECISION MEASUREMENT AND FUNDAMENTAL CONSTANTS FORMED

The American Physical Society council has officially accepted a new topical group on precision measurements and fundamental constants. The new group's statement of purpose reads in part "to serve as a focus for research activities in investing and testing the underlying connections among general physical laws, precise experiments relating to these questions, fundamental constants, and basic standards." The topical group arose from the Committee on Fundamental Constants and Basic Standards, an advisory group to the Numerical Data Advisory Board of the U.S. National Academy of Sciences/National Research Council. Barry N. Taylor of NIST is the Vice Chairman of the group.

CONTACT: Barry N. Taylor, (301) 975-4220

LABORATORY ACCREDITATION PROGRAM FOR NETWORK PROTOCOL TESTING

NIST, at the request of the Defense Communications Agency, has established a program to accredit laboratories that test computer software for compatibility with DOD computer networks. The new program, administered under the National Voluntary Laboratory Accreditation Program, provided national recognition to laboratories capable of performing testing programs that address: (1) Defense Data Network (DDN) X.25 Link and Network Layer Protocols as specified in the DCA DDN X.25 Host Interface Specifications; (2) the five DOD packet switching High Level Protocols (HLP); and (3) the AUTODIN Mode 1 protocol. Accreditation will initially be offered only for the X.25 protocol. The HLP and AUTODIN protocols will be offered after the first group of X.25 laboratories has been accredited.

CONTACT: John Donaldson, (301) 975-4017

NEW TEST TO MEASURE RESISTANCE OF COMPOSITE RESINS TO DELAMINATION

Scientists in the Polymer Division have developed a method to measure the resistance of polymer composites to delamination. Delamination is caused by cracks that grow in the polymer resins that bind the fibers or layers in composite laminates together and is an important mode of failure for these materials. Test methods that determine the composite's resistance to this "interlaminar" crack growth are needed so that new polymers, developed to make tougher composites, can be evaluated for improved performance. The new test employs a thick adhesive bond between metal adherents with a bond thickness that is similar to the thickness of the polymer layer between plies in the composite. In this way the polymer experiences a similar constraint of deformation in the two geometries. Experiments comparing the results obtained for the composite with those obtained with the adhesive specimen were carried out using three polymers having diverse mechanical properties. The excellent correlation in these tests strongly suggest that the new method could greatly reduce the time and expense associated with composite testing. It is particularly appealing for the evaluation of new, tough, polymer systems where available quantities of material are small.

CONTACT: Donald L. Hunston, (301) 975-6837

NEW PROBE CHARACTERIZATION TECHNIQUE PROMOTES MORE EFFICIENT USE OF GEOSTATIONARY ORBIT FREQUENCY "SPACE" BY COMMUNICATIONS SATELLITES

Staff of CEEE's Electromagnetic Fields Division have developed new analyses and associated techniques for characterizing the dual-port, circularly polarized probes used by the Division and others in carrying out near-field antenna scanning measurements of communications satellite antennas. The Division characterizes probes used by virtually all U.S. near-field ranges. The new techniques provide reduced uncertainty in the probe axial ratio and tilt angle, which provide a measure of polarization isolation. Both physical orbital space and frequency space with the designated bands

are scarce commodities, with pressures being applied from lesser-developed countries on the developed nations to move to higher-frequencies bands fo which the technology is still evolving. The reduced uncertainty is a result of an improved theory and a measurement technique.

CONTACT: Allen C. Newell, (301) 975-3743

TEN RECENTLY RELEASED NEWS RELEASES

The Public Information Division distributed the following news releases to trade, technical, and general news media outlets during October: *Chemical Thermodynamics Database Now Available Online, Worldwide; NIST Data Standard 'Testbed' Will Aid Computer-Integrated Design, Manufacturing and Logistics; Government, Private Sector Team To Develop Common Language For Innovation Process; Computerized Vote-Tallying Could Be Made More Secure; Competitiveness Drive Should Not Overshadow Need For International Cooperation, Ambler Says: News Briefing Will Announce Ways to Improve Medical Tests; Turbulence Within The Walls: Flow Metering Non-Ideal Conditions; Department of Commerce Awards Top Honors to 20 NIST Employees; Expert Panel Announces Ways to Improve Pap, AIDS and Other Medical Tests;* and *The Beauty of Time.* Copies of each are available by calling (301) 975-2762.

CONTACT: Mat Heyman, (301) 975-2762

DIAMOND FILMS

Information regarding the presence and distribution of impurities and defects in diamond films prepared by the hot filament chemical vapor deposition method has been obtained in cathedoluminescence imaging and spectroscopy experiments. Diamond is a potential high-performance transistor, optical emitter, and ultraviolet detector material whose performance will be affected by the presence of such defects and impurities. Defects were tentatively identified as associated with nitrogen impurity atoms, interstitials, atomic vacancies, and dislocation lines. The presence of the defects was found to depend on the deposition temperature. Work is under way to examine how other processing variable effect the presence of the defects.

CONTACT: Larry Robins, (301) 975-5263; Albert Feldman, (301) 975-5740

EXPANSION OF THE NIST-DOD FLOWMETER TESTING PROGRAM

The national standards laboratories in Italy and the United Kingdom have joined the round-robin flowmeter testing program sponsored by the Department of Defense (DOD) and conducted by the NIST Chemical Process Metrology Division. The ultimate goal of the program is to quantify the traceability of all DOD flow measurements to NIST, which would provide DOD with more widely distributed and convenient sources of flow measurement services. Tests have shown that fluid flow measurements in two European laboratories, the Instituto de Metrologia in Italy and the National Engineering Laboratory in Scotland, show good traceability links to NIST. These results indicate that overseas DOD laboratories such as the U.S. Navy in the Mediterranean and the U.S. Air Force in the United Kingdom can use these laboratories as sources for calibrations.

CONTACT: George E. Mattingly, (301) 975-5939

VIDEOTAPE NVLAP TRAINING PROGRAM

The National Voluntary Laboratory Accreditation Program (NVLAP) of NIST is the subject of a 9-minute videotape training program which describes procedures used to provide accreditation to testing laboratories. The videotape follows an assessor completing each step of the accreditation process. The program will be used for assessor training and to be sent to interested testing laboratories. Robert Gladhill of NVLAP served as technical advisor for the project.

CONTACT: Ron Meininger, (301) 975-2758; Roger Rensberger, (301) 975-2762

AWARDS FOR OPTICAL METALLOGRAPHY MICROGRAPHS

Dominique Sheperd and Chris McCowan of the Fracture and Deformation Division were recognized for their optical microscopy work on Y-BA-Cu-O high temperature superconductors by the International Metallographic Society (ISM) and ASM International (formerly the American Society for Metals) at this year's ISM-ASM annual meeting in Toronto, Canada. Shepherd won a first prize in this year's International Metallographic Contest; his micrographs were entered in a class for the optical microscopy of ceramic and composite materials. McCowan received an honorable mention in the color micrograph class for his work on the recognition of preferred grain orientation in Y-Ba-Cu-O using optical microscopy.

CONTACT: Chris N. McCowan, (303) 479-3699

TOO HOT TO HANDLE, BUT NOT TO MEASURE

Trying to measure the melting point of graphite at atmospheric pressure is a lesson in disappearing acts. The graphite evaporates! A NIST researcher has developed a technique to avoid that problem with a measuring system that allows investigation of materials properties at temperatures ranging from 1300K to 6000K is within reach of the system. Practical applications include space-related work, where temperatures soar during reentry, nuclear reactor safety, and

(Continued on page 28)

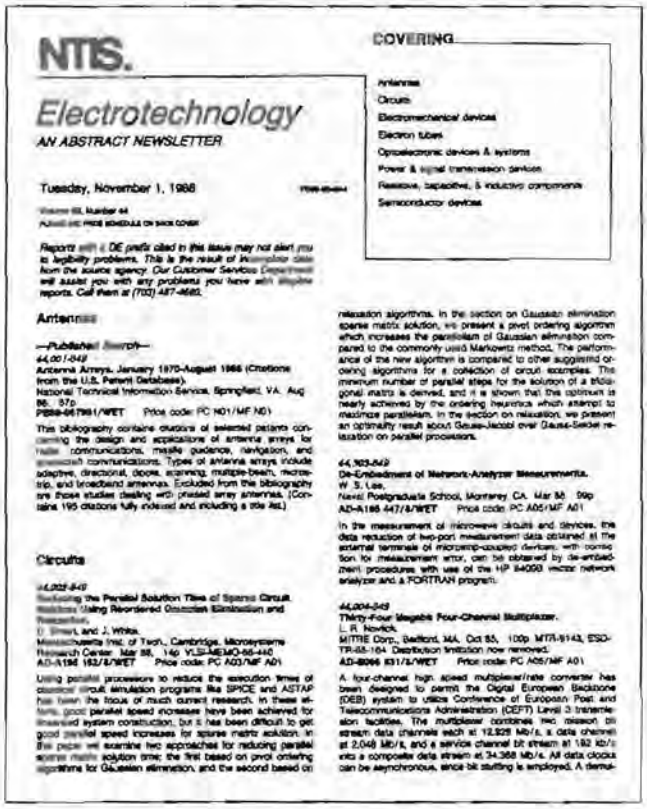
ABSTRACT SERVICE FOR TECHNICAL PUBLICATIONS

Ed. Note: I've been receiving a weekly abstract service covering government documents from NTIS. The subjects reviewed are: antennas, circuits, electromechanical devices, electron tubes, optoelectronic devices & systems, power & signal transmission devices, resistive, capacitive & inductive components & semiconductor devices.

An annual subscription costs $95.00.

Write:

U.S. Dept. of Commerce
National Technical Information Service
5285 Port Royal Rd.
Springfield, VA 22161



NTIS.

COVERING

Electrotechnology

AN ABSTRACT NEWSLETTER

Antennas
Circuits
Electromechanical devices
Electron tubes
Optoelectronic devices & systems
Power & signal transmission devices
Resistive, capacitive, & inductive components
Semiconductor devices

Tuesday, November 1, 1988

Antennas

Circuits

VIDEO TRAINING FOR QUALITY ASSURANCE

Rockford, IL: Federal Procurement Services now offers a complete and comprehensive quality assurance video training library to Defense contractors and sub-contractors. The video training library consists of seven videos:

(1) MIL-I-45208A Q.C. Manual
(2) SPC & MIL-Q-9858A Q.C. Program
(3) Cost of Quality in Government Contracts
(4) Q.C. Crisis Management & First Article Rejection
(5) DD Form 250 Material Inspection Report
(6) DD Form 1423 Contract Data Requirement
(7) Total Quality Management

All of the videos are a must for Defense contractors and are currently in use by over 1,500 of the leading prime Defense contractors. The U.S. Army, Navy and Marine Corps also use the video training programs. For more information call 800/833-3776 (Illinois call 815-963-6630) or write to: Federal Procurement Service, 810 East State Street, Rockford, IL 61104.

FREE ASTM PUBLICATIONS CATALOG AVAILABLE

The 1989 ASTM Publications Catalog describes 67 volumes of the *Annual Book of ASTM Standards* and several hundred ASTM Special Technical Publications, Compilations, Data Series, and Standard Adjuncts. ASTM standards and its related technical publications are used worldwide to specify materials, assure quality, integrate production processes, promote trade, and enhance safety.

The catalog is available free from ASTM Customer Service, 1916 race Street, Philadelphia, Pennsylvania 19103, (215) 299-5585.

LOCATE THE BEST U.S. GOVERNMENT R&D

NTIS *Tech Notes* will help you profit . . .with selected, practical, applied research and technology generated by the U.S. Government and its laboratories.

Scientists, engineers, and technology scouts who subscribe to *Tech Notes* receive this valuable information each month in a timesaving, review-at-a-glance format covering these dynamic areas:

* Computers * Electrotechnology * Materials
* Engineering * Manufacturing * Medicine

concentration (and their spatial homogeneity) in a short time. The technique has also been used to assess crystal damage during ion-implanting and to determine the built-in strain in new semiconductor composites such as Gallium arsenide (GaAs) on silicon (Si). Photoreflectance is particularly useful in characterizing custom-made semiconductor microstructures such as superlattices and modulationd-doped structures. The manufacturing of the structures requires control on an atomic scale to achieve the optical and electrical properties desired. Microstructure based electronics means faster computer, smaller and higher frequency microwave transmitters, and new multicolor chip lasers.

FIRST VACUUM TRANSISTOR DEMONSTRATED

The Naval Research Laboratory (NRL), Washington, D.C., is developing a radically new vacuum microelectronic device that is reminiscent of a miniaturized vacuum tube, yet is thousands of times smaller.

The principal investigator at NRL states that vacuum microelectronics combines the fabrication, processing, small size and weight, and low-cost advantages of solid-state technology with the advantage of ballistic vacuum electron transport. He also states that it is superior to the solid type with respect to saturation velocity and associated transit time.

This new microelectronics technology is ultrafast, ultraradiation hard, temperature insensitive, and very efficient. It can be used for both analog and digital applications and for electronics designed to be used in hostile environments. The technology can use metals, high-temperature superconductors, organic conductors and compounds and composites as the active electron conduction material as well as semiconductors.

LONG RANGE PLANNING

A meeting to consider the NCSL long-range planning prices was held on Oct. 4, 1988. Gary Davidson, Del Caldwell and Bob Smith met to address the organization and committee structure. The resulting recommendations of that meeting have the following features:

* Provide emphasis to the annual conference.
* Expand the duties of the Business Office.
* Spread committee work more equitably.
* Increase the emphasis of "Special Interest Groups".

Bob Smith (1), Del Caldwell and Gary Davidson meet at the Naval Weapons Station at Corona to work on the NCSL long-range plan and organization

TYPO CORRECTIONS FOR CONFERENCE PAPER

Enclosed are typographical errors which appeared in the 1988 NCSL Symposium paper "Strategic Calibration Through Automation and Determination of Realistic System Calibration Requirements" by T. Mukaihata. The paper was published for the NCSL conference held August 14-18, 1988 in Washington DC.

Page	Correction
11-20	$\sigma_o = \sqrt{\sigma_e^2 + \sigma_a^2}$
11-22	K = 7595.980
11-24	σ_1^2, σ_c^2, σ_I^2 and σ_e^2

The results of the paper are not affected.

Thanks, Tad Mukaihata

* Energy * Machinery and Tools * Physical Sciences
* Environment * Testing and Instrumentation

Tech Notes brings you selected R&D results and state-of-the-art advances and information on promising new technologies.

Each monthly issue comes to you as a bound publication of "Notes," single-sheet summaries (usually illustrated) of selected applied technology.

Subscribers receive one comprehensive publication each month. *Tech Notes* is available on a paid annual subscription basis of $147. In most cases, your subscription fee is tax deductible.

WRITE:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

PAPERS NEEDED FOR ASTM SYMPOSIUM ON LABORATORY ACCREDITATION TO BE HELD IN DECEMBER, 1989

Papers are needed for a Symposium on Laboratory Accreditation: Modularization and Improvement to be held December 7, 1989 on Orlando, Florida. This symposium is sponsored by ASTM standards-writing Committee E-36 on Criteria for the Evaluation of Testing and Inspection Agencies.

The program will cover national and international laboratory accreditation requirements and practices in generic and important specific areas. Papers are invited in the following areas:

* Organizing and managing a laboratory to meet accreditation requirements
* Writing and selecting standards intended for use in laboratories being accredited
* Techniques for evaluating capability and proficiency of inspection and test activities
* Considerations for developers of equipment and facilities used in laboratories to aid in laboratory accreditation
* Improving the productivity of the laboratory evaluation and accreditation process.

Prospective authors are asked to submit abstracts, titles, and the ASTM Paper Submittal Form by February 1, 1989 to Dorothy Savini, ASTM, 1916 Race Street, Philadelphia, PA 19103, (215) 299-5413. Paper Submittal Forms are available from Ms. Savini.

GIDEP PARTICIPATION COSTING GUIDELINES

by: Joe Dahrouge, General Electric

Ed. Note: GIDEP is the Government/Industry data exchange program. For its members, its value is very high. This cost analysis is interesting.

How often have you heard "It costs nothing to belong to GIDEP!"? That is true to a point. It cost nothing to join GIDEP, but there are inherent costs in participating in the program and using the data that is available.

This discussion will attempt to categorize the elements of cost, put some estimated limits on the cost of the elements, and define which are "needed" and which can make the job much easier to do.

The first essential element is space. To effectively run the GIDEP function you need office space for a desk, file cabinets, book shelves, microfilm/microfiche reader printers, and a computer terminal/printer. In many organizations, space is at a premium and is expensive. What it costs will vary from company to company, but the amount will remain fairly constant. A desk and chair take up approximately 30 sq. feet. With space for one guest to sit, let's make the number 50 sq. feet. Microfilm cartridges and a reader/printer on a table require another 40 sq. feet. A computer terminal and printer on a table will take another 20 sq. feet. A five drawer file cabinet will use 5 sq. feet more. The book shelves will fit on the walls. So, our fully equipped GIDEP office requires about 115 sq. feet of floor space.

The next essential element is a person to staff the office and run the program. The number of persons required depends on how deeply the facility is committed to the program. GIDEP has had, and does have today, representatives who spend 10 percent of one person's time operating the program. GIDEP has had organizational members who have had two to three persons full time in the program. Today, we have at least two representatives (S3 and S9) who have full-time GIDEP responsibility. The number of persons can be a function of whether GIDEP is contractually required (and is therefore quoted and charged off) or is voluntary (and is coming out of overhead). The percentage of a person's time that is required, times the hourly rate paid, is equal to the manpower cost of having GIDEP. The average GIDEP participating organization is using 1/4 person to run the program.

Another essential cost item is a microfilm, reader/printer. A machine which can read and print 35mm cartridges and 24X

microfiche or a machine to do both is necessary to be able to retrieve, view, and print the data that is contained in the GIDEP microform library. Several different makes and models are available. At GE Ordnance, we had a 3M Filmac 300 cartridge reader-printer and a 3M Filmac 800 for microfiche which cost about $6000 each new ($3000 used). These both have been replaced by one machine, a Canon PC80 which costs $10,000 new. These machines are also available through lease from IHS (if you have their VSMF system) or from the machine manufacturer. The lease cost is approximately $2,500 per year with much of the cost applicable to the purchase price in the event you choose to buy it later.

While not yet mandatory for the use of GIDEP data, the next necessary item for the GIDEP Representative is access to a computer terminal with modem and a printer. Full time GIDEP use of a computer is not essential; however, access is necessary to perform remote computer terminal searches as needed. While the item cost varies directly with the sophistication of the terminal, terminals with modems and printers run in price from $2,000 (for an HDS terminal with a Racal Vadic #3455 modem and a GE Termnet 300 printer) to $4,000 for an IBM P/C system. A table for the equipment will cost $100 to $200. Your choice and cost should be based on your need.

Five drawer file cabinets and wall hung book shelves are a common commodity in all companies. The cost could run from $0 (if you can find surplus equipment) to $150. A fiche storage container will add $20 to the cost.

Travel costs for Industry Advisory Group participation and Workshop attendance could add as much as $4,000 to your GIDEP costs. If you are chosen to be on an Advisory Group, the three management meetings will cost (depending on the locations for air travel costs) and average of $800 each. The Workshop will add approximately $1,200 more. One additional trip the first year to attend the Clinic at Corona will add $800 to $1,000 to the travel cost.

Telephone and reproduction costs are the last of the cost elements incurred in being a GIDEP participant. Telephone links to the Operations Center in Corona (or through Washington, DC) are long distance toll calls and add widely varying amounts to your operating expenses. One can reduce the telephone costs by applying for Defense Data Network access through GIDEP. Cost of computer printer paper and Xerox copies (at about 10 cents per copy) again depend upon usage and are not readily costable.

Let's summarize the cost elements and their value where possible.

Space	100-150 sq. feet	
Manpower	500 hours average	$10,000
Microfilm Reader/ Printer	Cartridge Only	$3,000 – $14,000 (for plain paper automatic copying)
Microfiche Reader/ Printer	24X	$3,000 – $6,000
Microform Reader/ Printer	Combined	Approx. – $4,000
File Cabinets and Shelves	1 each	$0 – $200
Travel	1 trip min. per year	$1,200 – $5,200 (if you are on one of the advisory groups)
Telephone and Reproduction		as required

I hope that you now have some useful information with which you can estimate the "cost of belonging to GIDEP".

OPTICAL TOOL CHARACTERIZES ELECTRONIC MATERIALS

At the Naval Research Laboratory (NRL), Washington, D.C., scientists have developed an optical characterization tool – *photoreflectance* – to determine the electrical properties of electronic materials.

Photoreflectance is a contactless, nondestructive tool that can be used to inspect semiconductor wafers before, during, and after the fabrication of microelectronic chips. A wafer is a base material upon which integrated transistor circuits are formed. The measurement using this technique is rapid, automated, and cost-effective. It helps identify wafers that have faults that arise in crystal growth and/or processing time and reduces chip failure.

Photoreflectance can determine important semiconductor characteristics, such as alloy composition and carrier

ELECTION, 1989 OFFICERS

The results of our election for members of the NCSL Board of Directors have been reported as the following:

Past President:	Gary Davidson*
President:	Delbert Caldwell
Executive Vice President:	William Simmons
Secretary:	William Doyle
Treasurer:	Roland Vavken
Vice Presidents:	Robert Smith**
	James Ingram**
	Val Gersbach
	Chester Crane
	Klaus Jaeger
Directors:	Ralph Bertermann
	L. David Duff
	Anthony Anderson (1)
	William Brenant
	David Goodhead
NIST Representative:	Joe Simmons***
International Region Director:	Graham Cameron***

* Follow-on position

** Elected 1987 for 2-year term

*** Appointed Positions

(1) Ed Note – Tony Anderson, with the most votes of the directors was elevated to VP when the board decided to add a 6th VP. Bob Willett took his place as Director.

1989 ELECTION RESULTS

We received the ballots for the 1988 election of 1989 NCSL officers, counted them on October 3 (the first business day after October 1) and reported the results to the immediate past president, the president, and the executive vice president, per Administrative Guideline 6.1.

The following is the summary of the past six elections:

Year	Number of Members	Ballots Cast	Percent
1989	895	288	32%
1988	816	301	37%
1987	736	236	32%
1986	691	277	40%
1985	685	298	43%
1984	624	280	45%

REPORT FROM LONG RANGE PLANNING MEETING

MISSION OF THE NATIONAL CONFERENCE OF STANDARDS LABORATORIES

The National Conference of Standards Laboratories (NCSL) is a continuing, non-profit corporation oriented toward organizations involved in metrology and related activities.

The mission of NCSL is to advance technical and managerial excellence in the field of metrology, including standards, calibration, test and measurement, through voluntary activities aimed at improving product and service quality, productivity and the competitiveness of member organizations in the national and international market place.

NCSL accomplishes its mission through activities whose purposes are to:

1. Promote voluntary and cooperative efforts to solve common problems faced by its member organizations.

2. Collect and disseminate relevant information that is important to its member organizations.

3. Formulate concensus positions of the membership when requested by outside organizations and government bodies that will serve all or segments of the member organizations.

4. Serve as an intermediate between the National Institute for Standards and Technology and the metrology community.

5. Advance the state-of-the-art in metrology and related activities in both technical and management areas.

6. Provide liaison with technical societies, trade associations, educational institutions and other organizations or activities that have common interests.

7. Assess metrology requirements and develop uniform, recommended practices related to the activities of the membership.

8. Provide a forum to accomplish the objectives of NCSL through conferences, regional and sectional meetings, committee activities and publications.

NCSL, established in 1961, is international in scope. Its open membership consists of academic, scientific, industrial, commercial and government organizations that have a common interest in metrology and related activities.

KEY NCSL INITIATIVES FOR 1989

1. Improve NCSL effectiveness and contributions in the medical service; automotive and petroleum fields; and government agency coordination.

2. Develop a National Metrology and Calibration Initiative to develop management practices and measurement technologies to better meet the needs of the Nation. Focus areas include: product and service quality and productivity; international competition and trade; defense; education; and technology development and transfer to the private sector, including small business.

3. Lead and support activities that:

a. Improve and standardize means to express and demonstrate standards and calibration laboratory capabilities;

b. Provide recognition and formal publication of standards and calibration laboratories which achieve levels of self declared qualifications;

c. Develop or improve documentation of calibration system requirements. Improve the quality of calibration system evaluations and reduce redundant audits;

d. Improve standards and calibration laboratory contributions to the parent company's product quality and competitive position in national and international markets.

4. Emphasize activities to improve management of test, measuring and calibration equipment, and standards from development through evaluation, acquisition, operation, control, and disposal.

5. Increase international effectiveness in the areas of membership and section development and support; standards development, review and coordination; and measurement traceability.

6. Explore improving NCSL organizational effectiveness through:

a. Individual membership provisions;

b. An organizational relationship with the Measurement Science Conference and the Precision Measurement Association;

c. Directly elected regional representation to the Board of Directors;

d. Formalized Region and Section organizations.

7. Improve national level conference effectiveness through use of long range plans, advance annual committees and activities, and business office support.

8. Explore improvements in metrology and calibration education through:

a. Expansion of 2-year college curricula availability;
b. Including test, measurement, and calibration concepts in 4-year engineering and engineering technology programs;

c. Sponsoring, developing and conducting tuition based courses/seminars on calibration system and laboratory management, calibration and measurement techniques and other relevant and timely topics;

d. Developing text and reference material on metrology technical and management topics.

9. Improve effectiveness in the development of national standards and calibration services through:

a. Expanded assessment of national measurement requirements in terms of industry product/service affected, priority and value or national impact;

b. Participation in review and assessment of NIST programs and projects to develop or improve standards or calibration services;

c. Exploration of the feasibility of NCSL management of industry consortium funded metrology projects at the NIST.

10. Increase emphasis on committee effectiveness through:

a. Publication and recognition of committee membership and their results;

b. Encourage concurrent committee and Board meetings and participation;

c. Increased committee membership balance and involvement;

d. Establishing standing committees for: calibration reports; medical, automotive, government and petroleum sectors; personnel qualifications; laboratory capabilities; and international programs.

VERITY APPOINTS NEW COMMERCE UNDER SECRETARY FOR TECHNOLOGY

Commerce Secretary C. William Verity today announced the appointment of Ernest Ambler as acting under secretary for technology, a new position in Commerce.

Ambler has served since 1978 as director of the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards.

Ambler will head Commerce's new Technology Administration, created in legislation signed by President Reagan in October.

"Todays global market realities demand not only the creation of new technologies – at which America continues to excel – but rapid and continuous transfer of these technologies to new products," Verity said. "The undersecretary for technology

(Continued on page 44)

LIAISON NEWS

19 October 1988
REPORT FROM ANSI

ANSI/ASQC DRAFT Q4, AMERICAN NATIONAL STANDARD FOR THE QUALITY CONTROL OF MEASUREMENTS

Draft 2, Revision 0 of the proposed ANSI/ASQC Standard Q4. Quality Control of Measurements, has been awaiting its first review since August 1988. This process has been slowed down by a key person leaving the ASQC. Review is expected to begin before year end. Meanwhile, with ANSI/ASQC Standard M1, Calibration Systems, in operation, the development of similar international standards is gaining in importance and has already caught the attention of the DOD.

ISO DRAFT STANDARD, QUALITY ASSURANCE REQUIREMENTS FOR THE MANAGEMENT OF MEASURING AND TEST EQUIPMENT

The U.S. Involvement and Position

ANSI is the U.S. representative to the International Standards Organization (ISO). Dr McCoubrey of NBS temporarily had assumed the position of U.S. delegate to the ISO committee developing an international standard covering the area of MIL-C-45662A. Les Huntley, John Fluke Manufacturing Co., represented the U.S. at the first meeting of that committee in Oslo in April 1987, and I represented the U.S. at the subsequent meeting in London in October 1987.

At Dr. McCoubrey's request and with the concurrence of ASQC and ANSI, I received in September 1988 the formal appointment from ANSI to represent the U.S. in that ISO committee (ISO TC176/WG1). The standard is to follow AQAP-6, NATO Measurement and Calibration System Requirements for Industry, which was fashioned after, and closely resembles, MIL-C-45662A. The draft of the ISO standard is titled "Quality Assurance Requirements for the Management of Measurement of Measuring and Test Equipment".

One of Dr. McCoubrey's primary interests, supported by the U.S. Advisory Group he had formed, was the introduction of the measurement assurance concept; the ASQC is interested in promoting statistical process controls in all areas of quality control in the international standards. ANSI/ASQC M1 and Q4 are the first standards dealing with measurement process controls called measurement assurance.

The DOD Interest and Roll in the New ISO and ANSI/ASQC Standards

In the interest of avoiding unnecessary duplications and conflicts in procurement, the DOD is exploring the use of industry and international (ISO) standards. In view of the potential importance of the standard being developed by ISO TC176/WG1, Director Ira Epstein of the Office of the DOD Assistant Secretary of Defense has appointed Dave Mednick to the U.S. Advisory Group. Dave Mednick prepared an extensive set of excellent and well considered comments and change recommendations to the draft of ISO TC176/WG1 that represent the consensus of the DOD branches which had earlier developed MIL-STD-45662 and 45662A.

The mission of the U.S. delegate to ISO is to represent U.S. National Standards such as ANSI/ASQC M1 and Q4 to the extent possible and with due regard to a consensus or the opinions of his Advisory Group. Priority is to be given to existing U.S. National Standards.

ISO TC 176 met in Arlington, VA, from October 10 through 14, 1988. At this occasion, I had the opportunity for an extensive meeting with Dave Mednick to coordinate our activities regarding the ISO standard and to come to a mutual understanding of our positions and responsibilities. Dave assured his continued cooperation in the work of our ISO committee and the coordination of his inputs with the interested service branches. The ISO committee is aware of the important role the DOD can play in helping the standard gain wide international acceptance.

The aim of our ISO committee was to dispose of the international comments received on the first draft which did not include the DOD comments directly. The DOD comments, however, were helpful in deciding my position on the disposition of related comments received from others. Although prepared several months earlier and in due time, I had not received the DOD comments until ten days prior to the ISO meeting because of the slow pace of getting organized on the U.S. side. Hence, the next draft will not yet contain the DOD change recommendations.

In recognition of the potential impact of the ANSI/ASQC standards on the international standards and DOD procurements internationally, Dave Mednick also joined our standards writing group and intends to obtain a consensus of the service branches for his contributions.

A New Guideline Document for Measurement Assurance

The next draft of this ISO standard will also not address itself, to a satisfactory extent, our change proposals for inclusion of measurement assurance methods, except for a considerably watered down version of our proposal for measurement process controls. Despite the acceptance in principle of the concepts of statistical process controls by most delegates,

especially the Soviet delegate, the principles and methods of measurement assurance were deemed essentially unknown outside North America. The committee, therefore, decided to propose the opening of another project, writing ISO Guidelines for Measurement Assurance, before the ISO standard can address itself to it. I was nominated to spearhead this project for the committee if ISO adopts the proposal.

The pressure for the ISO committee to include provisions for measurement assurance in the standard is considerable, given the U.S. insistence. Perhaps more important, however, is an already accepted ISO Standard 9004, Quality Management and Quality System Elements – Guidelines, which specifies under "Measurement Control": ". . . Procedures should be established to monitor and maintain the measurement process itself under statistical control, including equipment, procedures and operator skills. Measurement error should be compared with requirements and appropriate action taken when precision and/or bias requirements are not achieved."

The need for such a document had been established by ASQC Metrology Technical Committee at the 1988 Quality Congress in Dallas for U.S. consumption. A second writing group of that committee was, therefore, established under Karl Speitel, and it was planned that this group help the ISO committee in the writing of its guidelines. A single document may serve both the U.S. and the international needs. As a member of that writing group, I shall coordinate the efforts of both groups.

At the conclusion of the meeting of ISO TC 176, the assembled delegates unanimously accepted the proposal to establish a project to write ISO Guidelines for Measurement Assurance.

I have learned that the term "ensemble" coined in ANSI/ASQC M1 is apparently finding considerable approval and acceptance at the PTB. A PTB delegation reportedly will take our definition of "Traceability" to the next international meeting on vocabulary and propose it to supersede the existing definition.

Rolf B.F. Schumacher, ANSI Liaison

****

IEEE ACTIVITIES OF INTEREST TO NCSL

1. The following are highlights of some recent activities of the IEEE that may be of interest to NCSL:

   a. An update to the IEEE specification on test equipment control in nuclear power applications has been initiated by the IEEE Standards Board. I have requested that I become a reviewer of the document so that NCSL interests can be considered. The document appears to seek the same objectives as Mil Std 45662A plus controls of test equipment selection methods.

   b. The IEEE Engineering and Defense Research and Development Committees have been involved in developing policy and position papers for approval and release by the IEEE United States Activity Board. These include:

      (1) Recommendations for policies on university/industry cooperative activities in advanced technology. The objective is to stimulate and strengthen university/industry cooperation to enhance the effectiveness and relevance of technological education and to help improve the competitiveness of the U.S. industry (increased manufacturing science and technology programs, industry/university personnel exchanges, tax incentives for university staff participation in government contracts with industry, active database of interested and capable universities and industries in specialty areas and listings of problems needing solutions, etc).

      (2) Recommendations on IR&D funding changes by Department of Defense that would increase incentives for more R&D in industry. Current IR&D funding is tied to bid and proposal funding and all are "capped" or limited by rules Congress has imposed on DOD to hold down the extent of allowable bid and proposal (B&P) expenses by the defense industry. Removing the cap will allow more flexibility and would eliminate the drain on R&D funding ceilings to feed B&P requirements, as is now often the cased. The subject becomes pretty complicated. The 3 October issue of "Defense News" has a front page article on the subject.

      (3) Recommendations regarding national priorities for R&D activities. These are separated by technologies and attempt to order priorities in those technologies for guidance to Congress and the Administration for budget planning of government agencies, such as DOD and NIST. This ambitious effort is in its early stages. It may be of interest for NCSL to participate with IEEE in inputs to this process by developing a set of priorities for the measurement technology/metrology area. This could form another ongoing basis for influencing government funding plans to support metrology interests.

   c. The IEEE Instrumentation and Measurement Society will hold its Instrumentation and Measurement

Technology Conference in Washington the end of April 1989 at the Key Bridge Marriott, Rosslyn (Alexandria, VA).

d. Having learned that a NIST, Boulder funding crisis was forecast for Fiscal Year 1989, representatives of the IEEE Committee for the Promotion of Microwave Standards met with John Lyons of NIST to urge the inclusion of millimeter wave and microwave R&D initiatives in the 1989 and 1990 NIST budget submission to the Department of Commerce and Congress. At the time of the meeting no such initiatives existed. Dr. Lyons expressed support of inclusion of these initiatives where possible.

Jerry Hayes, IEEE Liaison

* * * * * * * *

PMA LIAISON REPORT

The annual meeting of PMA membership was hosted by the Orange Section on 14 September 1988 in Buena Park, California.

PMA National Officers for the 1988-1089 year are as follows:

David Workman, President
Dean R. Marxer, Past President
Kevin Clark, Executive Vice-President
Donald Hays, Vice President
Rita Kirchgraber, Secretary
Darrell Klein, Treasurer
Richard Barnes, Director-at-Large
Terrelle Wilson, Director-at-Large
Max Unis, Director-at-Large
James Scoggins, Director-at-Large

The Orange Section of PMA won the John Quincy Adams award for having earned the most points in the competition between Sections.

The Precision Measurement Association presently has a membership of 638 members.

Steve Williams, Central Colorado Section, has been named to succeed Bob Courture as regular editor of the PMA Newsnotes.

Glenn E. Rassmussen, NCSL/PMA Liaison Delegate

NCSL Newsnotes

(Continued from page 41)

will serve as a strategic catalyst to promote the use of science and technology by industry and entrepreneurs and be both a listening post and a new voice for business in Washington on technology."

Verity said the new Technology Administration can help American industry remain competitive by putting under one umbrella technological research, technical literature, strategic resources, metric conversion, state and local initiatives, and telecommunications and information technologies.

Ambler joined the secretary in the announcement, saying the Commerce Department is uniquely positioned as a cabinet-level organization responsible for trade and commerce, the Technology Administration can be a focal point for the federal government and U.S. industry to come together and take actions that will help not just science and technology enterprise, but our economy and our nation as a whole," Ambler said.

The secretary also was joined in the announcement by Thomas Murrin, recently retired from the Westinghouse Corporation, who has served as an adviser to the secretary in developing plans for the new organization.

Chairman of the advisory group is Simon Ramo, co-founder of TRW, Inc., of Cleveland. Other advisers include Roland Schmitt, president of Rennselaer Polytechnic Institute, and Lewis Branscomb, director of the Science, Technology and Public Policy Program at Harvard University.

Verity said creation of the under secretary position has struck a positive chord with the scientific community. He said statements made by advisers who are working closely with him on creation of the Technology Administration are representative of the response he has received.

Schmitt said the new technology administration is a step forward, welcomed by "all interested in strengthening America's capacity to remain at the forefront of technology development."

"Either the United States will excel in technology or our living standards will fall and we will not contribute our proper share to world progress," Ramo said, adding that creation of the new organization is an important signal.

Raymond G. Kammer, currently deputy director of NIST, will serve as NIST acting director.

WELCOME TO OUR NEW NCSL MEMBERS

REGION 1:

Texas Instruments, Inc.
Attleboro, MA 02703
Delegate:
Paul W. Sherman

Electronics Corp. of America
Waltham, MA 02154
Delegate:
Wayne P. Doucet

Digital Equipment Co.
Andover, MA 01810-1098
Delegate:
James M. Moore

Eaton Consolidated Controls
Bethel, CT 06801
Delegate:
Michael C. Wypy

REGION 2:

G. Raymond Peacock Consulting
Southhampton, PA 18966
Delegate:
G. Raymond Peacock

Westinghouse Instr. & Comp Sys.
Pittsburg, PA 15205
Delegate:
Kevin S. O'Donnell

Moog Inc.
E. Aurora, NY 14052
Delegate:
Joseph Maciag

REGION 3:

Kabivitrum, Inc.
Clayton, NC 27520
Delegate:
Terry L. Boykin

Cerberonics, Inc.
Baileys Crossroads, VA 22041
Delegate:
Wayne R. Hay

Abbott Laboratories
Laurinburg, NC 28352
Delegate:
Kemp Stewart

REGION 5:

Kelsey-Hayes Co.
Romulus, MI 48174
Delegate:
Joseph F. Kosel

Indiana Standards Laboratory
Indianapolis, IN 46205
Delegate:
Richard F. Chance

REGION 6:

Abbott Labs
Irving, TX 75715
Delegate:
Orville Brown

Hewlett Packard Co.
Ft. Collins, Co. 80525
Delegate:
Richard G. Robinson

Coors Ceramics Co.
Golden CO 80401
Delegate:
Jim Reitz

3380 AMS/MAAP
Keesler AFB, MS 39534
Delegate:
Library

REGION 7:

Allied Signal/Bendix Field
Engineering Corp
Pasadena, CA 91107
Delegate:
Charles T. Martin

Chiron Corp.
Emeryville, CA 94608
Delegate:
John Miche

Precision Laboratory.
San Jose, CA 95111
Delegate:
Paul R. Nadeau

PI Instruments
Studio City, CA 91604
Delegate:
Don Knypstra

REGION 10:

Hewlett-Packard France
Les Ulis, France
Delegate:
Jean Claude Krynicki

Hewlett-Packard
Birkerod, Denmark
Delegate:
Kurt Jensen

Jola Instrument Services
Toronto, Ontario M6H 3Y2 Canada
Delegate:
John Raposo

REGION 11:

3M Co.
St. Paul, MN 55144
Delegate:
Alderis J. Doree

REPORTS FROM THE REGIONS

Nancy Thomas, Regional Editor, Hewlett-Packard
(415) 857-5197; FAX (415) 857-4598

October 26, 1988
Orlando, FL
John Riley
Florida Section Coordinator
Region 4

Twenty-five NCSL member delegates and guests representing 13 corporate and government laboratories participated in the Second "Florida Section" NCSL Metrology Workshop. Arrangements for the workshop were handled by Florida Section Coordinator, John Riley, NASA-KSC.

The workshop started at 9:00, following coffee and breakfast pastry. Mike Maxwell, Bionetics-KSC, handled at-the-door registrations. T.C. Brown, EG&G-KSC, served as recorder for the workshop.

Workshop sessions were devoted to networked automated calibration system, status report on the upcoming 10 volt round robin, discussion of the impact of Mil-Std-45662 changes, demonstration of an on-line calibration recall/workload management system and planning for the 1990 changes to the volt and ohm.

Blair Preston, EG&G-KSC, presented the Shared Resource Management System utilized by EG&G to control the automated calibration of electrical/electronic, pressure/vacuum, temperature, flow, photometric/radiometric, microwave and mass instruments and standards in the Base Standards and Calibration Laboratories at KSC. Blair explained the requirements driving the development of the system, the operating environment, hardware, software development, security, and data analysis capabilities of the current configuration. The presentation of the future enhancements including direct data transfer to history files for trend and stability analysis, and update of the recall system data base concluded the presentation, which was followed by a lively discussion session.

John Riley, NASA-KSC, provided a report on the ten volt round robin which will be run in the first quarter of 1989 among eleven central Florida laboratories. The experiment will utilize a pair of Fluke solid state voltage references (SSVR), one on loan from John Fluke Co. and the second on loan from Region 8, courtesy of Arno Ehrman, NCSL Measurement Assurance Programs Chairman. The SSVR's will stay a week in each participant laboratory. A minimum of five intercomparisons will be performed by each participant. Data reduction software will be provided with the units and the measurement data will be submitted on disc for all participants capable of running Lotus 1-2-3. Hard copy data will be accepted from those not running Lotus. Preliminary data feedback is scheduled within two weeks of the participants' completion of measurements. A comprehensive report will be produced following completion of the round robin. John Fluke Co., Inc., Orlando, will be the pivot laboratory for the round robin, following characterization of the SSVR's at John Fluke Co. in Beaverton, WA. Thanks to Walt Witko and Dave Agy respectively, for supporting this effort. Round robin scheduling, coordination, and data reduction will be handled by NASA, KSC.

Scott Muse, Bionetics Corporation, discussed and demonstrated the operation of an on-line calibration recall and workload management system. The system was designed to operate stand-alone on a personal computer network and upload calibration service and reliability data to a mainframe database of the NASA Equipment Management System/ Metrology Information System. The system currently supports 10 I/O terminals and maintains historical records on 26,000 items of test equipment. The system features windowed look-up tables for on-line verification/editing of coded entries for action taken, in/out of tolerance, performing organization, measurement discipline, status, manufacturer (H-4) code, and error trapping which disallows incorrect data entry attempts. The presentation was followed by a lively discussion on the relative merits of centralized (main frame) operations using dumb terminals, and distributed processing systems using PC's which may upload to a mainframe database, but run stand-alone.

Sectional Activity Session -- this was a discussion session. Blaine Bryan, EG&G-KSC, reported on the status of an AC round robin artifact being developed with Guideline support. The proposal to routinely invite DCAS participation was discussed, with members preferring to handle the matter with in-plant reps on a discretionary basis, depending on workshop topics. Interest was expressed in having a speaker from NIST at the Spring '89 workshop who would address the metrication legislation in the 1988 Trade Bill.

Bob Mecheid, CSR, Gene Ramba, Harris, and Mike Shaw, Guideline Instruments, discussed the impacts and the approaches to implementing the 1990 changes to the volt and ohm from the perspective of technical support services (DOD) contractor, a component and hardware systems manufacturer, and a precision instrument manufacturer, respectively. Mike Shaw discussed the activities of the ad hoc committee 91.4 and provided copies of a handout which will be provided to all attendees. The Section Coordinator distributed copies of a prospectus for a 1 day seminar to beoffered regionally in late 1989 by GWU on the changes which will be implemented by adoption of IPTS 90.

All participants completed a workshop critique and meeting topic preference form. It was the consensus of the group that the Airport Holiday Inn at Orlando was an optimum meeting site in terms of location, facilities, and food services, and would be the site for future regional workshops. The workshop adjourned at 4:00.

ATTENDEES

Steve Askew	Honeywell S&SA
Terry Bales	Sawtek
Jerry Batten	Kimball Electronic Lab
Paul Boon	Delta Electronics Laboratory
Fred Brooks	Delta Electronics Laboratory
Tom Brown	EG&G
Blaine Bryan	EG&G
Lawrence Crovo	Martin Marietta Missile Systems
Andy Fontenot	Harris
John Givens	Naval Research Lab UWSRD
Robert Holko	Kimball Electronic Laboratory
Mike Maxwell	Bionetics
Robert Mescheid	CSR
Scott Muse	Bionetics
Len Pinchek	CSR
Blair Preston	EG&G
Gene Rainba	Harris
John Riley	NASA, KSC
Larry Romeo	Honeywell S&SA
Elmore Saxon	Honeywell S&SA
Fred Schimmel	Naval Research Lab UWSRD
Mike Shaw	Guideline
John Shumake	Honeywell S&SA
Jim Stewart	Harris
Walt Witko	John Fluke Co.

* * * * * * * *

Nov. 22, 1988
Yellow Springs Instr. Co.
Yellow Springs, Ohio
Combined No./So. Ohio
Section Meeting
Mike Barnes,
South Ohio Coordinator

There were about 20 Attendees at the November combined No./So. Ohio Sectional Meeting. The meeting was held at Yellow Springs Instrument Company, Yellow Springs, Ohio.

Main topic of discussion was a paper presented by Henry Sostmann reviewing the 1990 ITS proposed changes.

The meeting was followed by a tour of the Yellow Springs Instrument manufacturing facilities followed by a lunch that can only be described as marvelous.

We want to express our gratitude to Yellow Springs Instrument for their gracious hospitality. We also want to express our appreciation for Henry's presentation.

The next meeting will take place late winter, time and place are to be determined. We are open for suggestions as to speakers and subjects, and should a host come forward you will be greatly appreciated.

ATTENDEES

Anne Zuker	BP America
Phil Alderton	Instrulab
Joe Kosel	Kelsey Hayes
Phil McRury	Battelle
Dale Martin	RDP Corp.
Douglas W. Schenk	Newark AFB
Phil Pierson	Newark AFB
Frank Butrof	GTE South
Stan Tekamp	Instrulab
Amos "MAX" Green	
Robert L. Mieltcal	EG&G Mound
Tom Lowler	I&C Sales
Mary K. Odom	Sandia Labs
Jim Brown	Consumers Power
Robert Sawyer	Consumers Power
Henry Sostmann	
Jim R. Simpson	YSI
Philip Wetz	YSI
Ben Barnet	YSI

Combined North/South Ohio Section 5 Yellow Springs Instrument Co.

International Temperature Standard Changes 1990 -- Henry Sostmann

* * * * * * * *

Nov. 9, 1988
Tektronix
Irving, Texas
Clyde Orrison,
Central (DFW) Section
Coordinator

The meeting attendance was fifty-one (51). By category there were 19 representing Measuring & Test Equipment (M&TE) users, 6 representing independent calibration laboratories, and

15 representing the M&TE manufacturers. Twenty four member organizations were represented and six NCSL members from the South Section of Region 6 were present.

Don McKenzie of our host company Tektronix welcomed the group and covered logistics and facilities followed by the usual greetings, door prize registration, and roster data check.

NCSL ACTIVITY/SUBJECTS COVERED

Bob Willett (Rockwell/Richardson) briefed the group on the October 1988 NCSL Board of Directors (BOD) meeting. Many topics were covered and each attendee received a copy of Bob's BOD meeting summary. Several short group discussions were spawned by this report. As a result, a number of topics will be added to the Central Section Topics Log and discussed at more length at future meetings.

Following Bob's discussion of the NCSL Equipment Management committee's activities and reports, Ron Groom (AT&T/Oklahoma City) explained further the charter and operation of the Committee.

Much discussion resulted concerning the need for more involvement in NCSL by the members of the Biomedical community. Information was shared concerning how the states and other agencies monitor hospital operations. Siemens representatives Ron Glover and Ken Moon took an action item to evaluate and make recommendations for a regional/sectional initiative to stimulate more health care communications on measurements and control of M&TE. They will report to the Region 6 coordinator as well as make a report at the Spring 4/89 Central Section meeting.

Bob also distributed copies of the Region 6 1988/89 Objectives document and requested responses and suggestions.

Ron Groom (NCSL National Membership Chairman) explained membership in the NCSL and the actions required to join. A short discussion followed concerning NCSL follow-up actions for members who do not renew. The Region 6 initiative to promote spreading the NCSL word through a one page mailer to be included with M&TE/representative literature mailings for three to six months was discussed.

During the Open Forum period, the M&TE manufacturer representatives were questioned concerning training mediums and activities their companies were planning for the near and long term. H-P, Tektronix, and Fluke/Philips, and independent reps discussed their current training programs and will report on plans for the future at the Spring 4/89 meeting. In addition to Fluke's calibration technician training seminar, H-P offers video training for measurement and calibration of DMM's, digital storage oscilloscopes, and RF/microwave devices. Measurement and M&TE application as well as calibration/repair training is needed.

DISCUSSION TOPICS COVERED

Bob Willett covered the major elements of the new release of the NCSL Recommended Practice RP3-1988 on content and format for Calibration Procedures. Bob explained the intent and application of the RP document. Terminology used in the RP as well as any measurement/M&TE document continues to be a source of concern and discussion, especially the definition of the word "calibration". Copies of RP3-1988 were provided. – B. Willett/Rockwell NTSD, 214/996-7070.

Steve Meyer of Fluke/Philips presented a brief technical discussion on specification interpretation for digital storage oscilloscopes (DSO). Copies of the information was provided. Discussion lead on to the availability of calibration software for this type of instrumentation. Fluke/Philips, Tektronix, and HP representatives provided the information to the types of software available and hardware (computers and interfaces) required to use it for their particular units. This generic topic will be scheduled for discussion at a future Region 6 meeting. – Steve Meyer/Fluke/Philips, Austin, TX, 512/340-0498.

Cliff Snellings of TI lead the discussion on the new changes for NBS to NIST based on the presentation information provided by Dr. Joe Simmons of NIST in the early fall. In August the National Bureau of Standards (NBS) became the National Institute of Standards and Technology (NIST) with many other perceived changes. Because of the many unanswered questions brought up during the discussion, it has been arranged that Dr. Simmons will be at the January 11, 1989 South Section meeting in Austin. He will provide more insight into the future for NIST and customers to knowledge at that date. MARK YOUR CALENDARS AND PLAN TO ATTEND, – Cliff Snellings, TI/Dallas, 214/995-4898.

Clyde Orrison of TI reported on an RF power sensor Measurement Assurance Program (MAP) conducted by the IEEE Automatic RF Techniques Group (ARFTG) in which TI/Dallas, HP service group/Richardson, and others participated. An HP model 8481A and 8478B sensor was measured for calibration factor by seven participants which included NIST/Boulder. Data comparison charts in the form of transparencies were shown. – Clyde Orrison, TI/Dallas, 214/995-5031.

Clyde Orrison lead an introductory discussion to the ANSI/ASQC M1-1987 standard for Calibration Systems document. Basically the two types of calibration systems were described and the relative merits of each were discussed. Conclusion: Few in attendance were familiar with the document. More time needs to be allocated to the subjects which this document particularly addresses which probably should be rhe practice of the future. However, the level of detail and communication must be high to do it justice as it relates to Measurement Assurance/Integrity, Statistical Process Control (SPC), Total Quality Management/Control (TQC), Total Customer Satisfaction, etc.

A brief introductory discussion of the subjects starting to be addressed by the new NCSL Intrinsic & Derived Standards Committee was made. This is a committee with great working potential which is going to require and deserve participation when they get into that phase.

The drawing for the door prices was held at the conclusion of the meeting. The big winner was Gerald Davis of Inotek Corp. in Dallas who was fortunate to win the host's door prize, a Sony Walkman portable television set. We won't tell, but a couple of other people would have won the set if they would not have left a little early. Other attenders won coffee cups. Multiple of copies of both the 1987 and 1988 NCSL Annual Conference Proceedings were available while they lasted.

COMING EVENTS

Measurement Science Conference, Jan. 26-27, 1989 in Anaheim, California; announcements etc. are being mailed the week of 11-28-88.

South Section of Region 6 Meeting, Jan. 11, 1989 at Austron in Austin, Texas; Special Program with Dr. Joe Simmons of NIST on NIST changes and Omnibus Trade Bill implications and Ted Elms of HP (Stanford Park Div.) on Total Quality Control/Management (TQC) experiences.

Next Central Section Meeting, April 5, 1989 at Fluke in Irving.

Many thanks to our host company and Don McKenzie of Tektronix, and to those who led the topic discussions and who raised issues and topics from the floor, making many of the day's topic discussions both lively and informative.

Best Regards and Happy Holidays from your NCSL Region 6 Coordinators.

ATTENDEES

M.B. Lee	GD/Ft. Worth
Allen Wilson	TI/Dallas
W. J. Day	TI/Dallas
Gerald Davis	Inotek
Jerry Gartt	Inotek
Ron Groom	AT&T
Frank Miller	AT&T
Howard R. Adams	Cal Labs, Inc.
Terry Mitchell	Motorola
Larry Treat	LTV
Jim Puri	Hewlett-Packard
Mike Daffin	Hewlett-Packard
John Lidh	Anritsu
Jerry Price	Rockwell Intl.
Tommy Weaver	Tracor Aerospace
Bill Doyle	U.S. Instruments Rentals
Gene Coslett	Rockwell Intl.
Clyde Orrison	T.I. Dallas
Ray McLendon	FAS OKC
Harvey Evans	Scientific Devises
Byrt Scammel	Airep Electronics
Jerry R. Creech	E-Systems
Luke Smith	E-Systems
Brannin McNeill	E-Systems
Jim Bailey	Metrology Specialists
Rick Watkins	Silvers Calibration Lab (formerly J&S)
Bill Eddy	Continental Electronics
Ted Richards	Quest Medical
Kenneth Wischnewsky	Bruel & Kiser Instruments
Orville Brown	Abbott Labs
Mark Thornton	Mensor Corp
Bob Roberts	R-Tech & Roberts Instruments
Glenn Bondy	Fluke
Johnnie Winters	Fluke
Keith Scoggins	Houston Power & Light
Ed Barker	Electrospace Systems
Ted Buell	Electrospace Systems
Ken Moon	Siemens Medical Systems
Ron Glover	Siemens Medical Systems
Bob Trevino	TI
Cliff Snellings	Texas Instruments
Chuck Cox	Dalfort Corp.
Robert Woods Jr.	Fluke
Jim Blue	Tektronix
Steve Meyer	Fluke
Don Jones	Honeywell
Jim Factton	Tucker Elec.
Craig Sleong	Tucker Elec.
Don McKenzie	Tektronix
Bob Willett	Rockwell Intl.
Joe Brown	Data Marketing Assoc.

Region 6 meeting held at Tektronix in Irvington, TX on Nov. 9, 1988

* * * * * * *

November 3, 1988
Hewlett-Packard
Mountain View, CA
Bard Dunkelberger
Region 7 Coordinator

Region 7 met at the Hewlett-Packard Customer Support facility in Mountain View, California on November 3, 1988, with 46 individuals representing 26 different organizations and one individual representing himself. Our host was Joe Corege, Hewlett-Packard.

The meeting agenda included the NCSL BOD report, and overview of the Hewlett-Packard Customer Support Division, four special topics and a tour of the Hewlett-Packard Customer Support facility.

After individual introductions, I introduced Jim Ingram, a group leader for Lockheed Missiles and Space and NCSL VP-Industrial Technology to provide us with the review of the 1988 NCSL conference and the plans for 1989. Also Jim was to give a review of the BOD meeting last month.

John Lee, VP-Telogy Inc. and chairman of the NCSL Government Affairs Committee, gave the report on the new MIL-STD-45662A. He discussed the new standard in detail and answered questions. John also suggested that we call Dave Mednick, 202-274-8090 if we have any serious problems with the standard or any interpretations. He, John, also reviewed the MIL-Handbook, to support this standard, and hoped that it would be available in plenty of time for the members to review. John pointed out that there were three main changes to the standard, and reviewed all other minor changes. Copies of the standard was made available to the member attendees.

Joe Corege, reviewed with the attendees the VOLT/OHM change for 1990, and led the discussion how Hewlett-Packard is reviewing the change. Joe reminded everyone that serious planning must start to make the change on time.

Roger Costa, Hewlett-Packard Product Support Division Manager, gave a very interesting presentation on "Customer Support Future Direction". He described the Hewlett-Packard goals and gave information how they were going to approach the customers inquires. Roger took questions from the floor and it became a very active session. A few action items were addressed and inquiries for feedback suggested. Questions asked covered service manuals, HP-IB test software, parts support, and answering service problems or user problems, for data products.

Jon Kim, Product Support Division software engineer, discussed the methods that Hewlett-Packard uses in writing of software, keeping in mind economics and flexibility, within the Hewlett-Packard organization.

Once again, my thanks to our host, Joe Corege and my personal thanks to each of the presenters and the attendees for their contributions to this meeting.

At the end of the afternoon we were conducted on a tour of the Hewlett-Packard Customer Support facility.

ATTENDEES

Diana Aquila	FMC-CEL Division
Bruno Benassai	Hewlett-Packard
Steve Bickford	Intel
Robert Bahrs	Teledyne MEC
Charles Balkon	IBM
Mike Bradshaw	Test Lab Co.
Dixon Browden	Hewlett-Packard
Debbie Cabusas	Watkins-Johnson
Joe Corege	Hewlett-Packard
Bard Dunkelberger	ESL
Steve Dickey	Intel
Steve Frei	Wiltron
Howard Fairchild	SE Laboratories
Malcolm Gregory	Wiltron
Dave Hopping	Hewlett-Packard
Pete Haro	NASA - AMES
Walt Herr	Hewlett-Packard
Jim Ingram	Lockheed
Steve Isaacs	Litton
Rusty Jarzombek	Avantek
Bud Jenkins	Hewlett-Packard
Doug Johnson	FMC
Robert Lucenea	Lawrence Livermore
John Lee	Telogy
Frank Myers	Signetics
David Mahoney	Apple
Bill Mauer	Apple
Donald Maclean	Watkins-Johnson
Paul Nadean	Precision
R. R. Peck	Metro Labs
Chuck Person	Dalmo Victor
Gary Ross	Kaiser Electronics
James Ralley	Raley Engineering
John Philip	GTE
Ron Schlichtemeier	Ford Aerospace
Edwin Sabathis	IBM
Emil Santos	Leasametric
Karen St. Germain	SE Laboratories
James Sedlacek	Lawrence Livermore
Ivan Therrien	Apple
Marga Trader	Watkins-Johnson
Dennis Tryon	Teledyne MED
Richard Volpi	Telogy
Bill Wexted	GTE
Thomas Whiteley	Ampex
Gretchen McIlvena	Telogy

Region 7 Meeting at Hewlett-Packard Product Support Division

September 20, 1988
Embassy Suites Hotel
Anaheim, CA
Kenneth Landis
LA/Orange County
Section Coordinator

On September 20, 1988, the second meeting of the Orange County Section of Region 8 took place. Forty-five people attended.

Ken Landis called the meeting to order at 9:07 AM. He reported that the NCSL Conference held in Washington, D.C. in August was well attended and that copies of the proceedings were available. Attendees introduced themselves to each other and the first speaker, Dr. Howard Castrup, Science Applications International, was introduced.

Dr. Castrup is the chairman of the NCSL committee on calibration intervals. This committee collects, develops, and disseminates information on calibration intervals for test equipment and standards in order to promote improvements in the assessment and mangement of equipment measurement quality. The following point were discussed:

* Dr. Castrup elaborated on the interval committee's responsibilities.
* He explained the relationship of failure items to costs to the companies investigating the failures.
* The committee seeks to establish an Analytical Metrology Resource Library.
* They are establishing a quantitative link between end item quality/performance objectives and the calibration interval.
* They are developing a Recommended Practice for calibration intervals – draft completed in 1989.
* The contents of this draft were discussed in detail.

After a short break, Tom McGavney of TRW was introduced. Tom explained the NCSL Electronic Bulletin Board. He went into the history of its development, how it is used, what information it can provide, and its possible futures. The four basic areas within the bulletin board are:

a. Electronic Mail
b. Posted Messages
c. File Transfer System
d. General Information

The next subject discussed the work done by the National Measurement Requirements Committee. The chairman, Lauri Baker of Rockwell International, introduced the topic. He first spoke of the committee's goals and their charter. These included:

a. Range, accuracy, and operating conditions beyond current calibration laboratory requirements.
b. The need for this information several years in advance where possible.
c. Reporting these requirements to NCSL members.

Specific objectives for this committee are to prioritize their tasks by identifying the most critical areas and the largest user bases, and to quantify these needs: (ie, how this benefits users in terms of improved efficiency, how dollars are saved/lost because of the presence or lack of capability).

Next, Richard Ailer of TRW discussed Out-Of-Tolerance Feedback comittee goals. A primary point addressed by the speaker was whether or not there is a payback in the dissemination of out-of-tolerance data to users of MTE. The costs associated with reporting this data seem to outweigh the benefits in some cases. Unfortunately, according to a recent survey, most companies haven't really thought about these costs. The discussion following the introduction was quite lively and seemed to back up the survey results. Everyone had strong opinions, but not a lot of hard data to back the opinions up. Other than being required by MIL-STD-45662, there wasn't any data showing that data feedback can be cost justified or that it adds any amount of quality to the final product.

After lunch, Arno Ehman of Beckman addressed the attendees on the Measurement Assurance Committee. He reported on future plans for MAPs and the possibility of using NCSL standards. Arno asked any interested parties to call him.

Chet Crane of Teledyne followed with a report from the NCSL Board of Directors. He gave an overview of the August conference held one month prior, and reminded everyone that next year's conference will be held in July, 1989. Chet said that consideration is being given to an international conference, to include Japan, Korea, etc. He also reminded the attendees that the revised handbook for MIL-STD-45662A will be coming out in early 1989 and the volt/ohm change will be happening in early 1990.

Ron Goff, Rockwell International, lead the next discussion. He addressed the coming change to the Volt and Ohm. He reminded everyone to be aware of the affects of the change on sources and receivers (DMMS). Not all devices are adjusted in the same direction. Ron also mentioned the use of a label to inform users when a device has been corrected to the new standard.

The final session, "Feedback to NBS", was somewhat modified compared to the usual feedback session. A more descriptive title would have been, "Feedback to and from NIST". Ernest Garner of NIST gave everyone an excellent overview of the recent changes to that organization. He explained that NIST has been redesigned to give support to a wider cross section of industry. Finally Mr. Garner presented a chart explaining current (and tentative) structuring of NIST.

The meeting actually went ten minutes past three thirty, and would have continued past then if the threat of Orange County taffic had not been present. My thanks to all of the committee chairman and members who lead discussions and special thatnks to Mr. Ernest Garner for flying out to Orange County to attend the meeting.

ATTENDEES

Rick Ailor	TRW
Lauri Baker	Rockwell International
Steve Blakesley	Interstate Electronics
Jeff Blasko	Comtel Corporation
Howard Casper	Scientific Applications
Dave Collins	GTE, California
Steve Cooke	General Dynamics
Bob Couture	Rockwell International
Don Cox	GIDEP Service Center
Chet Crane	Teledyne Microelectronics
Gary Davidson	TRW
Jack Edison	Beckman Instruments, Inc.
Arno Ehman	Beckman Instruments, Inc
Brad Einstein	Northrop Corporation
Fred Elliott	Kwikset Corporation
Curt Farren	Beckman Instruments, Inc.
Karoly Fenyvesi	Photo Research
Ernest Garner	NBS Representative
James Glidwell	Shiley, Inc.
Ron Goff	Rockwell International
Sid Harper	GTE, California
Jerry Hayes	Consultant
Mike Hewitt	McDonnell Douglas
Ken Landis	Hughes Aircraft
Dave Lorenzen	McDonnell Douglas
Ken Lund	Rockwell International
Charles Martin	Allied Signal/Bendix
Bill Moore	LA County Weights & Measures
Kin Morganstern	FPS Technology
Tad Mukahata	Hughes Aircraft
Paul Nelson	Hughes Aircraft
Phil Painchaud	Consultant
Dennis Pinnecker	Rockwell International
Georg Rice	Rockwell International
Don Royster	Hewlett-Packard
Rolf Schumacher	Rockwell International
Howard Shafer	Shafer Engineering
Bob Smith	Ford Aerospace
Inge L. Stork	Temperature Standards Lab
Jum Tavenier	Airojet Electrosystems
Alan Vancouvering	Hughes Aircraft
Roland Vavken	Rockwell International
Larry Snow	ITT Gilfillan
Dale Beckar	SPS Technologies
Dennis Evans	EIL Instruments

* * * * * * * *

October 27, 1988
The Inn at the Airport
Tucson, Arizona
Lee J. Walters
Asst. coordinator
Phoenix/Tucson Section

Forty persons assembled at The Inn at the Airport in Tucson for the eleventh NCSL Region 8, Phoenix/Tucson Section meeting. It was a warm, pleasant, October day.

After registration, coffee and danish, Wayne Benda (Hughes Aircraft), Phoenix/Tucson Section Coordinator, welcomed those present and self introductions followed.

Wayne asked about topics for discussion at future meetings. When asked about subject matter, a show of hands indicated that technical talks would be very popular.

Don Strittmatter, of Hughes Aircraft in Tucson, was introduced to address the topic "Proposed Standard for Magnifying Power of Visual Magnification Aids/Devices". Don noted that the calibration of devices used to perform visual inspection of solder joints is addressed in specifications DOD-2000 and WS-6536E.

Don described problems encountered when it was determined that magnification factors for basic observation devices in the 4X to 10X magnification range were found to be in error by as much as 300-400%. Requirements at that time simply did not exist except in a few MIL solder specs; therefore certification on magnifiers was a new requirement for the industry.

Several popular commercial devices were described, none of which met the 4X magnification power (MP) specification.

Confusion regarding the measurement of MP exists even at the level of the optical device manufacturer. Apparently, the term "diopter" (which involves relative power of a lens) is being confused with MP. Don's efforts have included defining what MP is and how to measure it.

As the result of a solder specification from the Navy, Hughes Aircraft funded a project, headed by Don, to define MP and to design and build a suitable two eye device. A strong recommendation from the project soon followed to also accept one eye devices.

Hughes produced a 4X/19X device which meets the 4X specification as have other manufacturers. They've also designed and produced an automated device which was described as the "utopian" approach to visual inspection.

Devices from other manufacturers which were found to be acceptable at 4X included the Schneider Lupe 4X and the Nikkon SMZ1 stereo microscope.

Because of the many uncertainties in magnification systems, certification is a must. Hughes has designed and built what is called the "Magnascope". The device is used to calibrate magnifiers and is simple to use. The "Magnascope" principle is available to industry from Hughes.

Resolution was discussed. The way DOD-2000 is written, no device can pass its requirements at 10X, which is where the auditor will probably want to check, and DOD-STD-2000 is the new specification!! New contracts are not being written

specifying the older WS6536E, which has finally, after numerous rewrites, become a workable document.

At the request of the DOD, 14 industry representatives have formed a committee to recommend changes to the DOD-2000 specification. A copy of these recommendations had been provided for each person present. The Committee had itemized paragraphs from the DOD-2000 standards which presented problems. A "should be" paragraph, recommending appropriate changes, followed each "as is" paragraph listed. Meanwhile, the typical industry calibration facility could be shut down for non-compliance with a document from which compliance cannot be obtained.

Don urged that as much influence and/or pressure as possible should be brought to bear on the DOD by industry to see that the specs are changed to be more concise and present a uniform interpretation of the ground rules for everyone. He noted that each of us needs to stress, to our respective management areas, the need to comply with the requirements of the standards which are now being enforced. For some, there could be rough times ahead when dealing with DCAS or other enforcement agencies.

An hour of discussion followed which helped clarify the issues Don had presented. After lunch, Wayne requested that anyone who had brought feedback issues for the National Institute of Standards & Technology (NIST), present them. There were no written responses. Two concerns from the floor were stated.

1. Why can't there be a second person at NIST to sign certificates when the department head is away? Certificates are sometimes delayed for long time periods when this occurs.
2. How are the volt/ohm changes going to be implemented?

Chet Crane (Teledyne Microelectronics), Director for NCSL Regions 6 and 8, reported on items of interest from the Board of Directors meeting which had just concluded in Santa Fe.

Chet described reasons for the recent name change from NBS to NIST. NIST has been assigned new tasks which expand its area of service. Although present services will be retained, they will be expanding into new areas such as aiding industry in the development of new technologies and manufacturing processes.

The question about how the volt and ohm changes would be implemented was answered. Chet advised that NIST would be forwarding calibration updates to holders of recent volt or ohm calibrations. The updated will include corrections for the original values given on the certificate and is intended to update the certification.

The possibility of an NCSL name change was noted. The reason given was that NCSL has an international interest as well as international representation (NCSL has 89 non-U.S. members).

The NCSL electronic bulletin board was given another plug. It must be used more than it has been or will have to be abandoned. It is a great way to keep abreast of happenings within the organization.

There were 69 persons from Region 8 in attendance at the annual conference in Washington D.C. this past August.
MIL-HDBK-52 is still scheduled for release by the end of the year. Chet didn't believe this schedule would be met.

Chet urged that anyone whose needs are not being met by NIST should submit their concerns to Lauri Baker at Rockwell International (your section leader can supply the address). Lauri is chairman of the National Measurements Requirements Committee.

Recommended Practice (RP) 8 has been completed. This RP helps relieve some of the dilemma encountered when trying to decipher equipment specifications. The RP should be distributed to NCSL members in January 1989.

A new handbook is in the process of being produced which describes intrinsic standards (those which do not require traceability). A due date was not specified for this activity.

RP-7 is in the process of being updated.

Anyone who would like to chair the NCSL Compendium Committee should contact Del Caldwell. The task of this group will be to document the history of NCSL.

New developments at NIST were briefly discussed. Noise figure measurements can now be provided to 12 GHz.

Discussion of the MIL-STD-45662A was chaired by Wayne Benda. The "significant' issue and the new 4:1 requirement were addressed. A great deal of uncertainty existed in the minds of those present regarding exactly how and at what level the 4:1 requirement were addressed. A great deal of uncertainty existed in the minds of those present regarding exactly how and at what level the 4:1 ratio will be required. Although the "A" version is dated 1 August 1988, when, exactly, does the contractor have to comply?

Seals appeared to be another potential area for unreasonable interpretation. For example, instruments with plug-in modules, when removed, have calibration controls which could, conceivably, be user (mis)adjusted. Attempting to "seal" controls such as capacitors at uhf frequencies could change their operating characteristics enough to be seriously detrimental. That would most certainly be counterproductive.

Such requirements seem unreasonable and must be questioned by any intelligent person or entity as being unnecessary. As U.S. industry regroups for world competition and the highest quality products, our energies must be expended toward doing the right things the right way!

It was observed that a lot is riding on how MIL-HDBK-52 interprets these new requirements.

The meeting was adjourned at about 330 PM. The next NCSL, Region 8, Phoenix/Tucson Section meeting will tentatively take place in the Phoenix area on Thursday, 27 April 1989. The fall meeting, in Tucson, is tentatively scheduled for the 5th of October 1989.

ATTENDEES

Richard Barnes	Global-Wulfsberg
John Barr	Hughes Aircraft Company
Wayne E. Benda	Hughes Aircraft Company
Jim Berg	Honeywell
David R. Bennett	Airtronics, Incorp.
Cecil H. Cole	EG&G Flow Technolgy
Chester J. Crane	Teledyne Microelectronics
Michael Curtis	Precision Measurement
Constance V. Davis	Litton Electron Devices Div.
Richard H. Davis	Loral Defense Systems Division
Harold J. Foxhoven	IBM Corp.
Jean W. Gardner	Electronic Instruments
David S. Golsner	Motorola Semiconductor Products Sector
Richard M. Hanley	Micro-Rel
Kenneth W. Haupt, II	Sydel-System Development Corp.
Bill L. Heer	Motorola Semiconductor Products Sector
Richard P. Horn	State of Ariz. Weights & Measures
Bill Humes	IBM Corporation
William B. Hutchinson	Motorola Government Electronics Group
Ken C. Jackson	UniDynamics/Phoenix
Don Liisiecki	Motorola Semiconductor Products Sector
Jerry Lund	Motorola Semiconductor Products Sector
Jsmrd M. Makela	Global-Wulfsberg
Robert A. Mercier	W. L. Gore & Associates, Phoenix
Kelleen M. Moody	State of Ariz., Weights & Measures
Gary W. Oliver	INTEL Corp.
William F. Quigley	Hughes Aircraft Co.
Francis L. Richardson	Delco Systems, Goleta, CA
Karda K. Rollins	Motorola Semiconductor Products Sector
Ralph W. Schneider	Metrology Div. PMTC, Point Mugu, CA
Walt H. Schuknecht	M/A COM, Active Assemb. Div
Miles L.Smith	Motorola Gov. Electronics Group
Juan J. Solis	AiResearch Electronic Systems Division
John W. Spence, Jr.	IBM Corporation
Dieter H. Steinert	Delco Systems, Goleta, CA
Don Strittmatter	Hughes Aircraft Co.
Earl P. Tofanelli	Loral Defense Systems Div.
Lee J. Walters	Motorola Gov. Electronics Group
Walter D. Wiley	Hughes Aircraft Co.
Darryl R. Womack	Honeywell Test Instrumentation Division

Don Stritmatter, Hughes Aircraft, explains the problems of measuring magnification as required by DoD-2000 and WS-6536E

Attendees of the Phoenix/Tucson Section meeting in the Inn at the airport in Tucson, Arizona

* * * * * * * *

Oct. 6 1988
Medtronic
Palatine, Ill.
George Harris
Region 11, Twin Cities Section

October 10, 1988 meeting was hosted by Medtronic, Inc., who manufactures the number one pacemaker prescribed in the world today (Activitrax), along with many other healthcare items such as artificial heart valves and neurostimulation devices. There were 48 members and guests present making this one of our largest meetings. Many of the guests were new to an NCSL meeting and requested information about membership.

Walt Peterson of Medtronic, Inc., our host, presented a videotape to the group which told about Medtronic, and the products they have on the market. It was an excellent tape that also included some interviews with patients.

John Buck, of Unisys, our Region 11 coordinator, then discussed the following topics:

* NBS changes to NIST, highlights
* Accreditation/Certification
* Round Robins
* Ohm/Volt changes/potential problems
* Mil-Std-45662A changes/problems

John also later discussed the possibility of a joint regional meeting for sometime next year, and recieved a good amount of support from the group, indicating they would be able to travel to a meeting somewhere central to the sections.

Tom Lambert, of Medtronic, gave a presentation on requirements for biomedical calibration labs, which are audited by the FDA. Tom recommended a handbook published by ASQC called Quality Systems Auditor Training Handbook for additional information. He stressed the importance of trying to answer any possible questions an auditor might ask by having the answers written down in the procedures and manual, and also by having the appropriate people answer questions. Tom also recommended having internal audits on a regular basis. I appreciated Tom stepping in on short notice to give the presentation, as the original speaker was unable to talk that day.

Bob Overturf, of Wm K Nelson Company, gave us a presentation on bar coding. He discussed the various format options and suggested some possible uses for them in the inventory and calibration of equipment. He also recommended a book by Harry Burke called *Handbook of Barcoding Systems* (1985). Bob also has an interest in railroads and told us that this is where bar coding was first used, for car tracking.

Nick Helm, of FluiDyne Engineering, discussed Pressure Measurements and Traceability. This was a very informative paper which had been requested as a topic in the past. Nick talked about defining uncertainty and establishing a reasonable value based on bias plus two standard deviations. He also highlighted the potential improvement which can be made by finer calibrations for mass and length. He also discussed a new automated system, which has an even lower uncertainty than prior testing.

Before lunch we had a few minutes and gave away some NCSL door prizes such as Conference Proceedings and NCSL portfolios, a deck of playing cards, and a coffee mug.

After lunch, which was provided by Medtronic, we had a presentation given by Sumedha Sengupta, of Stat-Tech, an independent statistical consultant. Sumedha discussed statistical process control (SPC) and design of experiment (DOE). She stressed that before one can do anything with a process, one must be very familiar with all of the steps in the process. One can do this with a flow chart, which can then indicate measurement points, inspection points, and decision points. She also discussed the concepts of "in control" vs out of tolerance. Sumedha also presented information on statistical tools and tests which are used in process control.

Jeff Osterhues of DataMyte gave a quick overview (as we were short on time) of gauge reproducibiltiy. He mentioned that there can be three sources of error, such as operator, environment, or gauge. Then he discussed the gauge factors which can affect measurement results. These included: resolution, reproducibility, accuracy, stability, precision, and capability.

We then split into three groups for tours of the Medtronic facility. The tour covered some of the history of the company which is only 39 years old with sales worldwide and has between 5000 and 6000 employees. We also viewed laser etching which is done to the outside of the pacemaker case, and can be seen on an x-ray once implanted.

The interest survey, which was filled out by 38 people during the meeting, gave the following results. Topics are ranked in order.

1	19	Instrument Specs vs Uncertainty
2	17	Technical Topics: #1 Flow #2 Dimensional
3	15	Measurement Error Studies
4	13	Local Sources: Metrologists/Techs & Training
	13	Self Calibrating Instruments
	13	Process Control Measurements/Verification
7	11	Automatic Calibrations
8	10	Engineering Standards
9	9	Lab Environment Requirements
10	8	Standardizing Software
	8	Effects of Shipping on Equipment Calibration
	8	Uncertainty Staatements
	8	Accreditation/Certification
14	7	Software QA
15	6	Equipment Management

Plans for meetings in 1989 will try to make use of topics which are of interest to the group. Dates have tentatively been set for:

April 11, 1989 at FMC Northern Ordinance, Minneapolis,
October 17, 1989, TBA.

Thanks again to Walt Peterson, and Doug Burch, and Medtronic, Inc., for hosting the meeting and providing lunch, and refreshments to the group. Thank you also to all of the speakers for their willing participation and enthusiasm. A list of attendees follows.

ATTENDEES

Rich Barnes	Rosemount, Inc.
Jeff Brandt	Twin City Testing

Dennis Brown	Best Cal, Inc.
John Buck	Unisys Corporation
Doug Burch	Medtronic, Inc.
Jim Canfield	St. Jude Medical
Sandra Clifford	MKS
Gaylord Degroot	MTS Systems Corp.
Al Doree	3M Company
Jerry Drake	GTE North Inc.
Elsa Frettem	SM Company
Gary Furman	Honeywell
Desmond M. Granrose	3M Company
Georgia Harris	MN Weights & Measures
Urban Hartman	Rosemount, Inc.
Nick Helm	Fluidyne
Don Hess	Pharmacia Deltec
Todd R. Holmes	Cardiac Pacemakers, Inc.
Nathaniel Hudson	Honeywell
Al Isaacs	Unisys Corporation
Gary Kloss	Onan Corporation
Jerry Kolkind	Rosemount, Inc.
Dave Kreitlow	MTS Systems
Joseph Kresse	John Fluke Mfg. Co.
Serafima Lamin	3M Company
Don Larson	Honeywell (DSG)
Laura McDonnell	3M Company
Gary C. Meyer	Technical Institute of Hutchinson
Don Nass	The Trane Company
Tam Ngo	Lee Data Corporation
Daniel Novak	Honeywell, Inc.
Russ Olson	Onan Corporation
Jeff Osterhues	DataMyte
Bob Overturf	Wm K Nelson Company
Walt Peterson	Medtronic, Inc.
Charles O. Regal	3M Company
Larry Roden	Cardiac Pacemakers, Inc.
Brian Roepke	Hutchinson Technology, Inc.
Jim Schepers	Unisys Corporation
Holly Schwerzler	Schneider/Shiley (Angiomedics)
Sengupta, Sumedha	Stat-Tech
David Sorenson	Tescom Corp
Don Spies	3M Company
Don Swanson	3M Company
Kevin Vosler	Trane Company
Richard Weber	3M Company

* * * * * *

October 4, 1988
Bendix/King
Kansas City
John Buck
Region 11, Coordinator
(St. Louis Sectional Meeting)

Program opened with John Buck presenting information from the 1988 NCSL National Conference and the adjoining Board of Directors meeting. His report included 1) details of the NBS to NIST name change and their expanded charter, 2) the American Association of Laboratories Accreditation asking NCSL to join them in pursuing accreditation of Metrology labs that want this kind of recognition, 3) the imminent publication of the results of the NCSL survey on Out-of-Tolerance Feedback, 4) the renewed effort by NCSL to assist companies wanting to do Round Robins, and 5) the status of the international change in the volt and ohm due in Jan. 1990.

Then information on some of the work done on Recall Interval analysis was presented to begin a lively discussion among the attendees on this very interesting topic. It gave each member a chance to learn what others are doing and how they are doing it.

Before lunch we discussed future meeting places, times, and topics. Included was a discussion on possibilities and desirability of all 3 sectionals within Region 11 having a joint meeting (possibly through a video teleconference, we heard Tektronix has a good one); this will be discussed among the Sectional Coordinators over next several months. Both McDonnell Douglas and AT&T volunterred to host the next meeting, March 10, 1989; the host was not selected but will be announced with the March 10 agenda. Some topics of interest: 1) progress report on International standard, 2) Jim Perkins presented his involvement in training of Metrology personnel or use some other authority in this field of education, 3) reverse traceability, and 4) a Test Equipment Management presentation, maybe from tahe Equipment Management Forum in NCSL.

After lunch a video on ElectroStatic Discharge (ESD) was shown, followed by an open discussion.

Before the tour, John Buck updated the group on Mil-Std-45662A. Besides noting that it is now an official revision, copies were available, some of the major changes were mentioned and discussed.

Then John Cessna gave an interesting tour of the entire facility. One of the highlights was a demonstration of the advanced instruments used on todays aircraft. Via this working mock-up of an instrument panel, we could see how the pilot gets his weather and navigational information. And even which button he pushes to ask the computer for the nearest airport when he is running out of gas. He also showed us the radio station manned by Bendix/King people who were listening to the Voyager's trip around the world, ready to give assistance if they needed it. And some nice large posters of the Beechjet instrument panel, with Bendix/King products of course, were passed out.

Most of the meeting used group discussion. And the ready participation by everyone provided a very effective means for learning and passing on information.

Our thanks to Bendix/King for providing the facilities and to Kelley McDaniel, John Cessna and the others at Bendix/King for making it a very enjoyable experience.

ATTENDEES:

Leon Barnes	Allied Signal
John Buck	Unisys
John Cessna	Bendix/King
Kris Dalager	Bendix/King

Scott Dunbar	Bendix/King
Max K. Galaway	US Air Force
Dennis Gilbert	Ledford Mach. & Gage Lab
Don Grint	JC Air
Charles Helphrey	Bendix/King
Bob James	Allied Signal, KCD
Robert Johnson	Bendix/King
Les Jones	IFR Systems, Inc.
Brian L. Mack	Bendix/King
Kelley McDaniel	Bendix/King
Larry T. Rabeneck	Bendix/King
Mike Rollins	Marion Labs
Dick Schneider	AT&T
Glenn Thompson	Monsanto
David White	ISL Corp. KC, Mo
Dean R. Yarolimek	McDonnell Douglas

Bendix/King General Aviation Avionics Division hosted the Oct. 7, 1988 Region 11, St. Louis meeting

****

October 6, 1988
John Fluke Manufacturing Co.
Palatine, ILL
Art Vogt
Region 11
Chicago Section Coordinator

The meeting was hosted by Gary Hoffman of John Fluke. A list of the 45 attendees is attached.

The meeting opened with coffee, get acquainted and registration.

Art Vogt opened the discussion with comments on the change in the National Bureau of Standards name to the National Institute of Standards and Technology (NIST) and its expanded role to provide technical expertise to industry. It was made clear that NIST would still provide their traditional services.

John Buck, the Region 11 Coordinator, then led a lively discussion on the revised MIL-STD-45662A. Some time was spent in discussing paragraphs 5.2 *Adequacy of Measurement Standards* and 5.6 *Out-of-Tolerance Conditions* and the impact of various changes on people and their organizations in the audience. John discussed the possibility of a joint meeting of the three sections in Region 11 at a to-be-determined location. Enough people seemed to be interested in such a meeting to make it a possibility in the next year or so.

There was some interest in a local Measurement Assurance Program (MAP). The interested parties should get in touch with Art Vogt at 312/567-4499 with the types of standards they would be interested in checking so that the details can be worked out.

Our next meeting will be held on April 6, 1989 at the Commonwealth Edison Nuclear Plant Simulator in Braidwood, Illinois. This should be a very interesting meeting so make sure that you reserve this date. We are always interested in your ideas for future meetings. If you should have any ideas please call me at 312/567-4499.

Mr. Jim Pecore of Gen Rad gave an excellent talk on "Enhancing Precision and Capability for Many Critical Measurements Using a Digital Impedance Meter." The digital impedance meter gives high resolution and repeatability that approaches and in some cases is better than older manual bridges. The newer digital impedance meters offer part-per-million resolution and with the IEEE 488 bus a personal computer can do all of the statistical computations and print out a complete certificate. The instruments are capable of measuring inductance, capacitance and AC resistance over a wide frequency range.

During our morning session there were some questions regarding equipment management in large industrial organizations. Bob Henry of Motorola volunteered to share some ideas he has used in his organization. After an excellent lunch provided by Fluke, Bob gave an outstanding 45 minute presentation on equipment management. We need more volunteers like Bob.

Our next presentation was given by Wayne Cummings of John Fluke who described their new 5700 Calibrator and the 7411 Personal Computer Calibration Software which allows you to completely automate the calibration process. The 7411 software can also be used on other Fluke calibrators that are equipped with the IEEE 488 interface bus. The 5700 Calibrator is a high performance, easy to use instrument that covers a wide range of workloads. Only three standards are needed to do all of the 5700 internal adjustments: a 10 volt DC reference standard, a one ohm standard resistor and a 10k ohm standard resistor. Wayne gave a very interesting and entertaining presentation.

The days activities ended with a tour of the Fluke facility. I would like to thank Gary Hoffman of John Fluke for hosting the meeting.

ATTENDEES:

K. V. Abraham	Johnson Controls
George Benter	AT&T

Ralph Bertermann	G. D. Searle
John Buck	Unisys Corp.
Douglas Burnett	Gen Rad Inc.
Roy Campbell	Caterpillar, Inc.
Tim Coleman	Micro Switch
Wayne Cummings	John Fluke
Ronald Dettling	Rockwell/Wescom
Denise Jones	Honeywell
William Keinz	G.T.E. Communication System
Michael Kuri	G.T.E. Communication System
Jack E. Leedom	Simpson Electric Co.
Diane Massey	Honeywell I.S.D.
Joe McIntyre	IIT Research Institute
Jerry McKenzie	Sundstrand Aviation
Sheila McNamara	Gen Rad Inc.
Kathi Miller	Baxter Health Care
Russ Miller	AT&T
James Morrissey	Nutrasweet
Jim Pecor	Gen Rad Inc.
Mark Pierce	Nutrasweet
Grant W. Reichard	Dickson
Bonie Salyards	Baxter Health Care
Timothy J. Scanlan	Commonwealth Edison
Dan Schreiber	IIT Research Institute
Richard Spears	Simpson Electric Co.
Jack Stansbuary	Dickson
Marcial Villaverde	Siemens Gammasonics
Art Vogt	IIT Research Institute
David H. Walters	Commonwealth Edison Co.
Tom Waltrich	NutraSweet R&D
Stuart Wells	Woodward Governor Co.
Jim Williams	Woodward Governor Co.
Doug Young	Caterpillar, Inc.

Motorola's Bob Henry shares ideas on equipment management John Fluke Manufacturing hosted the Oct. 6 Chicago Section Meeting.

Jim Pecore of Genrad describes the increased resolution and repeatability of the newer digital impedance meters.

John Fluke Manufacturing hosted the Oct. 6 Chicago Section Meeting

Wayne Cummings of John Fluke Manufacturing shows how the Fluke 4700 Calibrator and 7411 PC Software can completely automate the calibration process

NCSL BOARD OF DIRECTORS
1989

4.0 PRESIDENT*

Delbert H. Caldwell
NWS Seal Beach
Corona Annex (Code 313)
Corona, CA 91720-5000
(714) 736-4456 FAX 714-736-4237

5.0 EXECUTIVE VICE PRESIDENT*

Bill Simmons
Sverdrup Technology, Inc.
Bldg. 1105, Rm. B208
Stennis Space Ctr., MS 39529
(601) 688-3192

20.0 – 60.0 VICE PRESIDENTS

20.0 Anthony Anderson
Guildline Instruments, Inc.
4403 Vineland Rd., Suite B-10
Orlando, FL 32811-7335
(305) 423-8215

30.0 Bob Smith
Ford Aerospace Corp.
Ford Rd., MS EV-8-26
P.O. Box A
Newport Beach, CA 92658-9983
(714) 720-4820 FAX 714-720-6413

40.0 Dr. Klaus Jaeger
Lockheed Missiles & Space Co.
Bldg. 195A, D/48-75
P.O. Box 3504
Sunnyvale, CA 94088-3504
(408) 756-0289

50.0 James Ingram, Jr.
Lockheed Missiles & Space Co.
Bldg. 195A, O/48-72
P.O. Box 3504
Sunnyvale, CA 94088-3504
(408) 756-0276

60.0 Chester J. Crane
Teledyne Microelectronics
12964 Panama St., MS-15
Los Angeles, CA 90066
(213) 822-8229, Ext. 2449

70.0 Val Gersbach
John Fluke Mfg. Co., Inc.
P.O. Box C9090
Everett, WA 98206
(206) 356-5473

6.0 PAST PRESIDENT*

Gary Davidson
TRW Space & Defense
One Space Park, S-2767
Redondo Beach, CA 90278
(213) 812-1388

7.0 SECRETARY*

William F. (Bill) Doyle
U.S. Instrument Rentals
1830 W. Airfield Dr.
DFW Airport, TX 75261
(214) 456-4125

8.0 TREASURER*

Roland Vavken
Rockwell International, D120 031-DG14
3370 Miraloma Ave.
Anaheim, CA 92803
(714) 762-3560

9.0 NIST REPRESENTATIVE TO THE BOARD

Joe D. Simmons
National Bureau of Standards
B 362 Physics Bldg.
Gaithersburg, MD 20899
(301) 975-2005

10.0 NSCL BUSINESS MANAGER

L. Kenneth Armstrong
NCSL Secretariat
1800 30th St., Suite 305B
Boulder, CO 80301
(303) 440-3339

80.0 – 89.0 DIRECTORS

81.0 Ralph Bertermann (Regions 1 & 11)
G. D. Searle & Co.
4901 Searle Pkwy.
Skokie, IL 60077
(312) 982-7611

82.0 L.D. (Dave) Duff (Regions 2 & 5)
Eli Lilly & Co., MC263, 32/W
303 McCarty Street
Indianapolis, IN 46285
(317) 276-2973

83.0 William Brenant (Regions 3 & 4)
Loral Electronics Corp.
1440 Story Ave.
Bronx, NY 10473
(212) 378-2300 Ext. 376

84.0 Bob Willet (Regions 6 & 8)
Rockwell Int'l/NTSD, MS 405-110
P.O. Box 568842
Dallas, TX 75356-8842
(214) 996-7070 FAX 214-996-7062

85.0 David Goodhead (Regions 7 & 9)
Westcon, Inc.
5101 N. Interstate Ave.
Portland, OR 97217
(503) 283-0132

89.0 INTERNATIONAL DIRECTOR

J. Graham Cameron
Dept. of National Defence
Quality Engineering Test. Estab., QETE 7
Ottawa, Ontario, CANADA K1A 0K2
(819) 997-3411

*Executive Committee Members

11.0 Government Affairs

John Lee
Telogy, Inc.
150 Shoreline Dr.
Redwood City, CA 94065
(415) 594-1700

20.0 VP Operations & Marketing Anthony Anderson

21.0 BUSINESS SYSTEMS

G. Tom McGovney
TRW Space & Defense S/2767
One Space Park
Redondo Beach, CA 90278
(213) 812-1389

22.0 PUBLICITY

Alan Herman
Cooper-Cameron Inc.
9 Village Square East
Clifton, NJ 07011
(201) 546-2262

23.0 NEWSLETTER

John Minck
Hewlett-Packard Co.
SPD 5U, Box 10151
Palo Alto, CA 94303-0889
(415) 857-2060 FAX 415-494-1379

24.0 ADMINISTRATIVE GUIDELINES & BY-LAWS

Dean A. Brungart
Teledyne Systems Company
19601 Nordhoff Street
Northridge, CA 91324
(818) 717-6872 FAX 818-717-6862

25.0 HONORS AND AWARDS

Jeff Taylor
Lockheed Georgia Co., Dept. 59-13, Z-262
86 S. Cobb Dr.
Marietta, GA 30063
(404) 424-2900

30.0 VP Calibrations Systems Mgmt Robert Smith

31.0 LABORATORY EVALUATION

Carl Quinn
Simco Electronics
382 Martin Ave.
Santa Clara, CA 95050
(408) 727-3788

32.0 LABORATORY FACILITIES

Ray Perham
Michelin Tire Corp., GX-MET/USO
P.O. Box 2846
Greenville, SC 29602
(803) 277-9300

33.0 CALIBRATIONS PROCEDURES

(TBA)

34.0 CALIBRATIONS SYSTEMS

Dennis Pinnacker
Rockwell Int'l
Dept. 120 O31-HCO2
3370 Miraloma Ave.
Anaheim, CA 92803
(714) 762-4574

35.0 CALIBRATIONS INTERVALS

Howard T. Castrup
Science Applications Int'l
1307 W. 6th
Corona, CA 91720
(714) 272-2503

40.0 VP Measurement Science & Technology — Dr. Klaus Jaeger

41.0 AUTOMATIC TEST & CALIBRATION

Ken Landis
Hughes Aircraft Co.
TC 18/A 108
3301 W. Malvern
Fullerton, CA 92634
(714) 732-3094

42.0 MEASUREMENT ASSURANCE PROGRAMS

Arno Ehman, M/S H-02-C
Beckman Instruments Inc.
2500 Harbor Blvd.
Fullerton, CA 92634
(714) 773-8475

43.0 NATIONAL MEAS. REQUIREMENTS

Laurie H. Baker
Rockwell International
AES Metrology HC02
3370 Miraloma Avenue
Anaheim, CA 92803
(714) 762-7864

44.0 INTRINSIC & DERIVED STANDARDS

Dr. Klaus Jaeger (Acting)
Lockheed Missiles & Space Co.
Bldg. 195A, D/48-72
P.O. Box 3504
Sunnyvale, CA 94088-3504
(408) 756-0289

50.0 VP Industrial Programs James Ingram

51.0 BIOMEDICAL & PHARMACEUTICAL METROLOGY

Douglas Smith, Dept. 736-M4
Abbott Laboratories
1400 Sheridan Rd.
N. Chicago, IL 60064
(312) 937-4929

COMMITTEE CHAIRMEN (cont'd)

53.0 EQUIPMENT MANAGEMENT FORUM

C. A. (Charlie) Sides
Boeing Aerospace Co.
P.O. Box 3999, M/S 86-03
Seattle, WA 98124
(206) 773-9944

54.0 UTILITIES

Raymond D. DiSandro
Philadelphia Electric Co.
P.O. Box 650
Valley Forge, PA 19482-0650
(215) 971-7225

60.0 VP Education & Training
Chester Crane

61.0 TRAINING AIDS

(TBA)

62.0 TRAINING INFORMATION & DIRECTORY

Dave Lorenzen
McDonnell-Douglas Corp.
5301 Bolsa Ave.
Huntington Beach, CA 92647
(714) 896-4574

64.0 EDUCATION LIAISON

Kate Webster
Cortez III
5111 W. 164th St.
Brookpark, OH 44142
(216) 362-0040

65.0 GLOSSARY

Stan Crandon
2957 Quadada
Newport Beach, CA 92660
(714) 721-8753

66.0 METROLOGY COMPENDIUM

(TBD)

REGIONAL COORDINATORS

81.1 REGION 1

Harry Haymes
Sanders Associates
95 Canal St., NCA1-0137
Nashua, NH 03061-2004
(603) 885-4913

81.2 REGION 11

John Buck
Unisys Corp.
P.O. Box 64525, MS/S1M16
St. Paul, MN 55164-0525
(612) 696-4419

81.2.1 TWIN CITIES SECTION, Region 11

Georgia Harris
Minnesota Dept. of Public Service
2277 Highway 36
Roseville, MN 55113
(612) 341-7200

81.2.2 CHICAGO SECTION, Region 11

Arthur Vogt
IIT Research Institute
10 West 35th Street
Chicago, IL 60616
(312) 567-4499

81.2.3 ST. LOUIS SECTION, Region 11

Jim Perkins
Precision Calibration Laboratory
11789 Lackland Rd.
St. Louis, MO 63146
(314) 997-1981

82.1 REGION 2

William Brenant (Acting)
Loral Electronics Corp.
1440 Story Ave.
Bronx, NY 10473
(212) 378-2300 Ext. 376

82.2 REGION 5

Amos (Max) Green
Technology Applications, Inc.
5100 Springfield Pike, Suite 500
Dayton, OH 45431
(513) 256-6633

82.2.1 SO. OHIO/KENTUCKY SECTION, Region 5

Mike Barnes
I & C Sales
38 Triangle Park Dr.
Cincinnati, OH 45246
(513) 772-3101

82.2.2 INDIANA SECTION, Region 5

Steve Stahley
Datron Instruments
5808 Churchman Bypass
Indianapolis, IN 46203
(317) 782-4601

82.2.3 NORTHERN OHIO, Region 5

Anne Zucker
BP America
Research Center, E320C
4440 Warrensville Center Rd.
Cleveland, OH 44128-2837
(216) 581-5324

82.2.4 MICHIGAN SECTION, Region 5

Tom Lowler
I & C Sales
14056 Fort St.
Southgate, MI 48195
(313) 283-6599

83.1 REGION 3

Marlin Johnson
Johns Hopkins Applied Physics Lab.
Johns Hopkins Rd.
Laurel, MD 20707
(301) 953-5000 Ext. 8021

83.2 REGION 4

P.W. (Woody) Tramel
EG&G Florida, Inc./BOC 003
Kennedy Space Center, FL 32899
(407) 867-3619

83.2.1 ATLANTA SECTION — Region 4

J. Samuel Tolbert
Scientific Atlanta, Inc.
Calibration & Repair, MS/ATL. 33C
4357 Park Dr., Suite E
Norcross, GA 30093
(404) 925-5545

83.2.2 CENTRAL FLORIDA SECTION — Region 4

John Riley
NASA
SI-PEI-1B
Kennedy Space Center, FL 32899
(305) 867-4737

84.1 REGION 6

Bob Willett (Acting)
Rockwell Int'l/NTSD, MS 405-110
P.O. Box 568842
Dallas, TX 75356-8842
(214) 996-7070 FAX 214-996-7062

84.1.1 CENTRAL SECTION, Region 6

Clyde Orrison
Texas Instruments, Inc.
P.O. Box 655474, MD 264
Dallas, TX 75266
(214) 995-5031

84.1.2 SOUTH SECTION, Region 6

Bob Trevino
Texas Instruments, Inc.
P.O. Box 2909, MS 2221
Austin, TX 78769-2909
(512) 250-7423

84.2 REGION 8

Rolf B. F. Schumacher
Rockwell Int'l/Autonetics
Dept. 120 031-HC02
3370 Miraloma Ave.
Anaheim, CA 92803
(714) 762-0265

84.2.1 LA/VALLEY SECTION, Region 8

Brian F. Conroy
Teledyne Systems Co.
M/S 33
19601 Nordhoff Street
Northridge, CA 91324
(818) 886-2211 Ext. 2523 FAX 818-717-6862

84.2.2 LA/ORANGE CO. SECTION, Region 8

Ken Landis
Hughes Aircraft Co.
TC 18/A 108
P.O. Box 3310
Fullerton, CA 92634
(714) 732-3094

84.2.3 SAN DIEGO SECTION, Region 8

Randall Seefeldt
U.S. Navy Primary Standards Lab
North Island, MS/Code 06D, Bldg. 378
San Diego, CA 92135-5112
(619) 437-6414

84.2.4 PHOENIX-TUCSON SECTION, Region 8

Lee J. Walters
Motorola G.E.G./MS. H1179
8201 E. McDowell Rd.
Scottsdale, AZ 85257
(602) 949-3613

85.1 REGION 7

Bard Dunkleberger
ESL, Inc. MS/303
495 Java Dr.
Sunnyvale, CA 94088-3510
(408) 738-2888 x5207

85.2 REGION 9

Roger L. Fisher
Boeing Aerospace Co.
P.O. Box 3999, MS2P-30
Seattle, WA 98124
(206) 544-5382

89.0 INT'L DIRECTOR REGION 10

J. Graham Cameron
Dept. of National Defence
Quality Engineering Test Estab., QETE 7
Ottawa, Ontario, K1A 0K2 Canada
(819) 997-3411

89.1 CANADA REGION

Duane Brown
Measurements Int'l Ltd.
P.O. Box 2359
Prescott, Ontario, K1E 1T0 Canada
(613) 925-5934

NCSL BOARD OF DIRECTORS
1989

***PRESIDENT**
DELBERT CALDWELL
NAVY MEC
(714) 736-4456

NCSL SECRETARIAT
L. KENNETH ARMSTRONG
NCSL — BOULDER
(303) 440-3339

NBS REPRESENTATIVE
JOE SIMMONS
NBS — GAITHERSBURG
(301) 975-2095

***EXECUTIVE COMMITTEE**

***SECRETARY**
WM. F. (BILL) DOYLE
U.S. INSTRUMENT RENTALS
(214) 278-6147

***EXECUTIVE VICE-PRESIDENT**
BILL SIMMONS
SVERDRUP TECHNOLOGY, INC.
(602) 688-3191

***PAST PRESIDENT**
GARY DAVIDSON
TRW DSG
(213) 812-1388

***TREASURER**
ROLAND VAVKEN
ROCKWELL INTERNATIONAL
(714) 762-3560

V.P.
OPERATIONS & MARKETING
ANTHONY ANDERSON
GUILDLINE INST. INC.
(305) 423-8215

V.P.
CALIBRATION SYS. MGMT.
ROBERT SMITH
FORD AEROSPACE CORP.
(714) 720-4820

V.P.
MEAS. SCIENCE & TECH.
DR. KLAUS JAEGER
LOCKHEED MIS. & SPACE
(408) 756-0289

V.P.
INDUSTRIAL PROGRAMS
JAMES INGRAM
LOCKHEED MIS. & SPACE
(408) 756-0276

V.P.
EDUCATION & TRAINING
CHESTER CRANE
TELEDYNE MICRODELECS.
(213) 822-8229 Ext. 2449

V.P.
CONFERENCE MANAGEMENT
VAL GERSBACH
JOHN FLUKE MFG. CO.
(206) 356-5473

DIRECTORS

J. GRAHAM CAMERON
DEPT. OF NAT'L DEFENCE
(819) 997-3411

WILLIAM BRENANT
LORAL ELECTRONICS
(212) 378-2300 x376

RALPH BERTERMANN
G.D. SEARLE & CO.
(312) 982-7611

ROBERT WILLET
ROCKWELL INTERNATIONAL
(214) 996-7070

DAVID GOODHEAD
WESTCON INC.
(503) 283-0132

L.D. (DAVE) DUFF
ELI LILLY & CO.
(317) 261-2973

NCSL REGIONS

NOTE:
ALASKA — REGION 9
HAWAII — REGION 8
PUERTO RICO — REGION 4

DIRECTOR
REGIONAL COORDINATOR
SECTION COORDINATORS

REGION 11
RALPH BERTERMANN
JOHN BUCK
(612) 696-4419
GEORGIA HARRIS (TWIN CITIES)
(612) 341-7200
AUTHUR VOGT (CHICAGO)
(312) 567-4499
JIM PERKINS (ST. LOUIS)
(314) 997-1981

REGION 5
L.D. (DAVE) DUFF
AMOS (MAX) GREEN
(513) 256-6633
ANNE ZUCKER (NO. OHIO)
(216) 581-5959
STEVE STAHLEY (IND.)
(317) 782-4601
TOM LOWLER (MICHIGAN)
(313) 283-6955
MIKE BARNES (SO. OHIO/KY)
(513) 772-3101

REGION 9
DAVID GOODHEAD
ROGER L. FISHER
(206) 544-5382

REGION 1
RALPH BERTERMANN
HARRY HAYMES
(603) 885-4913

REGION 2
L.D. (DAVE) DUFF
WILLIAM BRENANT
(212) 378-2300 x376

REGION 3
WILLIAM BRENANT
MARLIN JOHNSON
(301) 953-5000 x8021

REGION 7
DAVID GOODHEAD
BARD DUNKLEBERGER
(408) 738-2888
X5207

REGION 4
WILLIAM BRENANT
P.W. (WOODY) TRAMEL
(305) 867-2419
JOHN RILEY (CENTRAL FLORIDA)
(305) 867-4737
J. SAM TOLBERT (ATLANTA)
(404) 925-5545

REGION 8
ROBERT WILLET
ROLF SCHUMACHER
(714) 762-0265
DEAN A. BRUNGART (LA/VALLEY)
(818) 717-6872
KEN LANDIS (LA/ORANGE CO.)
(714) 732-3094
RANDALL SEEFELDT (SAN DIEGO)
(619) 437-6414
LEE WALTERS (PHOENIX/TUCSON)
(602) 949-3613

REGION 6
ROBERT WILLET
BOB WILLETT
(214) 996-7070
CLYDE ORRISON (CENTRAL)
(214) 995-5031
BOB TREVINO (SOUTH)
(512) 250-7423

REGION 10
INTERNATIONAL REGION
DIRECTOR
GRAHAM CAMERON
(819) 997-3411
DUANE BROWN (CANADA)
(613) 925-5934