The Usual Hectic Start

The first quarter of our fiscal year is always the most hectic, and this year was no exception. Your Board of Directors, Officers and Committee people have been actively pursuing your interests and lining up the year's events.

An example of the Organization's activities this quarter are as follows:

The Equipment Management Forum was conducted on February 19th and 20th at McDonnell Douglas Helicopter Company's new facility in Mesa, Arizona. There were 77 attendees representing 45 different organizations. The majority of these attendees do not presently have a centralized equipment management operation, and their attendance at these Forums is to seek support, justification and guidance for implementing an equipment management function. This committee is chaired by Charlie Sides and will have its next meeting on October 8th and 9th.

On February 25th and 26th, an ad-hoc committee which included Dean Brungart, Stan Crandon, Carl Quinn, Joel Treshansky, Bob Weber and myself, under the leadership of John Lee, our Government Affairs Committee Chairman, met in California to put the final touches on our response to the proposed revision of MIL-STD 45662. Our July Newsletter will include our recommendations to the Government.

On March 3rd, NCSL provided testimony before the Subcommittee on Science, Research and Technology of the U.S. House of Representatives. This testimony is an annual authorization hearing on the 1988 fiscal year budget for the National Bureau of Standards and was presented by John Lee. A word of thanks to Pete England, George Rice and the others who were directly involved in putting our words on paper.

On the 17th of March, I will be testifying before the U.S. Senate Subcommittee on Science, Technology and Space. This testimony will be similar to that which was presented to the U.S. House of Representatives earlier in the month.

On March 18th the NCSL Executive Committee, which will include Gary Davidson, Pete England, John Lee and myself, will meet with Dr. Ernest Ambler, the Director of the National Bureau of Standards in Gaithersburg. Discussions will include our concerns regarding the measurement and calibrations services offered by the Bureau, as well as our continuing relationship.

Our 1987 Conference Committee people have been directing their energies towards making this year's Conference even bigger and better than ever. At present, we have commitments from 47 companies to exhibit their products and commitments from 70 people to give papers. Denver in July is magnificent, and I look forward to seeing you all there.

Ed Nemeroff
President
EDITOR'S MESSAGE

Questionnaire

In the last issue I asked for your ratings for various departments of the Newsletter, to give us some idea of the relative usefulness of news. So far the questionnaire response has been underwhelming. I have about 10 and hope there will be more. I'll be summarizing those and will give you a report in the July issue. Please mail in your preferences.

NCSL Annual Conference

We're getting pretty fancy this issue with a rear-cover "gatefold" which spells out all the wonderful things that will happen for you if you come to the July Annual Conference in Denver. Aside from the great weather and scenery, the company and sessions are unbeatable, and for you newcomers, you'll be amazed at how friendly and helpful NCSL people are. In fact, it is just this willingness to share problems and solutions that makes our organization really work.

Type style

Anyone can see we're using a different typestyle since the October issue. All comments have been positive. Being on the other side of 55, I still have a bit of trouble with the smallness (so-called 9-point type). So in this issue, I printed the NBS News section with 10-point size. How do you like that compared with the rest? Don't keep me & my typesetter in suspense. Let us know.

(This Editor's message is also 10-point)
HIGHLIGHTS OF THE NCSL BOARD MEETING

GEOE AUTRY HOTEL
PALM SPRINGS, CA
JAN. 26-28, 1987

SECRETARY'S REPORT – Chet Crane
Chet Crane submitted a written report.

TREASURER'S REPORT – Gary Davidson
Gary Davidson submitted a written Treasurer's Report.

All the 30 new PR tapes will be of the VHS format. Reproduction of the tapes from the master will come from the Marketing budget. One of the PR tapes will be put into a loop so that it can be played unattended and continuous at a conference or exhibit.

Gary presented a resolution to the Board of Directors supporting the signature change at the bank.

NBS REPRESENTATIVES REPORT – George Uriano
George presented a written report which highlighted the following items:

A. NBS improves phase angle device described in report.
B. Revised federal standard for COBOL.
C. Automatic measurements of FM signal generators.
D. Special Measurement service for S band noise sources.
E. NBS/HP join in radiation instrument calibration.
F. New NBS facility to improve flow calibration.
G. President signs NBS Authorization Bill into law.
H. President signs continuing Appropriations Act into law.
I. United Kingdom and NBS sign Agreement.
J. Voltage unit to change value January 1, 1990.

Ed Nemeroff noted that a meeting had been arranged with Dr. Ambler, NBS, for March 19, 1987. This meeting would be attended by Ed, Pete England, and Gary Davidson. There are several topics for discussion however the Board was asked for their inputs.

BUSINESS MANAGER'S REPORT – Ken Armstrong
The name of Secretariat's Report has been changed to the Business Manager's Report.

Ken reported that for the 1987 election he had sent out 736 ballots which resulted in a return of only 231 or 31% of the voting members. In reviewing the voting history over the last four years, Ken noted that there has been a decline in responses since 1984 when 45% of the membership had cast ballots.

During the last quarter, 33 new companies had joined NCSL.

GOVERNMENT AFFAIRS COMMITTEE – John Lee
John informed the Board that copies of the proposed revision to MIL-STD-45662 had been mailed to the entire membership. All responses should be directed to the Laboratory Evaluation Committee Chairman Carl Quinn. It has been requested that NCSL respond to DOD as a group.

John further noted that a major element of the revision is reference to "Data Item Descriptions." This should be studied in connection with Paragraph 5.6 of the MIL-STD.

BUSINESS SYSTEM COMMITTEE REPORT – R. Vavken
NCSL Laboratory Directory – Roland reported that the printing templates had been received from the printer, but had to be modified. He stated that we now have an adequate supply of good templates. With the laser printer we were able to print more data per page thereby reducing the page count from 90 to about 60 pages.

Business System Upkeep – Pending approval of the BOD, Roland reported that he has made arrangements with David Cotton to continue maintaining the system integrity for the Secretariat. He will charge $25.00 per hour to maintain the system including updates, assistance in operating the system, as well as preparing custom reports as requested. A contract for 1987 should be worked and agreed upon to insure proper coverage.

MEETINGS AND PROGRAMS COMMITTEE REPORT – M. Corrigan
Moe presented a report listing a tentative meeting schedule and general topics for discussion.
BOARD MEETING

VICE PRESIDENT OF MARKETING REPORT - B. Simmons

Bill attached a survey sheet to his report entitled, Regional Program Development Survey.

NEWSLETTER - John Minck

Bill noted that once again John Minck returned as Editor of the Newsletter.

MEMBERSHIP COMMITTEE - Bill Simmons

Bill announced that John Curtan had accepted the position of Membership Chairman.

Bill reported that there were 776 members on the book as of January 1987. Of these, 496 or 63.9% had paid their 1987 dues.

PUBLICITY COMMITTEE REPORT - Al Herman

Bill reported that Al Herman would once again serve as Publicity Chairman.

An action item was given to Al Herman to write an article on NCSL, its mission and goals, and publish the article in selected publications.

Ed Nemeroff, Tony Anderson, and Al will formulate a means of measuring the results of the publicity upon the membership's growth.

HONORS AND AWARDS COMMITTEE - Jeff Taylor

Jeff pointed out that the new NCSL Banner was on display at the meeting and that he had received 12 podium banners.

VICE PRESIDENT OF LAB MANAGEMENT REPORT - Del Caldwell

Del reported on a meeting held 12/4/86 as requested by the Board to identify issues associated with Laboratory Accreditation and evaluation. The report has been sent to the Newsletter for publishing.

MEASUREMENT ASSURANCE COMMITTEE - Arno Ehman

Arno reported that the Region 8 Group 1 Voltage MAP will have to be repeated due to the failure of the NBS transport standard to properly recover from the trip.

He also reported that the California Gage Block MAP, a group of eleven labs, will start another MAP as soon as two new sets of blocks are made ready.

George Uriano noted that NBS had canceled the Gage Block Measurement Assurance Program.

Rolf Schumacher noted that people are looking for MAPS to participate in but nothing is being done to provide them. Ralph Berghman said that a Recommended Practice is needed in measurement capabilities on "how to do", without the need to go to NBS.

NATIONAL MEASUREMENT REQUIREMENT COMMITTEE - Klaus Jaeger

Klaus reported that a continuous input is required by the NMRC. He has therefore suggested that a standard survey form be included in each printing of the Newsletter.

As proposed at the last Board Meeting a new survey of standards available was undertaken. There were no responses. Klaus considers this of major importance to the U.S. members. As part of his report, Klaus enclosed a copy of the proposed survey form. It was suggested that the data could be put into an informational directory to aid others in finding and using equipment needed to make the measurements of their choice.

LABORATORY EVALUATION COMMITTEE REPORT - Carl Quinn

Carl is planning to hold a Lab Eval Committee Meeting on Monday, July 13, 1987, at 4:00 PM in Denver.

CALIBRATION INTERVAL COMMITTEE REPORT - Howard Castrup

Howard has announced the start of three tasks to be performed by his committee. These are:

A. Compile a comprehensive calibration interval analysis resource library.
B. Define calibration interval analysis requirements for supporting new technology test equipment and prime systems.
C. Update the current NCSL Calibration Interval Recommended Practice (RP#1).

EQUIPMENT MANAGEMENT FORUM COMMITTEE - Charles Sides

Charles' Committee has been focusing their attention on preparations for the EMF Meeting at Mesa, Arizona scheduled for February 19-20, 1987 (See Committee News).

VICE PRESIDENT OF INDUSTRIAL TECHNOLOGY - Joe Simmons

BIOMEDICAL & PHARMACEUTICAL METROLOGY COMMITTEE - D. Smith

Doug is beginning to investigate the possibility of establishing a measurement assurance program for vacuum measurements.
AUTOMATIC TEST & CALIBRATION SYSTEMS COMMITTEE - K. Carrington

The committee received and processed two orders for the distribution of calibration programs through Bob Smith’s Tape Exchange Program.

The Committee has declined sponsorship of a workshop on Automatic Calibration for the 1987 Conference. They suggest that papers would be a more suitable vehicle for communicating progress in this field.

PRODUCT DESIGN & SPECIFICATION COMMITTEE - James Hartley

James reported that the main activity of this committee was the update of the Recommended Practice for the Preparation of Calibration Verification Procedures. This RP was submitted to the Board in draft form for approval.

An Ad-hoc Committee is engaged on the final integration, assembly, typing and proofing of the re-write of RP#3. The project has been delayed because of the availability of time. It is hoped that the job will be completed during February.

UTILITIES COMMITTEE - Ray Disandro

Draft “B” of the Utilities Glossary is underway.

Mil-STD-45662 is being reviewed as to the extent by which it can be applied to Utility Requirements.

A 1-1/2 hour time slot has been allocated to the Utility Committee at the 1987 Conference. The Committee plans on having three representatives on the panel.

1987 BUDGET - Gary Davidson

A motion was made, seconded and passed to accept the 1987 NCSL BUDGET as amended. Vote: 15 Approved, 0 Disapproved (see last page of BOD Report).

At this time, Dean Brungart presented a plaque from the Measurement Science Conference to President Ed Nemeroff, commemorating NCSL 25th Anniversary.

VICE PRESIDENT OF EDUCATION - J. Martin

ADJUNCT TRAINING COMMITTEE REPORT - R. Drews

John Martin is still looking for a chairman for the Adjunct Training Committee. Dick Drews has agreed to continue in that capacity until said chairman can be found.

DIRECTOR/COORDINATOR REPORTS

REGION 1 - Drews/Haymes

Harry Haymes is planning to have a meeting in April and sometime in the fall of 1987.

REGION 2 - Drews/Brenant

Region 2 is also planning to have two meetings this year. As in Region 1, they are scheduled for April and the fall of 1987.

REGION 3 - Anderson/Adams

Region 3 thought that they may like to sectionalize their region because of the problem of traveling great distances.

REGION 4 - Anderson/Roberts

Sectionalization is also a subject in this part of the country. Most of the meetings are held in the southern part of the state. This tends to leave out members in Georgia and northern Florida. Tony Anderson said that the matter required more investigation.

Region 4 is forming a MAP.

REGION 5 - Bertermann/Duff

This region has had three meetings, each being well attended. They are planning to hold six more meetings this year.

REGION 6 - Crane/Willett

Bob reported that the Dallas/Ft. Worth meeting was a great success with 51 people in attendance. They have had 2 visitors from NBS the last quarter. The Houston Section has a small base at present but shows great promise for the future.

Bob noted that in his region they are having trouble convincing the Utility Companies of the benefits of NCSL membership. It was suggested that members of the Utility group should get into contact with those in Bob's area and exchange views on the matter. He further reports that he is having the same problem with the Hospital/Medical groups.

Bob feels that there should be more exchange on the topics discussed at meetings. This exchange should be between the coordinators.

REGION 8 - Ingram/Chong

Jim reported that Region 7's new Coordinator was Paul Chong. He held a meeting during the first week in December...
Board Meeting

with about 40 in attendance. An excellent agenda was one reason for the turnout of participants.

REGION 8 – Crane/Schumacher

Rolf reported that meeting were held 10/29/86, Phoenix/Tucson Section; 11/5/86, Los Angeles Section; and 12/3/86, San Diego Section; with 41, 61, and 23 in attendance, respectively. A result of the Los Angeles meeting was the formation of an ad-hoc committee called Region 8 Calibration Contractor Evaluation Committee.

REGION 9

Region Nine reported that they too were scattered over a large area with concentration of members in three general locations. Their membership was diversified.

INTERNATIONAL REGION – Graham Cameron

Ninety persons attended the 6th Annual Canadian Section Meeting held November 26 & 27, 1987 in Ottawa.

GENERAL REGION DISCUSSION

A. Del Caldwell suggested the leader of MAP's in the various Regions should automatically become members of Arno Ehman’s Measurement Assurance Committee.

B. Gary Davidson again commented on the fact the NCSL Calendar as published in the Newsletter failed to indicate the dates and places for any of the Regional meetings that were to be held this year. This indicated that either the dates were not being furnished, were not being submitted for publication, or were not being picked up for publishing. He remarked that the meetings should be set six months in advance.

LIAISON DELEGATES REPORTS


MEASUREMENT SCIENCE CONFERENCE – Dean Brungart – The MSC this year had a registration greater than $30. They attribute this in part to the advertising campaign that was carried out.

OIML – George Uriano – The main activity has been the formation of a task force on uncertainty. The object is to draw up guidelines for statements of uncertainties in measurements.

CPEM – Moe Corrigan – Activities of the Conference of Precision Electromagnetic Measurements has been limited to obtaining speakers and promoting attendees for CPEM 88, to be held in Japan.

ISA – Mike Suraci – ISA Mid-America Conference will be held in Chicago at O’Hare in March.

IECQ – This liaison has been terminated.

NVLAP/AALA – The liaison duties of the delegate has been divided into two separate delegations. NVLAP will have Carl Quinn as it’s delegate while AALA will have Pete Ungar as delegate, if he accepts.

CORM – Bill Simmons – The 1987 CORI Conference and Annual Meeting will be held at the National Bureau of Standards, Gaithersburg, MD on May 28-29, 1987. Problems and successes for high accuracy radiation measurements will be the topic in the two half-day sessions.

An action item was given to Bill Simmons to supply the address and phone number of the CORM president to Ed Nemeroff.

AIA – Bob Willett – The main AIA-QAC WSC#1 Committee concerns have been with the proposed changes to Amendment (1) of both MIL-S-7742B and MIL-S-8879A by Johnson Gage Company. Another point which came up was that relating to the calibration of employee’s personal tools as controlled by MIL STDS.

PMA – Glenn Rasmussen – PMA has accepted NCSL’s invitation to display the PMA booth at the 1987 NCSL Conference in Denver, Colorado. Glenn also reports that a feasibility study is being made to determine whether it is practical to create a new PMA section in Colorado Springs, Colorado.

1987 EXHIBIT CHAIRMAN’S REPORT – Dean Brungart reports that he expects a gross income from the exhibits of $48,300 with a net of $35,600 realized. He further reports that there will be 33 Booths and 11 Tables of exhibits at the 1987 NCSL Conference.

1987 CONFERENCE REPORT – Bob Weber

Bob presented the plans for the conference speakers, sessions, workshops and meals. He also spoke of the International Dinner scheduled for Monday Night.

The conference is basically divided into three session grouping; (1) Equipment Management which seems to attract a lot of interest; (2) Intrinsic Standards; and (3) a variety of sessions on physical standards, cal intervals, etc.

An action item was given to Al Herman to provide an insert on the Conference for the April Newsletter.
### 1987 NCSL Budget

<table>
<thead>
<tr>
<th>Description</th>
<th>1986 Estimated</th>
<th>1987 Budget</th>
<th>1987 Estimated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publications</td>
<td>$3114.99</td>
<td>$3,500.00</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>Adm Guidelines &amp; By Laws</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>Newsletter</td>
<td>$29,739.46</td>
<td>$25,000.00</td>
<td>$25,000.00</td>
</tr>
<tr>
<td>Membership</td>
<td>$0.00</td>
<td>$500.00</td>
<td>$100.00</td>
</tr>
<tr>
<td>Honors &amp; Awards</td>
<td>$3,717.99</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Cal Lab Management</td>
<td>$0.00</td>
<td>$150.00</td>
<td>$75.00</td>
</tr>
<tr>
<td>Measurement Assurance</td>
<td>$0.00</td>
<td>$7,000.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Measurement Requirements</td>
<td>$0.00</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Laboratory Evaluation</td>
<td>$0.00</td>
<td>$300.00</td>
<td>$75.00</td>
</tr>
<tr>
<td>Calibration Intervals</td>
<td>$0.00</td>
<td>$150.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>Equip management Forum</td>
<td>$815.00</td>
<td>$1,700.00</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>Training Information</td>
<td>$2,823.00</td>
<td>$1,500.00</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>Publicity</td>
<td>$14,696.25</td>
<td>$6,000.00</td>
<td>$6,000.00</td>
</tr>
<tr>
<td>25th Anniversary</td>
<td>$22,255.03</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total Committee</strong></td>
<td><strong>$57,143.61</strong></td>
<td><strong>$53,400.00</strong></td>
<td><strong>$43,050.00</strong></td>
</tr>
</tbody>
</table>
### OPERATIONS ACCOUNTS

<table>
<thead>
<tr>
<th>Category</th>
<th>1985</th>
<th>1986</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presidents' Expenses</td>
<td>$5,623.42</td>
<td>$6,500.00</td>
<td>$6,000.00</td>
</tr>
<tr>
<td>Meeting Expenses</td>
<td>$3,312.43</td>
<td>$3,700.00</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>CPEM Support</td>
<td>$1,000.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Legal Fees</td>
<td>$972.26</td>
<td>$3,000.00</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Wildhack award (1986)</td>
<td>$1,000.00</td>
<td>$15,000.00</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>Secretary's expenses</td>
<td>$20.06</td>
<td>$120.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>Treasurer's Expenses</td>
<td>$1,251.16</td>
<td>$2,500.00</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Secretariat Expenses</td>
<td>$5,092.01</td>
<td>$7,000.00</td>
<td>$6,000.00</td>
</tr>
<tr>
<td>Comptr Supplies/Hardware</td>
<td>$500.00</td>
<td>$5,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Computer Programing</td>
<td>$4,500.00</td>
<td>$2,500.00</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Telephone</td>
<td>$800.00</td>
<td>$6,000.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Postage</td>
<td>$1,300.00</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Office Supplies</td>
<td>$1,078.27</td>
<td>$1,000.00</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Personnel &amp; RFE</td>
<td>$11,000.00</td>
<td>$40,000.00</td>
<td>$40,000.00</td>
</tr>
<tr>
<td>Office Space</td>
<td>$3,100.00</td>
<td>$6,500.00</td>
<td>$6,300.00</td>
</tr>
<tr>
<td>Travel</td>
<td>$1,077.97</td>
<td>$4,000.00</td>
<td>$3,800.00</td>
</tr>
<tr>
<td>Furniture &amp; Equipment</td>
<td>$4,213.84</td>
<td>$500.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>$300.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 1 Meeting Support</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 2 Meeting Support</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 3 Meeting Support</td>
<td>$126.00</td>
<td>$100.00</td>
<td>$100.00</td>
</tr>
<tr>
<td>Region 4 Meeting Support</td>
<td>($144.61)</td>
<td>$125.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 5 Meeting Support</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 11 Meeting Support</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$100.00</td>
</tr>
<tr>
<td>Region 6 Meeting Support</td>
<td>$0.00</td>
<td>$125.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 8 Meeting Support</td>
<td>($351.25)</td>
<td>$450.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 7 Meeting Support</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Region 9 Meeting Support</td>
<td>$0.00</td>
<td>$100.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>International Region Supp.</td>
<td>($199.67)</td>
<td>$400.00</td>
<td>$300.00</td>
</tr>
</tbody>
</table>

**TOTAL OPERATION** $45,720.89 $112,120.00 $105,150.00

**SUB TOTAL** $102,864.50 $165,520.00 $148,200.00

### SELF SUSTAINING ACCOUNTS

<table>
<thead>
<tr>
<th>Category</th>
<th>1985</th>
<th>1986</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Aid Deposits</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>1985 Conference</td>
<td>($295.00)</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>1986 Conference</td>
<td>$25,000.00</td>
<td>($18,000.00)</td>
<td>($18,000.00)</td>
</tr>
<tr>
<td>1987 Conference</td>
<td>($3,318.91)</td>
<td>$20,000.00</td>
<td>$20,000.00</td>
</tr>
<tr>
<td>1988 Conference</td>
<td>$0.00</td>
<td>($3,000.00)</td>
<td>($3,000.00)</td>
</tr>
</tbody>
</table>

**TOTAL SELF SUSTAINING** $21,368.09 ($21,386.09 ($13,000.00)

**SUB TOTAL** ($81,478.41) ($178,520.00) ($161,200.00)

### INCOME ACCOUNTS

<table>
<thead>
<tr>
<th>Category</th>
<th>1985</th>
<th>1986</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dues</td>
<td>$76,776.80</td>
<td>$100,000.00</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Interest</td>
<td>$8,000.00</td>
<td>$7,500.00</td>
<td>$7,500.00</td>
</tr>
<tr>
<td>Sales - Publications</td>
<td>$1,417.37</td>
<td>$1,500.00</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>Newsletter Subscriptions</td>
<td>$410.00</td>
<td>$450.00</td>
<td>$450.00</td>
</tr>
<tr>
<td>Sales - Items</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**TOTAL INCOME** $86,604.17 $109,450.00 $109,450.00

**INCREASE/DECREASE IN FUND** $5,125.76 ($69,070.00) ($51,750.00)
The NCSL Newsletter needs a few good contributing editors.

* Thrill to see your name in genuine print.
* Help your presently - overworked and unpaid editor (me).
* Release your creative self.
* Capture a place for your name on the Masthead.

Here's the situation. At the last Board of Director's meeting, we discussed the Newsletter's strategy and operation. Being a totally volunteer and part-time operation, the Newsletter lacks some of the detail and class that might be available with a full-time editor. It goes without saying that no one in their right mind would volunteer for this job. (I never claimed to be in my right mind, and those who know me will attest to that).

So, as an alternative and partial solution, we decided to try to recruit several people to take charge of small sections of the Newsletter. For example, one person has already volunteered to take charge of the Regional Reports Section, to nag the Regional Coordinators for their minutes and pictures of meetings.

To help you consider this, perhaps these would be reasonable projects:

1. **Regional Reports**
   - Someone You Should Know
   - NCSL Laboratory Tours

2. **News from NBS** -- Most of this section now comes from the NBS Press Relations department, but it needs culling and some light editing.
   - NCSL Newsnotes

3. **Training Information**
   - NCSL Calendar
   - Committee News

So there you have it. I'll be happy to discuss your possible assignment and the duties as I see it. I will still continue to do all the type-setting here with final proof-reading and production as before. The job at hand is something anyone can do with the simple decision to help.

John Minck
Editor (415) 857-2080
WOODINGTON AWARD

One of the most enjoyable tasks of the Chairman of the Measurement Science conference is to present the Woodington Award for Professionalism in Metrology. This award, sponsored by the Measurement Science Conference is a memorial to Andrew J. Woodington, is the measurement community’s recognition for outstanding contributions by an individual who represents the highest level of professionalism and dedication in the field of metrology. The award carries an honorarium of $500 and an appropriately inscribed plaque.

Andy Woodington’s presence as a metrology professional had significant impact on all of us. Indeed, Andy clearly personified the expression “metrology professional”. The Woodington Award was conceived following Andy’s untimely death just days before the 1978 Measurement Science Conference.

This year’s Woodington Award recipient has distinguished himself as a true professional in the field of metrology in the tradition of Andy Woodington. Some of the outstanding personal characteristics of this year’s recipient are:

- His superior technical abilities and accomplishments;
- His hard driving work ethic and energetic professional involvement;
- His willingness to accept, recognize, and utilize the assistance of others in achieving measurement goals and requirements;
- His commitment to technical excellence;
- His vision and timely response to changing measurement requirements;
- and lastly, and perhaps most visible to his peers, his professional dedication and inspirational leadership.

For his exceptional qualities, it is the unanimous decision of this year’s Woodington Award Committee that the individual we now honor truly deserves to join the roll of previous distinguished recipients of this award. Therefore, I now ask that you all join me in expressing our congratulations and appreciation to the 1987 recipient of the Woodington Award — Dr. Klaus B. Jaeger.

At this time, I would like to present a brief overview of Dr. Jaeger’s professional career and highlight some of his contributions and accomplishments in the field of metrology.

Klaus was raised in Lubeck, West Germany, and immigrated to the United States in 1958. He received his undergraduate degree in Physics from Syracuse University, and later earned his M.S. and Ph.D. degrees in High Energy Physics from Syracuse as well.

For twelve years, Klaus was active in the field of experimental particle physics at the Argonne, Brookhaven, Fermi, and Stanford Accelerator Centers. One of his assignments was Project Manager for the twelve (12) foot superconductive magnet first assembled at Argonne and later redesigned and moved to Stanford. During this period, he wrote twenty-three (23) papers as well as numerous technical reports.

In 1982, Klaus left the world of High Energy Physics and joined Lockheed’s Metrology organization in Sunnyvale, California. He has advanced through a series of technical and management assignments to his current position as Manager of the Primary Standards Laboratory.

Dr. Jaeger is a member of the Instrument and Measurement and Elementary Particle Groups of the American Physical Society. He has been very active within the Measurement Science Conference, (MSC), National Conference of Standards Laboratories (NCSL), and IEEE organizations as a committee chairman for, and a contributor to, workshops and presentations.

He has served as Chairman of the Temperature and Pressure subcommittee of the National Measurement Requirements Committee (NMRC) organized by the NCSL. He currently holds the position of Chairman of NMRC. He has been appointed to the IEEE Awards Committee and is a member of the IEEE Electro-Optics Requirements Committee.

Although relatively new to the metrology field, Dr. Jaeger has gained the respect of the measurement community for his accomplishments and innovative approach to measurement problems.

Klaus, it is my privilege as Chairman of the Measurement Science Conference to present to you the 1987 Woodington Award. Again, congratulations!

Dean A. Brungart, Chairman
Dr. Dale L. Compton, Deputy Director – NASA Ames Research Center Presenting the Keynote address at the 1987 Measurement Science Conference.

MSC President, John Schulz (L) presenting the "Best Paper Award" to Martin Girard (R) of DH Instruments, Inc. for his paper on "Multiplying and Dividing Techniques to Improve Pressure Definition in the Extreme Ranges."

MSC's Chairman of the Board, Dean Brungart, presenting a plaque to NCSL President Ed Nemeroff (R) commemorating NCSL's 25th Anniversary.

MSC President, John Schulz, presenting an appreciation certificate to luncheon speaker, Mr. Peter Stein (L) for his talk "How to be a Ring Master in Tommorrow's Measurement Circus."

Featured luncheon speaker, Mr. Gilbert Hamblet, TRW, Vice President of Industry and Regulatory Affairs speaking on "Things I Shouldn't Do".

Door Prize Co-Chairman, Ken Morrison of Northrop Corporation, (R) conducting door prize drawings at MSC. Co-Chairman, Bob Couture of Rockwell International and his wife Joan are assisting.
CALL FOR PARTICIPATION

2nd Symposium of the IMEKO Technical Committee of Metrology TC 8 on:

METROLOGICAL ASSURANCE
FOR ENVIRONMENTAL CONTROL

FIRST ANNOUNCEMENT AND CALL FOR PARTICIPANTS AND PAPERS

Helsinki University of Technology
Otaniemi, Espoo, Finland
August 18-20, 1987

Background

The activities of IMEKO Technical Committee TC 8 (Metrology) are directed to organizing symposia, colloquia and training courses on timely topics of scientific metrology. TC 8 provides an international forum for the exchange of opinions and information among specialists in the various fields of metrology.

The first symposium on "Metrological Assurance of Measurements for Environmental Control" was organized in Leningrad, USSR in 1981. TC 8 has also organized symposia on theoretical metrology and one international training course on ensuring measurement accuracy.

The Symposium will focus on the present state of the art in environmental metrology, i.e. the reliability and traceability of environmental measurements. The following areas:

* air quality measurements
* water quality measurements
* soil quality measurements.

Within each of these areas, special emphasis will be given to:

* traceability and calibration of environmental measuring instruments
* modeling and data analysis
* micro and macroenvironmental measurements
* new methods of measurement and new equipment

Correspondence

All correspondence related to the Symposium should be addressed to:

IMEKO TC 8 Symposium
The Finnish Society of Automatic Control
P.O. Box 165
SF-00101 Helsinki
Finland

Phone: Int. 358 0 7015657

IEEE INSTRUMENTATION AND MEASUREMENT TECHNOLOGY CONFERENCE

The "Changing Face of I & M Technologies"

April 27-29, 1987
Sheraton-Boston Hotel
Boston, Massachusetts

Sponsored by: IEEE Instrumentation and Measurement Society, IEEE Boston Section

Welcome to Boston and IMTC/87

As it celebrates its twenty-fifth anniversary the Boston Chapter of the Instrumentation and Measurement Society and the IEEE Boston Section are pleased to welcome you to the fourth annual Instrumentation and Measurement Technology Conference, IMTC/87. We are happy to be joined by the Test Measurement Division of the Instrument Society of America, the Precision Measurements Association and the Conference on Precision Electromagnetic Measurements as Participating Societies. We welcome ISA, PMA and CPEM members who may be attending.

The principal objective of IMTC is to provide an internationally recognized forum for dissemination and exchanging information concerning the science and application of instrumentation and measurement. In 1987, during these three days, seventy-eight selected papers, both theoretical and practical, are to be presented at sixteen sessions. A wide range of subject matter is to be covered: from antennas, automated instruments and automatic testing to software, standards and waveforms.

In keeping with the practical nature of instrumentation and measurement, exhibits are being provided to demonstrate living, working evidence of our theme, "The Changing Face of I & M Technologies." The conference, exhibits and all functions will take place at the Sheraton Boston Hotel.
Because our schedule is fairly tight, arrangements are being made for the hotel to serve lunch each day. This service and the Awards Banquet are included in the registration fee.

Daniel Sheingold
IMTC/87 General Chairman

**DALFI, INC. FLOW MEASUREMENT TRAINING COURSES**

**Introduction**

Liquid and Gas Flowmeters are used in a wide variety of applications. These flowmeters must be selected carefully and maintained properly to provide the desired performance. In addition, they must be calibrated periodically to assure their continued accuracy. These courses will provide solutions to these Flow Measurement problems.

All commonly used types of flowmeters will be discussed. Each will be compared in terms of accuracy, limitations, maintenance and repairs. Typical applications will be reviewed. Potential errors will be analyzed. Installation requirements and troubleshooting will be described and methods of calibration will be explained.

1987 Course Schedule
Gas Flow Measurement
20-24 July, Fort Collins, Colorado

Liquid Flow Measurement
26-30 October, San Diego, California

Who Should Attend

These Flow Measurement Training Courses will benefit Managers, Engineers, Designers, Technicians, and Quality Control personnel who are involved with specifying, calibrating or using flowmeters. Numerous flow measurement applications are found in Metrology Laboratories, Field Calibration, Overhaul Facilities, Repair Shops, Shipboard Maintenance, Utility Management and others.

**Tuition**

The Tuition for each five-day training course is $845 per person. This includes all course materials, a comprehensive Flow Measurement Handbook and refreshments during the class hours. It does not include meals or hotels.

**For Further Information**

If you would like more information, please contact:

A.C. Catland
DALFI, Inc.
10085 Carroll Canyon Road
San Diego, California 92131 - 1107
(619) 578-9500

---

**DALFI, INC. MEASUREMENT UNCERTAINTY TRAINING COURSES**

**Introduction**

Measurements are vital to our everyday lives. Our quality of life, health, safety, environment and economy are all influenced in some way by measurements. The accuracy of these measurements may often be an important consideration. To be valid, the accuracy must be traceable to legal or generally recognized standards.

This course will provide instruction in the nature of errors and the methods used to determine the uncertainty of a system or process. Programs for measurement assurance will be discussed as well as methods that can be used to control the quality of a measurement.

Students will work practice problems that are directly related to real measurement and calibration application.

1987 Course Schedule:
Measurement Uncertainty
6-10 April San Diego, California
12-16 October Orlando, Florida

Who Should Attend

This training course will benefit Managers, Engineers, Designers, Technicians and Quality Control personnel who are involved in making measurements, determining system performance, calibrating instruments and evaluating system uncertainty and traceability.

**Tuition**

The Tuition for each five-day training course is $845 per person. This includes all course materials, a comprehensive notebook and refreshments during the class hours. It does not include meals or hotels.

**For Further Information**

If you would like more information, please contact:

A.C. Catland
DALFI, Inc.
10085 Carroll Canyon Road
San Diego, California 92131 - 1107
(619) 578-9500
MEASUREMENT UNCERTAINTY – MEASUREMENT ASSURANCE TRAINING COURSE OFFERED

A five-day, thirty-five-hour course given by Rolf B. F. Schumacher in the systematic assessment, control, and determination of the magnitude of the elements of measurement uncertainties as well as the overall uncertainties of measurements and calibrations, with special emphasis on the control of measurements and calibrations as repeatable processes.

The course will also show how a program to assure the systematic determination and control of measurement uncertainties (an internal measurement assurance program) can become an integral part of an organization's total quality program.

Who Should Attend

The course is intended for engineers, supervisors, and senior technicians, including quality control professionals, of laboratory and production activities where measurements are of paramount importance, including calibration and measurement standards laboratories. Not more than a working knowledge of algebra is required as the more advanced mathematics have been translated into simpler techniques.

Subjects Covered

- Origin, nature, and classification of measurement errors
- Variability of natural phenomena
- Probability, combinations, and permutations
- Distributions of data
- Mean, variance, standard deviation
- Small samples and Student's t distribution
- Measurement assurance
- Trend Charts and the control of reference standards
- Controlling measurement and calibration processes with control charts
- Risks and decision criteria, levels of significance, and confidence levels
- Deciding whether a process differs from another; F-tests
- Deciding whether a standard or measurement differs from another; t-tests and z-tests
- Residual systematic errors
- Understanding the changing nature of systematic and random errors
- Propagation of errors
- Measurement assurance in the context of a total quality system

OPTIONAL TOPICS


Instructor

Rolf B. F. Schumacher, P. E., MS in EE, Senior Metrologist at Rockwell International with over 25 years experience in standards and calibration laboratories, author of many articles and papers on measurement uncertainties, calibration control systems, and quality control. Senior Member IEEE and PMA. Was awarded the grade of Fellow of the American Society for Quality Control (ASQC) for his work in measurement uncertainty determinations, calibration control systems, and quality control. Chairman of the ASQC Writing Group for Quality Standards for Calibration Systems and the Quality Control of Measurements. Member advisory group on international standards on measurement uncertainties, member Eta Kappa Nu and Tau Beta Pi.

Classes

Open enrollment classes are scheduled to begin the second half of 1987 on the West Coast and on the East Coast. Watch this space for additional details. Classes are also available to organizations for their personnel on premises of their choice.

Tuition

Open enrollment classes: $750 per person

Organization classes: $7,500 for up to 15 persons; additional $200 for each person in excess of 15 up to a total of 30 attendees.

For More Information:

Contact COAST Quality/Metrology Systems, Inc., 35 Vista del Pont, San Clemente, CA 92672, (714) 492-6321
BUTLER COUNTY COMMUNITY COLLEGE

Butler County Community College will have 23 students available for Summer Internships beginning May 26, 1987. Some of the students have already been placed in positions at the Sandia National Laboratory. All students will be available for permanent positions in August 1987. The final course of the program is a Work/Research Internship in which the student completes a project in the metrology field.

A brief biography of each member of the class is provided below. Interested firms should contact Dr. Donald A. Drum at (412) 287-8711 or (412) 285-8004 for further information.

The metrology faculty recently updated and refined the curriculum. Applied Calculus is required as an important part of the metrology program. New additions to the metrology courses include process control, modeling, and material science. Recent equipment donations and purchases include automatic optical pyrometers, infrared spectrophotometer, and electrical calibration instrumentation and accessories.

The College is in the process of developing a standards laboratory for temperature and electrical metrology, optics, and dimensional metrology. The laboratory will be used for both metrology student education and training seminars for employees of industry and government agencies. Thus far, a one-week dimensional metrology seminar was offered for the Department of Defense. Additional seminars scheduled during April and May include Productivity and Quality Control (May 19-20), Gage Block Precision Measurements, and Fluke Instrumentation Calibration (May 4-9 and May 11-16).

As of August 1986, Dr. Donald Drum was hired as Chairman of the Technology Division at Butler County Community College. The Metrology Department has recently hired two additional professors to teach AC/DC circuitry, Electronics Calibration, and Dimensional Metrology. They are David Schiebel, RIT graduate in electronics and industry consultant, and Dr. Denny Michalopoulos, an engineer and University Professor. Dr. Michalopoulos has twenty years of industrial experience in design, electromechanical measurements, and manufacturing, and twelve years experience as University Professor with emphasis in design, measurements, and tribology.

Left: I would like to obtain a position in electrical calibrations at any location in the Eastern United States. Prefer employment in a standards laboratory where I could apply calibration knowledge and skills to perform the measurement requirements of my employer. I am a member of the Instrument Society of America. Plan to attend night school to continue my education towards an advanced degree.

Right: I would like a metrology position working in electronics/digital or chemistry. I am looking forward to applying the qualifications learned in my formal schooling in an actual work environment. I have no geographic preference for a job location.

Left: An entry level metrology position with emphasis on electrical calibration/dimensional is desired. Anxious to apply the knowledge and skills acquired in my academic program. Looking forward to working with more experienced personnel to enhance competencies in my chosen career. Employment in the eastern part of the United States is preferred.

Right: I plan on pursuing a career in the chemistry area of metrology with an emphasis in research and development or...
The skills and knowledge I have obtained in metrology will allow me to apply equipment operation techniques in the sales field, and skills necessary for research and development. I am looking forward to working with experienced personnel in the chemistry area of metrology. I will relocate anywhere in the eastern United States.

James Hixon

James Breski

Left: The skills and knowledge obtained in the areas of electronics, physics, optics, analytical chemistry, and quality control have given me a wide foundation to qualify for an entry level position in metrology. I feel confident in each of these areas and will accept a position in any one of them. Membership in the Precision Measurement Association, Instrument Society of America, and Metrology Club have enabled me to develop skills in communication and the ability to work with others. My current GPA in Metrology is 3.50. I am open to employment anywhere in the U.S. My plans are to continue formal education by attending night school.

Right: I would like to acquire a position in electrical metrology. I feel confident that I can competently fulfill the entry level requirements of this position. My GPA is 4.0. The metrology preparation I acquired at BCCC is supplemented by military training in electronics and nuclear power. A position in the eastern or southeastern United States is desired. I plan to continue my formal education by attending night school.

Steve Goettler - Age 24

John D. Anderson

Left: I have been fortunate to obtain a full-time job, beginning June 29, 1987. I will be employed by Sandia National Laboratories as a Technical Aide in the Electronic Support and Calibration Department. My present GPA is 3.75. I have enjoyed very much my studies in Metrology and plan to continue my education in the area of Electrical Measurements and Electronics.

Right: I am looking forward to a challenging and rewarding career in electrical metrology, preferably doing research and development. I am confident that the knowledge I have gained, and the skills I have acquired will allow me to adjust readily to any entry level position in measurement science. Among personal traits that I have developed to enhance work quality are timeliness in fulfilling assignments and challenging my classwork, especially lab requirements, in a creative manner to test if desired results can be achieved. Will be available for employment in August 1987 following the completion of a summer practicum.

Ronald S. Zulick

James A. Yauger

Age 21

Age 21

Left: My immediate interest is to attain a challenging position in electronic metrology. I am a competent worker who is accomplishment-oriented and a team player. I respond readily to challenges and am usually successful in coming up with the required tasks to arrive at a desired solution. My interest in electronics has created a personal motivation to excel in this area of metrology. The achievements experienced in completing my academic program have given me a sense of competency to carry out entry level assignments in my chosen area. I am open to a job prospective in any location within the continental United States. Available for employment in August, 1987 following completion of a summer practicum. My plans are to continue my formal education while employed.

Right: I am anxious to pursue a career in electrical, dimensional, or chemical metrology, preferably in research and development. Have maintained a GPA of 4.0 in Metrology while working to finance education. Have excellent qualifications, both personal and professional. Motivated toward challenging my abilities and creativity to achieve new goals. Therefore, I welcome educational and work-related advancements. Preferable geographical location is on the mid-eastern coast.
Left: My interests include chemistry, research and development, and laboratory work. My course work has also provided a knowledge of AC/DC, electronics, optics, microprocessors, and digital circuitry. After completion of my studies in May, I will be anxious to begin my summer practicum to fulfill the requirements of the course, and to obtain full-time employment. Another year and half of college will allow me to earn a B.S. Degree in English and I would enjoy applying writing skills in my career. I am active in the Metrology Club and am also a member of the Instrument Society of America, National Honor Society, Who's Who Among American High School Students, and Phi Theta Kappa. I am willing to relocate, preferably to a more moderate or warm climate.

Right: I would like a challenging position in the metrology field which will allow me to apply the skills and knowledge acquired in my studies at ECC. My academic experiences have resulted in a sense of confidence to perform any entry level position in quality control, calibration and research. I have maintained a 3.0 grade point average in my metrology classes. Open to employment opportunity anywhere in the United States. I plan to continue my education by attending college at night.

Left: In May, after working night shift as a machinist for 4 1/2 years, I will be graduating with Associate Degrees in both Metrology and Electronics Technology. My overall GPA for both degrees is a 3.0, and I would like to apply my work experience and education in either electrical or dimensional metrology. Continued education in night school toward a B.S. degree in electronics is planned. Although I am willing to relocate, a Pennsylvania, Ohio, or Midwestern location is desired.

Right: I am open to employment in chemistry, electronics, optics, or quality control. I feel confident I can adequately complete measurement assignments in any of these areas of metrology. Membership in Student Senate (treasurer), Instrument Society of America (treasurer), Student Affairs Committee, and Metrology Club (treasurer), have provided the opportunity for me to develop leadership skills and to communicate effectively in a variety of circumstances. I have no preference of geographic location, and am willing to travel or relocate. I also plan to continue my education by enrolling in evening college.

Left: I am in the final academic semester of my Metrology studies at Butler County Community College. This experience has taught me many different measurement systems and the application of different techniques of representation to these systems. I am particularly interested in the challenge of figuring out new, state-of-the-art equipment and understanding the basic principles in which they operate. Relocation is welcomed anywhere in the United States.

Right: I am interested in any job in the field of metrology, especially those incorporating several aspects of this field. Any information you can provide that will aid me in obtaining either a full-time job or temporary job by which I can complete an internship will be greatly appreciated. I am also available to move or travel.
Left: The metrology program has given me a well-rounded education in the sciences. The experience I have had in completing the curriculum has made it possible to make better decisions and do precise work in instrumentation and all facets of measurements. I plan to use my education working with a team to develop new processes and or quality assurance of present processes. Employment opportunities at any location in the continental United States will be considered.

Right: I am presently seeking a position in the field of metrology. My interests include optical, chemical, electrical, and mechanical measurement, although I feel confident to fulfill any entry position in metrology. As a previous student senate officer and an active member of many clubs and organizations, my reliability, ambition and ability to work with others has been greatly enhanced. I plan to continue my education toward a more advanced degree. A position in the northeastern United States would be preferred.

Left: The metrology program has supplied me with knowledge in the area of specified measurement. The electrical part of measurement is where my interests are. I am looking for an exciting entry level position with a company that manufactures and services calibration instruments. I look forward to personal growth from my job experience. With this gained experience, I would like to eventually be assigned to servicing the company's products.

Right: I am seeking a challenging career in research and development with an emphasis on optics, fluids, and thermodynamics. Anxious to apply and further develop skills learned in my formal education while working with more experienced personnel. Have an intuitive personality, work well with others, and enjoy learning. Strong belief that metrology will play a major role in enabling our country to better compete in the world marketplace. Plan to pursue further education while attending night school. Although I am willing to relocate, a location in the eastern half of the United States is preferred.

Left: I am currently completing my final semester of academic studies in metrology at BCCC. I am seeking the opportunity of an internship which is the final requirement of my program. I feel confident to successfully complete this objective while contributing to the goals of the company accepting me for the internship. A practicum position anywhere in North America in North America is acceptable.

Right: (No Message)
Please accept the enclosed short biographies and pictures of this year's graduating Metrology students from the Hutchinson Area Vocational Technical Institute. We hope you will, once again, publish these in the NCETL Newsletter. These students will be available for employment starting in May, 1987.

This year's class is a most unique class. Most of the graduates are Veterans with a variety of skills from past training. These students are excited about graduation and anxious to start applying their skills in the field.

We wish to thank you for your time and consideration in this matter. Please feel free to call us anytime about any questions you may have. To quote last year's article, "Let's see if we can put every single graduate to work".

Sincerely,

Timothy Stark, Joe Rook, Cheryl Rook, Duane Schermann, Larry Galjen
(612) 587-3636

Upon graduation from HAVT's Metrology Technology course, I would like to obtain a position as a Metrology technician or in the quality control area. Prior Air Force PMEL technician with experience in calibration and repair of military test equipment. Held secret clearance. Willing to relocate.

Cheryl Rook

Seeking employment as a Metrology Technician upon graduation from Hutchinson Metrology program. Prior Air Force PMEL technician with experience in troubleshooting, repair and calibration of military test equipment. Held secret clearance. Planning to pursue a degree in electronics engineering through night courses. Willing to relocate.

Duane Schermann

Upon graduation from the Hutchinson Metrology program in May, 1987, I will be seeking a position as a Metrology Technician. Major areas of study are in the calibration and
Metrology Talent

repair of DC low Frequency Instruments. Former military electronics technician with experience in calibration and repair of military equipment.

Tim Stark

Will graduate in May, 1987 from Hutchinson Metrology Program. Would like a position in the field of Metrology as a technician in the calibration or standards laboratory. Major area of training is in DC Low Frequency. Prior military experience in technical writing, program management and course development (Military Intelligence Branch). Held Top Secret clearance.

Larry Gafkjen

Upon completion of the Hutchinson Metrology course this spring, I am seeking an entry level position as a Metrology Technician. I have been training in DC Low Frequency and I am also interested in Physical Dimensional Metrology. I am willing to relocate anywhere in the U.S. although I would prefer the Sunbelt. Prior industrial experience.
UTILIZING BAR CODE TECHNOLOGY IN EQUIPMENT MANAGEMENT

by

G. TOM MCGOVNEY
EQUIPMENT MANAGEMENT CENTER (EMC)
TRW, OPERATIONS AND SUPPORT GROUP

The Equipment Management Center (EMC) is responsible for the calibration and maintenance of all the General Purpose Test Equipment (GPTE) and much of the Special Purpose Test Equipment (SPTE) at TRW. The Equipment Control Department (ECD) within EMC owns the GPTE and is responsible for the deployment, tracking and recall of this equipment. In addition, ECD is responsible for the tracking and recall of customer owned SPTE, and once a year ECD performs a complete wall to wall inventory of all items in our recall system. With all of these functions being recorded in our EQUATES (Equipment Quality Utilization Analysis Traceability Evaluation System) database, TRW has found that the use of bar code technology can and is a viable method of increasing speed and reducing the errors when inputting data to EQUATES.

When ECD first considered using bar code technology for inventory control we made a study of bar code technology and came up with the following observations. There are a large variety of bar codes in use, some of the more popular types are:

POPULAR BAR CODE TYPES

- Code 39 (Code 3 of 9)
- MSI Plessey
- UPC (Universal Product Code)
- CODABAR
- Two of Five
- Two of Five Interleaved
- EAN (European Article Number)
- AS-6
- AS-10

ECD decided on Code 39 due to its versatility and because one of our largest customers, the U.S. Government, had decided to go with Code 39 (MIL STD 1189 and MIL STD 129H requires Code 39). Code 39 is designed so each character has 9 elements, five bars and four spaces (Illustration 1). Three and only three elements of the 9 element character are wide, hence, the name Code 3 of 9 (Code 39). Programming the reading device to recognize only bar codes with three out of nine elements wide will check for a correct reading, thus this code is self checking. Other attributes of Code 39 is it can be any length up to a maximum of 32 characters. The character set of Code 39 has 43 characters which includes 10 numeric, 26 alpha, and 7 special characters listed below.

CODE 39 SPECIAL CHARACTERS

- Space
- $
- /
- +
- %

Each complete code comprises of a start code (*), the data field, and a stop code and allows for bi-directional scanning.

After TRW selected the method of bar coding, we next determined the type of label density and method of reading the bar code label. Since our label would be placed on the front panel of electronic test equipment, which usually has limited space due to the many knobs and switches, we decided on the high density label of 9.4 characters per inch. Also, due to the life expectancy of our test equipment plus possible hazardous environmental conditions these bar code labels had to be of high quality with excellent adhesion characteristics. To acquire labels of this quality we decided on purchasing our labels from a reputable printing company that had a lot of experience printing bar code labels. Finally, a method of reading our label had to be decided on. The two methods available were to "wand" the label with a contact wand or to scan the label with a laser gun. TRW opted for the laser gun because they are much easier to use and considerably faster. The scanning is done electronically (forty scans a second and bi-directional) as opposed to wanding where the operator must physically do the scanning which requires a definite technique. Due to the nature of the location of many of our labels, physical contact required for a wand is impractical; however, a laser gun can read a label up to six inches away and at any angle, even upside down.

Illustration 2 shows the two methods ECD uses in collecting data using bar code technology. The on-line or interactive method is used in our pools. The bar code transactions that are generated in the pools are: issue, receive, and send-to-met (metrology) transaction. This is when the pool issues or receives test equipment from our internal (TRW) customer or sends equipment to the EMC calibration laboratory for
Bar Code

Prior to using bar code technology these transactions were keyboard inputted (Illustration 3). With the advent of bar code technology at ECD, we now have the ability to input some of this data using the scanner directly to our mainframe database (Illustration 4). Actually, the laser gun and controller are in parallel with the keyboard which allow for either type of input and the mainframe can not tell the difference.

The remote method of collecting data uses a hand held portable computer with a laser gun attached. This configuration is used for two types of input transactions: inventory and received-in-metrology. The inventory is performed in the field (Illustration 5&6) while the received in "met" is done in our incoming area (Illustration 7). In both cases the collected information is uploaded to the IBM PC where the data is further processed before being electronically transferred to the mainframe. Once the data resides in our mainframe it will update our main inventory data base EQUATES in a batch mode (off-line).

The size of ECS's operation and the extent we use bar code input is best shown in Figure 1. The 10,000 items that are not presently bar coded are those items whose physical design or surrounding environment preclude using bar coded labels. Figure 2 illustrates the break down by type; however, it's difficult to determine the extent of bar code usage in the online mode because the computer cannot determine the difference between keyed or bar coded input. However, we estimate approximately 60,000 bar codes inputted annually between the three types of on-line transactions.

EMC has other areas where we think the application of bar code technology will be an asset. ECD plans on bar coding our spare parts stockroom to help in issuing and in inventorying approximately 8,000 unique parts. Also, we have plans in using remote terminals that will allow ECD to issue test equipment out on the floor. These issue transactions would then be brought back to the pool for upload to our mainframe in a similar manner as our other remote computer input.

During this entire operation EMC did run into a pitfall that should be mentioned here. When ECD first acquired the remote terminal we had the supplier generate the portable computer's internal program to our requirements. This worked fine until we wanted to change the software for new requirements (special inventory etc.). The problem was that the turn-around time from the supplier was too long for our needs. To correct this problem ECD bought the software license. We now do our own programming and can alter or create a program for special requirements within days or hours instead of months.

In summary, ECD has been using bar code technology for three years. We are pleased with our results, in fact we will expand our usage in this area. Besides the obvious ease and increased speed for operators, management considers one of the biggest assets of using bar code technology is the reduction in data collection errors. Prior to using bar codes, our data collection errors were running about 5%. These errors were caused by keypunch, mis-reads, transposing numbers, etc., creating a substantial labor effort to correct. When using bar code technology our data collection errors have been reduced to zero. In three years of using bar codes our inventory people think they might have read one label incorrectly but they are not sure. The vendor from whom we bought our hardware says the error ratio is about one in 20,000,000 reads.

**EMC's Bar Code Related Statistics**

- EMC Controls 70,000 pieces of test equipment
- 60,000 items are bar coded
- EMC records 200,000 moves each year
- One-half of all moves are recorded using some type of bar code input

*Figure 1*

**EMC's Bar Code Input**

- Remote terminal input (batch)
  - On the floor inventory
    * 85,000 transaction annually
  - Bar Code Input 99%
- Receive into metrology
  - 70,000 transactions annually
  - Bar code input 80%

- On-line input (real time)
  - Received into pool
  - Issue to user
  - Send to metrology

*Figure 2*

**Illustration 1**

![Bar Code 39 Characteristics](image)
Illustration 2

Illustration 3

Illustration 4

Illustration 5

Illustration 6

Illustration 7
OMEONE YOU SHOULD KNOW

ED NEMEROFF

Ed Nemeroff, President of the National Conference of Standards Laboratories and President of Datron Instruments, Inc., has been in calibration and precision instruments field for over 27 years. Born in New York City in 1937, Ed gave up good New York hot pastrami sandwiches to join the United States Navy in 1954. He served in the U.S. Sixth Fleet with the rank of First Class Petty Officer in the field of electronics engineering. Following an honorable discharge, he went off to attend the University of Bridgeport in Bridgeport, Connecticut.

In the early 1960's Ed began his career with the Sensitive Research Instrument Corporation, where he worked in their calibration and test laboratory. During the next few years, Ed designed and tested DC-LF calibration instrumentation. In the early 60's, Sensitive Research Instrument Corporation was acquired by the Singer Company. Singer formed their metrics division and their acquisition included other small electronic companies. During this period, Ed spent his time in Research and Development, primarily in the area of DC low frequency calibration instrumentation. It was during his mid years at Singer that he switched from engineering to sales. By 1964, Ed had become a Regional Sales Manager for the Singer Company.

In the latter part of 1964, Ed and few of his associates resigned from Singer and formed Hallmark Standards Incorporated. Hallmark was a manufacturer of electrical measuring instruments in standards and was the national representative for Guildline Instruments. In 1969, when Ed left Hallmark, where he had been Director of Marketing and a member of the Board of Directors, he joined Guildline Instruments. Ed had responsibility for setting up the complete U.S. operation for Guildline. Guildline, of course, is a manufacturer of ultra-high precision DC and low frequency calibrators and standards. Ed spent the next 15 years of his career with Guildline, where he established an international reputation for the Company and himself. He resigned from Guildline in 1984, at which point he was Vice President and General Manager for the Company.

In 1984, he and his family relocated to Florida, where Ed became the President and Chief Operating Officer of Datron Instruments, Inc. Today, Datron is one of the world's leaders in precision digital multimeters and calibrators.

Ed's professional activities over the years have included his affiliation with the National Conference of Standards Laboratories, since 1974, where he became the member delegate for Guildline Instruments. During the years that followed, Ed served the National Conference of Standards Laboratories as a Regional Coordinator, Director, Vice President of Marketing, Vice President of Education Executive Vice President, and now, President.

In addition to his NCSL activities, Ed has been active in the Precision Measurements Association, where he has held section and national offices, the Measurement Science Conference, the IEEE and ISA. Over the years, Ed has authored over 100 technical papers in the field of precision measurements.

On the personal side, aside from being known as our "Fearless Leader" in NCSL, he is also nicknamed with other titles, such as "World's Greatest Dad"...Ed has two boys, Adam and Eric, ages 12 and 15, who are both involved in martial arts, surfing and fishing; "World's Greatest Golfer" (strictly his opinion) with a handicap of 12; and "Dog's Best Friend" - he has a pooch named Snowball (Siberian Husky, living in Florida?). The woman of his life is Cherie, who keeps most of his life in order.

Ed enjoys both golf and snow skiing, which keeps him busy during his spare time when he's not traveling around the world, or at the helm of Datron Instruments, Inc. or the National Conference of Standards Laboratories.

- 24 -
LABORATORY EVALUATION COMMITTEE REPORT

An ad-hoc meeting on standards laboratory evaluation and accreditation was held on Dec. 4, 1987 in Pomona at the SAIC facility. A News Letter report on the meeting was submitted expressing recommended policies, suggesting near term actions and noting a need for NCSL to host a meeting among NBS, DOD, AALAA and ASTM to review and improve collaboration on standardization activities affecting standards and calibration laboratories.

The draft MIL STD 45662A dated Dec. 15, 1986 was mailed to NCSL members with John Lee's cover letter of January 5, 1987. I received a copy on January 15, 1987. To date I have received (3) responses which does not make enough of a consensus to report on.

It is apparent the NCSL membership will not have sufficient time to review the document. John has indicated the Government wishes an NCSL response by Feb. 15, 1987. John would like the board to consider how the NCSL response should be presented.

I would suggest that the ARMY be advised of the NCSL timing and request that the NCSL survey be allowed to run its course. I estimate we will still be getting important feedback at the end of February.

I am planning to hold a Lab Eval Committee meeting Monday July 13 at 4:00 p.m. in Denver. Hotel meeting room will be announced at the Workshop.

The following topics relating to laboratory evaluation or accreditation may be on the agenda.

| Quality Program for Calibration/Standards |
| Procedures: |
| Quality Assurance and Control Procedures, Laboratory Operations Procedures, Calibration Procedures |
| Specifying Laboratory capability: |
| Uncertainty statements, Lists of standards, Lists of parameter |
| Technician Qualification and Certification: |
| Qualification Training records, Qualification Training requirements |
| Instrument certification: |
| MIL STD 45662 data requirements |

* Recall intervals, Assignment, adjustment, reverse traceability tracking.

Sincerely yours,
Carl Quinn, Chairman.

PUBLICITY COMMITTEE REPORT

1. This first publicity report of 1987 is more of a request for action than a report on activities for the prior.

2. There has been, of course, publicity activity. The updated version of the NCSL brochure, done in conjunction with Tony Anderson, has been completed for 1987 and this committee has worked closely with Jeff Taylor in securing President's awards for 1986.

3. My concern continues to be under-utilization of the publicity function within NCSL and under-utilization of the facilities available to carry out a successful program.

4. Most of our hardworking and dedicated member delegates have little or no background in the areas loosely referred to as promotion. Accordingly, I would like to reiterate, for the purposes of edification, why I feel that we should pay more than lip service to the promotion of NCSL.

5. Visibility creates viability, viability tends to build credibility and credibility goes hand-in-hand with acceptance. Through repeated exposure we will build strength, establish our position within the test and measurement community (and beyond) and "grow" our organization. That is the true purpose of promotion.

6. Many of you might say, "Look how far we've come in the past 25 years with limited promotion, why knock ourselves out now?" I would counter with the question, "why look for more accurate measurement techniques when previous methodology and technology did the job adequately enough?" The answers to both questions are obvious.

We want to be...to do...to have...the best that we can.

7. All of us who are actively engaged in NCSL are proud of the organization and our pride is evidenced by tireless efforts. Many of our member delegates have stretched their supervisors' tolerance levels to the limits while performing for or providing volunteer services to NCSL. What I am suggesting is that we all channel some
Committee News

of this pride and interest into the direction of promoting the organization for which we work so tirelessly.

In other words, I am asking for help, support and cooperation.

8. Many projects have been undertaken in the past few years without the direct or sometimes even the indirect involvement of the publicity committee.

Perhaps your chairman was not visible enough...if that was the case, I intend to do everything in my power to change that in 1987. After all, I did say that with visibility comes viability, and that viability builds credibility and acceptance.

9. I would like to see several things occur in 1987:
   a. A closer tie with the publicity committee and other committees such as membership, awards, training, newsletter, meetings and programs, publications, and of course, region coordinators.
   b. An active effort on the part of all member delegates to "feed" information to the publicity committee so that news releases and/or articles could be developed for the press which would put NCSL in a continuing public view.
   c. A better utilization of the personal and business resources of your publicity chairman in furthering the goals of the organization. (Bearing in mind that promotion is the activity in which I am professionally engaged on a full-time basis.)

10. In 1987 I plan to contact several important editors of trade publications involved in test and measurement to alert them to the fact that we will be submitting, from time to time, articles or releases which are timely and newsworthy. I can not however fabricate these stories out of thin air. That is why I need the support of all of you to feed raw data in so that newsworthy stories can be created.

11. I have already received clearance for an article based on the need for better education in the field of metrology. This article will be based on input from our President and if accepted, will appear in Test and Measurement World Magazine.

12. I would like to see a "limited" program of actual advertising for NCSL in the proper publication. The cost for such an effort would approximate $3,000 net (gross rate less magazine commission and production cost). A classified ad would cost far less.

We could set up an awards program for existing member delegates who bring in or introduce new members to the organization.

There are numerous ways we can build membership, create awareness and enhance the prestige of our organization. This committee welcomes ideas along this line from the Directors and Committee Chairpeople and Coordinators.

13. The NCSL has something to say - accordingly we have something to "sell". The selling of NCSL is the responsibility of everyone who attends these meetings.

I am asking for cooperation and support as well as going on record, placing my resources on the line, to accommodate that "sell".

Allan Herman
Publicity Chairman

* * * * * * *

NATIONAL MEASUREMENT REQUIREMENTS COMMITTEE REPORT

The "final" version of the NMRC report was forwarded to Del Caldwell in December 1986 for approval. Once approved, the report will be forwarded for printing and distribution.

Some slight reorganization has occurred with the NMRC committees. A list of subcommittee chairmen follows:

Further input to the NMRC committees is required on a continued basis. For this reason, it has been requested that a standard survey form be included with each NCSL Newsletter. It is essential that some type of survey form be included in future issues if the NMRC committees are to stay active. Action by the board during the next meeting is requested.

Finally, it was proposed by me, and presented by Del during the last board meeting, to undertake a new survey of standards availability. Del requested comments to be forwarded to him, or to me. Not a single response has been received. I personally consider this to be a very critical issue in the U.S. and hope that the board acts on the request at the next meeting. It should be emphasized that no comparison of existing standards will be done; only units available to users will be listed in alphabetical order. However, we hope that the lack of standards, or anticipated future lack of standards, be illuminated. NCSL is an ideal forum for such an endeavor.

Klaus B. Jaeger
Chairman, NCSL

DC - Low Frequency
Chairman: Donald Dalton, John Fluke Mfg. Co.; Inc.
(619) 456-9084
Committee News

RF - Microwave
Chairman: Frank K. Koide, Koide International Consultants
(619) 456-9084

Electro - Optical
Chairman: Gary Mathers, Naval Weapons Station, Seal Beach
Detachment (Code: 3123)
(714) 736-4421

Temperature - Pressure
Chairman: Laurie Baker, Rockwell International, Electronics
Systems Division, Metrology HC02
(714) 762-3923

Physical - Dimensional
Chairman: Robert Tobias, TRW, One Space Park
(213) 535-2445

CALIBRATION INTERVAL COMMITTEE REPORT

As a result of the committee's first meeting in October of last
year and several discussions with you, three tasks have been
started:

Task 1: Compile a comprehensive calibration interval analysis
resource library.

Task 2: Define calibration interval analysis requirements for
supporting new technology test equipment and prime systems.

Task 3: Update the current NCSL calibration intervals
recommended practice (RP #1).

A Committee meeting was held, January 28, at the Irvine
Marriott Hotel to review progress to date and discuss future
activities.

Task 1 Status:

In an endeavor to extend the considerable work Don Greb
has accomplished in past years, John Larsen is drafting a letter
for distribution to member organizations asking documenta-
tion of a non-proprietary nature on calibration interval
analysis methods or related subjects. John will present his
draft to the committee at the January meeting.

Task 2 Status:

I have been putting together a strawman list of task elements
for defining traceability of measurement reliability require-
ments through the calibration and test hierarchy. These
elements will be submitted to the committee at the January
meeting for review and comment. I hope we can refine them
further and begin to get some ideas on going forward with the
work.

Task 3 Status:

I am having some difficulty obtaining RP #1. John Ferling
sent me a copy which seems to be lost in the mail. I had
originally intended to review the document and provide a
brief critique to stimulate discussion at the January meeting.
Perhaps a copy will become available in time to do this.

Meanwhile, both Rolf Schumacher and Don Greb have
provided extensive documentation on calibration interval
analysis systems they are familiar with. This information,
together with what I and other committee members have on
methodologies used by various organizations and what we
obtain as a result of Task 1, should enable the identification of
key interval analysis elements and possibly point the way to
establishing valid approaches and practices.

Howard T. Castrup, Chairman
Calibration Interval Committee

UTILITIES COMMITTEE REPORT

The Utilities Committee progress since last report is listed
herewith by Sub-Committee:

54.1 - Glossary Committee - Draft "A" of the Utilities
Glossary has been distributed to members of the committee.
Some comments have been received and we are in the process
of developing Draft "B".

54.2 - Requirements Committee - We are presently reviewing
the most recent draft of MIL-STD-45662 as to the extent by
which it can be applied to Utility Requirements.

54.3 - Workshop Committee - A 1-1/2 hour time slot has
been allotted to the Utilities Committee for presentations and
discussions at the 1987 Symposium. We intend to have
representatives of three Utility Calibration labs. Mark
Reardon of Southern California Edison is from a laboratory
which solely supports the nuclear power plant functions of the
utility. Bob Dayke of Public Service Gas and Electric is from
a lab which supports both the Fossil and Nuclear portions of
the utility and is also a commercial vendor; and Tom Short of
Bonneville Power is from a utility which has no nuclear power
involvement.

Ray DiSandro
Chairman, Utilities Committee

AUTOMATIC TEST AND CALIBRATION SYSTEMS
COMMITTEE REPORT

The only activity of the committee this quarter was
distribution of calibration programs through Bob Smith, Tape
Committee News

Exchange coordinator. Two orders were received and processed.

Suggestions for contributions the committee can make toward the objectives of the NCSL would be appreciated.

The committee declined sponsorship of a workshop on Automatic Calibration for the 1987 conference. It was felt papers are more suitable as a vehicle for communication of progress in this highly technical field.

K. Carrington
Chairman

RP #3 RE-WRITE AD-HOC COMMITTEE REPORT

The Ad-hoc Committee work on the re-write was completed per the last report about a year ago. The final integration, assembly, typing, and proofing has been suffering because of my lack of time. I will have copies at the January Board Meeting.

Bob Willett
Ad-hoc Chairman, RP #3 Rewrite Project

MEASUREMENT ASSURANCE COMMITTEE REPORT

1. Region 8 Group 1 volt MAP to be repeated:

The NBS transport standard did not recover properly from the return trip. The MAP will have to be repeated. Norm Belecki will bring another transport standard on his way to the Measurement Science Conference, and we are planning to hand-carry it back after readings are completed here. It appears that something has been going wrong in transport with increasing frequency, but the exact failure mode is not understood at this time.

2. New Gage Block MAP planned:

At a recent meeting, the California Gage Block MAP Group of eleven labs decided to get ready for another MAP as soon as two new sets of blocks could be readied.

Arno Ehman
Chairman

GOVERNMENT AFFAIRS COMMITTEE REPORT

Subject: Proposed Revision A to MIL-STD-45662

The government has just released a proposed revision to MIL-STD-45662, and applicable "Data Item Descriptions" (DIDs).

The proposed revisions were sent to all NCSL members.

There are some very significant changes in these documents and I would suggest you each study them in detail.

The attached documents are being furnished to the entire NCSL membership for information. The NCSL has been asked to review and comment on the proposed changes. It is requested that the industrial segment of the NCSL membership provide their comments to our Laboratory Evaluation Committee at the following address:

NCSL Laboratory Committee
Simco Electronics
382 Martin Avenue
Santa Clara, CA 95050

Attn: Carl Quinn

All responses will be gathered and furnished to the government in one NCSL document. They have specifically asked that we do this as a group.

The time for our response is very short. They have asked that they have our comments by February 15, 1987. Please get your comments to Carl Quinn as soon as possible.

If I can be of any assistance or if you have any questions, please contact me.

John J. Lee
Chairman, Government Affairs Committee

Editor's Note: This letter & changes may be too late for comments, but for information of our other readers.

MIL-STD 45662A DRAFT (DATED 14 NOV 86)
SUMMARY OF CHANGES

<table>
<thead>
<tr>
<th>Paragraph #</th>
<th>Change</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Reworded to clarify M &amp; TB covered.</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Adds other term sometimes used for reference standards.</td>
<td></td>
</tr>
<tr>
<td>3.4</td>
<td>Adds other terms sometimes used for transfer standards.</td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Adds calibration requirement for employee owned tools to first sentence.</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Adds new sub-paragraph &quot;a&quot;, which requires consideration of recent (last 12 months) Government audits in determining compliance with the basic requirements of the standard.</td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Adds sentence which excludes built-in &quot;standards&quot;.</td>
<td></td>
</tr>
<tr>
<td>5.4</td>
<td>Adds provisions for temporary extension of calibration due date.</td>
<td></td>
</tr>
<tr>
<td>5.6.2</td>
<td>Deletes the word &quot;significant&quot; adds requirement that</td>
<td></td>
</tr>
</tbody>
</table>
any out of tolerance conditions be reported.

5.7.1 Minor wording change in 4th sentence.
5.7.2 Adds sentence on where to obtain information on U.S. National Bureau of Standards and Foreign Countries Agreements.
5.8 Adds the word "applicable" in 1st sentence; adds requirement for identification of facility performing the calibration, and identification of the procedure used.
5.9 Provides definition for "date"; adds requirement for tamper-proof seals.

EQUIPMENT MANAGEMENT FORUM

"Let's Get Organized" Pre-meeting
February 18, 1987, Mesa, Arizona.

The meeting was opened with a review of the objectives as follows:

Resolve open issues regarding EMF (February 19-20).
Present the "EMF Steering Committee" concept.
Propose a committee structure.
Propose definitions of the committee positions, duties, and operating philosophy (i.e. see the 1987 Draft Administrative Guidelines).
Acquire a list of potential Standing Subcommittees.
Adopt a plan/schedule for Steering Committee implementation.
Accomplish baseline planning for the next (third) EMF.
Accomplish planning for next Steering Committee meeting.

Prior to the meeting, each of the attendees had received the following "Issues for Discussion" and was requested to come prepared to share their opinions and ideas on these issues.

Role and responsibility of the Steering Committee.
Serving the Forum attendees.
Serving the Equipment Management community.
Serving the NCSL.

Committee organizational structure.
Non-structured (loose and flexible).
Structured (hard-lined responsibilities).
Vice Chairman, Secretary, Treasurer, etc.
Geographical Region Coordinators (East, Central, West).

Equipment Management Subcommittees
The Directory.
Recommended Practices.
Manager's Handbook.
Glossary of Terms, Definitions, and Acronyms.
Technical Issues.
Standards for Automation.
Other Candidates.

Staging the Equipment Management Forums.
Financially self-sustaining.
Registration fee? How much?
Number of EMFs staged per year.
2 independent Forums.
1 independent Forum and 1 as part of NCSL Conference.
1 independent Forum.
Hosted on company facilities vs. hotel/motel facilities.
Evening dinner social.
No host or included in registration fee.
Duration of forums.
1, 1 1/2, 2 days.
Committee meetings/duration.
Pre-Forum vs. Post-Forum or both.
1/2 day or 1 day.
Committee meetings at NCSL Conference.
Preferred day(s) of the week/date(s)/location(s).


Equipment Management workshops.
Equipment Management papers.
Committee meeting at conference.
Degree of interplay between EMF and future NCSL annual conferences.

Next (third) EMF.
Location.
Date.
Host.
Presentations sought.
Workshops needed.
Steering Committee Schedule.
Publicity/Membership.

Items from the attendees.

Charlie Sides presented his "EMF Chairman’s Goals for 1987" as follows:

By 1987 year’s end, the EMF Steering Committee shall be:
Structured.
All positions and duties defined.
Fully staffed.
Operating to a released set of Administrative Guidelines.

This goal was followed by an implementation plan designed to support the stated goal. The plan was adopted by the attendees. A draft edition of an EMF Administrative Guidelines manual was provided to each attendee. This manual consists of a compilation of job descriptions, administrative guidelines, and other administrative procedures patterned after the existing NCSL Administrative Guidelines Manual, but modified as necessary for the EMF needs.
Committee News

The “consensus” vote on various issues will be adopted and remain in effect unless altered in the future by the EMF Steering Committee. The following results were noted:

Next Forum:

WHEN: October 8-9, 1987
(Steering Committee on October 7, 1987)
WHERE: St. Louis, Missouri
HOST: McDonnell Aircraft Company

The meeting was closed after having covered all the desired agenda items. Chairman’s note: “They get hostile when they get hungry!”

Charlie Sides, Chairman

EQUIPMENT MANAGEMENT FORUM (EMF)
February 19-20, 1987, Mesa Arizona

The second Equipment Management Forum was held at the McDonnell Douglas Helicopter Company (MDHC) facilities at Mesa, Arizona on February 19-20, 1987. There were 77 registered attendees representing 45 different organizations. The Forum was hosted by Dale Kemper of MDHC. A welcoming address was given by Mike McCormick, MDHC Director of Facilities, followed by logistical announcements from Dale Kemper.

Charlie Sides, EMF Chairman, addressed the Forum with a brief recap of past activities including the ongoing effort to establish the EMF Steering Committee and associated EMF Subcommittees (see the Pre-forum “Let’s Get Organized” meeting minutes). Charlie related that, coincident with his appointment to Chairman, the EMF was transferred from an Ad-Hoc status to a Standing Committee during the July 9, 1986 NCSL Board of Directors meeting. The video “Introduction to the NCSL” was then shown to the Forum. Charlie closed his address by assuring the attendees that the next such “video” would include the EMF.

Arnie Doll of the Boeing Aerospace Company presented the “EMF Profile Analysis – 1986”. This was an audience participation review of information compiled from the 1986 Forum questionnaire as completed by attendees at the first Forum in May of 1986, and subsequently published in the 1986 Draft Edition of the Directory of Equipment Management Organizations. Many analysis charts revealing the 1986 EMF makeup and interesting differences between the organizations with “less than” or “greater than” 20,000 inventory items was presented. These pie chart presentations stimulated attendee interest, and many rationalizations for the various results were heard by the Forum attendees. The next release, i.e. 1987 Draft Edition of the Directory of Equipment Management Organizations, will contain a selected set of the analysis charts – updated with the additions and modifications to the 1986 version. Everyone was encouraged to review their organization’s profile as released in the 1986 Draft Edition and to forward any corrections per the instructions in the Directory. Handouts were provided of the presentation material, and copies of the 1986 Draft Directory were provided. Organizations not yet profiled within the Directory were requested to complete and return the questionnaire contained in the Directory.

A workshop on “The Rent/Lease/Buy Decision” was moderated by Gary Davidson of TRW, and consisted of the following panel of experts.

Ralph Bertermann (G.D Searle & Co) Pro-Buy Position
Gary Phillips (Electro Rents Corp.) Rent/Lease Position
Bill Stuntz (U.S. Instrument Rentals) Rent/Lease Position
John Lee (Telogy) Rent/Lease Position
Al Strand (TRW) Overview Commentary

Pre-Forum Attendees

EMF Conference opens to full house
The workshop was initiated by a presentation given by Ralph Bertermann regarding the "why" for equipment purchase within his company, a segment of the pharmaceutical industry. This was followed by a presentation representing the Rent/Lease industry position with Gary Phillips, Bill Stuntz and John Lee each presenting separate segments of the Rent/Lease industry's story, i.e. industry background, financial aspects and service/support respectively. Throughout the discussions and interchanges between panel members and Forum attendees, Al Strand offered recap analysis and opened discussions regarding related issues. Al also provided a final wrap-up overview and critique of the material covered. Many Forum members will no doubt be re-evaluating their individual situations regarding the Rent/Lease/Buy decision as a result of exposure to this workshop.

Three papers were presented to the Forum in the following order:

1. Preparing for a COR Audit - presented by Gerald Wilson of Boeing Military Airplane Company.
2. PC's for Spares Control of GPTE - presented by Ken Pierce of Motorola.

Each of these papers addressed subjects of particular interest to various segments of the Forum attendance. This was apparent from the question and answer sessions both during and following the paper presentations.

Dale Kemper of MDHC introduced and presented a video titled McDonnell Douglas. The video provided an overview of McDonnell Douglas Corporation and many of the products it produces.

The final activity of the day was the first phase of a workshop moderated by Ray Barrett of Tektronix on Equipment Management Problems/Solutions. The Pre-Forum flyers and registration material for this EMF requested the attendees to come prepared to discuss their problems and concerns as well as what they expected from the EMF.

Ray presented the goals for the workshop as follows:

To surface problems and concerns existing within the equipment management community.

To enable beneficial exchange of information, ideas, experience, and candidate solutions.

To scope what the membership expects from these forums and from the EMF Committee.
To identify areas needing future emphasis through Forum presentations, workshops and/or "unity of purpose" pressure for action.

To establish new goals and objectives for implementation by the EMF Committee and/or dedicated Subcommittees.

The workshop involved a random break-up of the Forum Attendees into eight separate subgroups. Instructions and workshop materials were provided to the eight volunteer subgroup coordinators:

- Ray Barrett Tektronix
- Jim Bergstrand Northrup
- Jim Ingram Lockheed
- Dennis Kushner TRW
- Bill Martin Lockheed
- Tom McGovney TRW
- Ken Pierce Motorola
- Roland Vavken Rockwell

These subgroups worked independently on varied areas of interest for the remainder of the day. It was announced that the subgroups would reconvene the following morning to finalize their activities, and the Forum was closed for the day.

Following the morning break, Ray requested that each subgroup coordinator define a problem discussed and any candidate solutions offered and/or desired future EMF actions identified. The subgroup items were then openly discussed by the full Forum for additional insights and experience sharing until the time available was exhausted. Ray volunteered to compile this information for subsequent distribution to the attendees by the EMF Chairman.

The final presentation of the day was given by Dale Kemper on the McDonnell Douglas—"PRESS System". The "PRESS", which stands for "Property Record for Equipment Servicing and Sharing" is an equipment management record system which services many of the various McDonnell Douglas Companies from a centralized computer system located in St. Louis, Missouri. The presentation was well received and the post-presentation discussions had to finally be halted as the lunch hour approached.

Charlie closed the Forum with the announcement that the next Forum is planned for October 8-9, 1987 in St. Louis, Missouri. Ben Brown of McDonnell Aircraft Company will be the host. Efforts are underway to expand the Forum membership and awareness throughout the nation, and everyone was requested to "spread the word".

Charlie Sides
Chairman
EDITOR:

Regarding 'NCSL Newsletter', Vol. 26, No. 3, September, 1986:

Being one of the few women that work in the Standards Laboratory at Sandia National Laboratories, I often see the type of "humor" depicted on the central picture on page 37. I feel sad for people that feel that they must behave that way, just as I feel sad for the drug addict who knows of no better way. Funny though, I don't see either as humorous.

Mary K. Odom
Sandia National Laboratories
Organization 7241
P.O. Box 5800
Albuquerque, NM
87185

Editor’s Note:

Mary, I apologize for simply missing that bit of 1960’s "humor" in our Anniversary issue, a clear cut example of sexist humor. It just went by me. Believe me, with two daughters in business, I’m well sensitized to such problems (I thought). Thanks for reminding us to stay professional & alert to all those old vestiges.

***********

TO: NCSL MEMBER DELEGATES

SUBJECT: RETIREMENT

My retirement from TVA becomes effective January 2, 1987. I will be 65 years young on January 19, 1987, and have been with TVA 38 years.

The past 14 years association with NCSL has been a very rewarding and enjoyable experience. I shall miss the fellowship at the quarterly Board of Directors meetings and the annual conference. When you are in the Chattanooga area I would like to hear from you.

My replacement as Chief of Laboratories Services Branch will be R. L. Morley. He will probably be the TVA delegate to NCSL. The Appointing officer will be A. T. Mullins, Director of the Division of Operation Support. The mailing address for both will remain the same (TVA, 1101 Market Street, LA PSC 1, Chattanooga, TN 37402-2801).

My most sincere best wishes for the continued success and influence of NCSL and to you and your families for a happy holiday season.

Sincerely,

Hillary A. Taff
Vice President
Industrial Technology

***********

ISO "UNCERTAINTIES" WORKING GROUP MEETS


The need for such a guidance document has been long felt throughout the international measurement community. In 1980, the Bureau International des Poids et Measures (BIPM) convened a meeting of experts from eleven national standardization laboratories for the purpose of arriving at a uniform and generally acceptable way of assigning uncertainties to measurement data. This BIPM Working Group on the Statement of Uncertainties agreed on a recommendation which was subsequently adopted by the Committee International des Poids et Mesures (CIPM) in October 1981. This Recommendation (1980) consists of five points which provide a general philosophy for reporting uncertainties. In large part, the points are more in the nature of an approach which indicates the goal to be achieved rather than an explicit specification of algorithms and methods. Even at the time of the formulation of the Recommendation, it was believed that many further details would have to be addressed and resolved before the recommended approach could be routinely, uniformly, and widely used.

In the past year, the CIPM referred this matter to the International Organization for Standardization (ISO) since it was felt that this was a more logical international body for trying to achieve agreement and uniformity on the statement of uncertainties within international standardization and metrology organizations. Responsibility was assumed by the ISO Technical Advisory Group (TAG) 4 since it serves as a coordination mechanism for addressing measurement issues of common interest to the two worldwide standardization bodies,
the ISO and the International Electrotechnical Commission (IEC), and the two worldwide metrology organization, BIPM and the International Organization of Legal Metrology (OIML). The present working group (ISO TAG 4/WG3) was thus constituted under the terms of reference of ISO TAG 4, and consists of 11 experts nominated by the represented organizations. The Chairman of the working group is Ron Colle of the National Bureau of Standards.

The terms of reference of the working group is to develop a guidance document based upon the recommendations of the BIPM working group on uncertainties which provides guidance on the expression of measurement uncertainty, for use within standardization, calibration, laboratory accreditation and metrology services. The purpose of such guidance is to promote full information on how uncertainty statements are arrived at and to provide a basis for the international comparison of measurement results. At the October meeting, the TAG 4 working group concluded that its task is to produce a document which will be based firmly on the BIPM recommendations of 1980, but which will be more specific and usable. The document will be directed towards two primary user groups; national primary standards laboratories and secondary level standards laboratories. A first draft of the guidance document is expected to be circulated to the working group by April 1987. TAG 4/WG3 will meet again in May 1987 to discuss the draft. For further information, contact Dave Edgerly at (301) 975-4023.

George A. Uriano
National Bureau of Standards
NCSL-OIML Liaison

December 15, 1986

NEW ASTM SUBCOMMITTEE ON LABORATORY EVALUATION AND ACCREDITATION SEEKS MEMBERS

PHILADELPHIA, PA - ASTM Committee E-36 on Criteria for the Evaluation of Testing and Inspection Agencies has established Subcommittee E-36.60 on Laboratory Evaluation and Accreditation Activities.

Subcommittee E-36.60 will develop standards that support laboratory evaluation activities and accreditation system operations, such as standard guides for evaluation and accrediting temporary and site laboratories, development and operation proficiency testing programs, and for evaluating the reliability of measurement data.

The first meeting of ASTM Subcommittee E-36.60 will be Wednesday, 13 May, 1987 at the committee week of Committee E-36.6 at the Omni Netherland Plaza, Cincinnati, Ohio. All those interested are invited to attend.

For more information, contact Committee E-36 chairman John W. Locke, AALA, 656 Quince Orchard Road, Rockville, Maryland, 20878, (301) 670-1377, or ASTM staff manager Ray Sansone at (215) 299-5521.

Anyone interested in becoming a member of Subcommittee E-36.60 should contact Locke or Sansone.

**********

NCSL NEWSLETTER EDITORIAL SCHEDULE FOR 1987

<table>
<thead>
<tr>
<th>Issue Date</th>
<th>In Mail</th>
<th>To Printer</th>
<th>Last Editorial to Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 87</td>
<td>1 Apr. 87</td>
<td>20 Mar. 87</td>
<td>1 Mar. 87</td>
</tr>
<tr>
<td>July 87</td>
<td>1 Jul. 87</td>
<td>20 Jun. 87</td>
<td>1 Jun. 87</td>
</tr>
<tr>
<td>Oct. 87</td>
<td>1 Oct. 87</td>
<td>20 Sept. 87</td>
<td>1 Sept. 87</td>
</tr>
<tr>
<td>Jan. 88</td>
<td>1 Jan. 88</td>
<td>15 Dec. 87</td>
<td>25 Nov. 87</td>
</tr>
</tbody>
</table>

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.

In the final editing, typesetting, and review process with the Board, time gets especially crucial, so please hold to those dates. And don't expect me to be calling anyone for getting their material in. You're all adults, and any manuscript that doesn't get here, doesn't get published. It's as simple as that.

The opposite side of the equation is not to wait for the last minute either. And if you know you'll be late, a phone call can help reserve a little more space in the final makeup of the book, for example, a late-breaking conference date or committee report.

I plan to print this schedule with each issue.
EDITOR'S NOTE

I guess items like this are on the borderline of printing or not. We certainly don't publish news about manufacturer's catalogs. But applications and measurement information is another matter. As I read the YSI literature, it always seems that they have measurement material of some use to Labs that are working with the International Practical Temperature Scale.

In any event, there is a document on basic temperature metrology available from:

Yellow Springs Instrument Co. Inc.
Box 279
Yellow Springs, OH 45387

FREE ASTM PUBLICATION CATALOG AVAILABLE


EXPERIMENTS IN RF AND MICROWAVE NETWORK ANALYSIS

For RF and Microwave Neophytes, who want to learn design and measurement consideration of Network Analysis, there is a new laboratory notebook from the University of Santa Clara, California.

Written for EE students at an undergraduate level, the manual contains 29 experiments in 14 Chapters which are impressively complete in concept. Starting with an experiment which models the RF characteristics of a led resistor, the book progresses through scattering parameters to time domain analysis.

The nice part of the whole manual is that it uses measurement techniques written around modern network analyzers like the HP 3577A and the 8753A equipment. The lab manual costs $20 (U.S.)

Contact:

Microwave and Communications Laboratory
Santa Clara University
P.O. Box
Santa Clara, CA
(408) 554-4482
CHANGE TO INTERNATIONAL PRACTICAL TEMPERATURE SCALE

At the 75th meeting of the International Committee of Weights and Measures held in Paris, October 14-15, 1986, a report was presented by the Advisory Committee on Thermometry that a revised International Practical Temperature Scale would probably be agreed upon at their next meeting in June 1987. A resolution, according to Dr. Ernest Ambler, Director of the National Bureau of Standards, is likely to be presented at the General Conference of Weights and Measures to coordinate internationally, the adoption of the new temperature scale to become effective January 1, 1990. This is the same date that the new definitions of the national representations of the volt and ohm are likely to become effective.

Dr. Ambler has requested comments from the NCSL regarding these changes so that the NBS can coordinate the changeover with minimum inconvenience to the U.S. measurement community. In that regard, a letter was sent out to all member delegates in March 1987 requesting comments to be forwarded to Dr. Ambler. Comments are due no later than May 1, 1987, and should be sent to:

Gary Davidson
TRW O & S G
Building S, Room 2767
One Space Park
Redondo Beach, CA 90278

The approximate values of the expected changes from IPTS-68 are shown in Figures 1 and 2. (page 61).

Preliminary analysis by the NBS shows that the effects of the changes will be minimal. The NBS analysis of effect on electrical standards, length standards, and thermodynamic tables follows:

Electrical Standards

The impact of the proposed change in IPTS-68 on electrical measurements and standards will be minimal since only the most highly stable and well controlled standard cells and resistors will be affected, and even for these the impact will be marginal. More specifically, for those few standard cells in client laboratories still maintained in oil baths, usually at 28 °C or 30 °C, the change in the temperature scale will lead to a change in assigned emf of roughly 0.3 microvolts or 0.3 parts-per-million (ppm). However, most laboratories maintain their cells in constant-temperature air baths each with its own arbitrary temperature indicator. In this case, no reassignment of emf value is required. It should be noted that the uncertainty in the calibration of client oil-bath cells sent to the National Bureau of Standards generally exceeds 0.3 ppm as does the calibration of such cells in a client's laboratory by means of the Volt Transfer Program, the Bureau's voltage Measurement Assurance Program or MAP. For standard resistors, which are generally maintained at 25 °C, the change in assigned value due to the change in the temperature scale will be in most cases only a few hundredths of a ppm of a nominal value. As for standard cells, this is smaller than any NBS client resistor calibration uncertainty. However, for both standard cells and resistors, a number of laboratories will no doubt wish to make the changes in order to ensure the exact continuity of their voltage and resistance units. To assist such laboratories, NBS will issue a detailed information and instruction sheet with worked examples.

Length Standards

The official international standard for the meter is "the distance traveled by light in a vacuum during one-299,792,458th of a second." Therefore, revision of the IPTS has no real effect on the unit of length. In practice, this unit of length is usually realized by using a mechanical artifact (gage block, line scale, etc.) or by laser-temperature. In the mechanical case the change is simply the change in the temperature scale times the coefficient of thermal expansion of the artifact since it is internationally agreed that the length of mechanical artifacts is the length at 20 degrees Celsius. (The reasons for such an agreement are convoluted and need not be repeated here.) For the proposed change of 6 millikelvins, mechanical artifacts made of steel will have a change in defined length of approximately 60 parts in a thousand million (or 0.06 micrometers in a meter). Such a change in the mean defined length will definitely be noticed by standards labs, but has no significant industrial impact. In fact, unless users of NBS calibration services were purposefully informed, very few, if any, would even notice.

For the interferometric measurements, the change is even smaller, and although manufacturers of such instrumentation should be informed, no shift will be detectable. (The refractive index correction is 0.93 ppm per degree Celsius and the lasers generally are stable to about 1 part in 10 to the seventh.)

Thermodynamic Tables

The proposed changes in temperature scale are not likely to significantly affect the chemical process industry in which temperature control is rarely better than ±1 K. The data that are used to compute thermodynamic tables for most of the substances of interest to science and technology are rarely accurate enough to be affected by these temperature changes. Exceptions to this include real gas measurements on steam, methane, ethylene, thane, nitrogen, oxygen, some rare gases and ammonia. Recalculation of thermodynamic tables would have to start with refigting all experimental data on the new scale.

It is unlikely that this will be done for either the real gases or the JANAF Thermodynamic tables which include ideas gas tables, which by definition are on the "thermodynamic scale" (continued on page 61)
MEETINGS AND PROGRAMS ANNOUNCEMENTS

April 15-17, 1987
NCSL Board of Directors meeting at San Antonio, Texas

April 27-29, 1987
Instrumentation & Measurement Technical Conference to be held in Boston, PMA & IEEE sponsored.

April 27-May 1, 1987

July 12-16, 1987
NCSL 1987 Annual Conference which will be held at the Regency Hotel in Denver, Colorado. Conference to include the standard Workshop and Symposium with the first time addition of exhibitors. It should be a pace setter; make plans now.

July 17-18, 1987
NCSL Board of Directors meeting at the Regency Hotel, Denver, Colorado.

August 18-20, 1987
IMEKO - Metrological Assurance for Environmental Control at Helsinki University of Technology Otaniemi, Espoo, Finland.

October 4-9, 1987
ISA/87 International Conference & Exhibit, Anaheim, CA (919) 549-8411.

October 5-7, 1987
NCSL Board of Directors meeting at Osage Beach, Missouri.

October 8-9, 1987
The Equipment Management Forum (EMF) will meet at McDonnell Aircraft Company in St. Louis, Missouri. The EMF steering committee will meet on the 7th, prior to the Forum. For information call Ben Brown (314) 234-9759 or Charlie Sides (206) 744-9944.

October 12-16, 1987
Measurement Uncertainty given by Dalfi, Inc. in Orlando Florida - call (619) 578-9500.

To have your organization's meetings and conferences announced, please send a notice to M. J. Corrigan, JR., Chairman, Meetings and Programs Committee.

REGIONAL MEETINGS SCHEDULE

REGION 1. Typically holds two (2) meeting per year, a regional business meeting and a technical session. The next meeting is scheduled for April, 1987.

REGION 2. Three (3) meetings are held each year. The next meeting is tentatively scheduled for March 24, 1987.

REGION 3. Apr. 23, Gaithersburg, MD, Sept. 24, Norfolk, VA

REGION 4. Jun. 10, Clearwater, FL, Oct. 21, Atlanta, GA

REGION 5. MEETING SCHEDULE FOR 1987*

Date       Section       Host or Comments
March 31    Dayton       Technology
            Dayton       Applications
May 5       Lavonia MI   Fluke-Detroit area to explore the possibilities of a new section.
May 7       Indianapolis Endless & Hauser.
Sept. 29    Dayton       Host to be announced.
Nov. 3      Cleveland    Host to be announced.
Nov. 10     Indianapolis Endless & Hauser.

REGION 6. The Dallas Fort Worth (DFW) Section (four year schedule): The Wednesday of the first full week of April and November, rotating between Tektronics, Fluke’s and Hewlett-Packard’s facilities adjacent to DFW Airport between Dallas and Fort Worth.

The dates are:

4/4/90, Fluke - 11/7/90, HP - 4/10/91, Tek

Houston Section (three year schedule):
The Thursday of the first full week of January, May and September. The locations to be determined within a fifty mile radius of Houston. The dates are:

1/8/87, 5/7/87, 9/10/87, 1/7/88, 5/5/88
9/8/88, 1/5/89, 5/11/89, 9/7/89, 1/11/90 (first full week = Sunday through Saturday)

REGION 7. Plans to hold three meetings each year. The next meeting is planned for May 28th at the Apple Computer facility in Cupertino, CA. They also plan a October 29th meeting, so mark your calendars.

REGION 8. Plans to hold six sectional meetings this year. The Spring meetings are: Los Angeles Section to meet April 1st at the Proud Bird Restaurant, Los Angeles, CA. The San Diego Section will meet on May 20th.

REGION 9. Plans to hold three meetings each year. The next meeting is tentatively scheduled for the Spring of this year.

REGION 10. Plans to hold a International Luncheon at the National Conference in July.

REGION 11. The tentative meeting schedule is as follows:
April, Chicago, Illinois
April, Minneapolis, Michigan
October, Chicago, Illinois
October, Minneapolis, Michigan

Schedules will be updated as firm dates and locations are received.

* The months of April/October have been set aside for meetings in the Twin Cities and Chicago areas.
SOMEONE YOU SHOULD KNOW

ALLAN M. HERMAN

Allan’s background is very different from most of the member delegates to NCSL. He is not a metrologist nor does he have an engineering background, but he is very much involved in the world of test and measurement.

He is the founder and President of Cooper-Cameron Incorporated, a full service advertising and public relations agency which specializes in high technology clients. The agency presently handles six clients who are directly involved in metrology and he reports that there are two additional firms (test and measurement oriented) almost ready to sign on as Cooper-Cameron clients.

This work background and experience has been quite helpful to NCSL. Immediately upon joining, in 1983, Allan was recruited by or (then) Vice President of Marketing, Ed Nemeroff, to serve as Chairman of our Publicity Committee. He still holds that chairmanship in 1987.

Over the years his contributions have included a new NCSL booth, slide presentation and innovative NCSL information and membership recruitment brochure. He has been helpful in the planning of several conferences and has served as a workshop moderator at the NCGL conference of 1984. This year, working in conjunction with Bob Weber and Jim Ingram, he has put together a publicity program for the 1987 conference which is different from anything we have done in the past.

When Allan was interviewed for this piece he said that his decision to join NCSL was not an easy one. “In the beginning I was some trepidation as to where I would fit among all the measurement professionals and engineers. However, I received a lot of help and guidance from people such as Ed Nemeroff, Peter England, Bob Weber and others which not only made me feel comfortable but identified a niche which I could fill and become a participating and contributing member delegate.”

He added, “the past four years have been very rewarding. Through my association with various member delegates and officers of the organization, I have learned specific aspects of the test and measurement world which has broadened my personal database and subsequently has made me more effective in behalf of my clients who are involved in the metrology disciplines. I am a believer and accordingly I promote membership in our association to those clients who ‘fit’ the membership criteria, every chance I get.”

Allan’s “pre-serious commitment” to the business world (as he puts it) is very interesting. He was a disc jockey at a New York radio station, an actor and a singer in a band prior to his involvement in marketing and advertising. “In fact”, he says, “advertising has a little bit of ‘show-biz’ involved in it so my background there has been helpful, particularly in making presentations to large groups of people.”

He and his wife Marsha reside in Clifton, NJ (a suburb of New York City) with their four children, two dogs and two cats. Their son Leigh, aged 25 is a film and video producer, daughter Randy, 24, is a manager with a local chain of fashion boutiques and their other two daughters, Tara 18, and Beth, 15, are high school students.

Allan’s all consuming interest is golf (he admits to a ten handicap), a hobby he shares with his wife who is also an avid player. When he is not in the office or out on the course he will dabble in oil painting and has been involved in athletic programs for young people and other civic groups.
EDITOR:

As I reported at the last Board Meeting, the NBS Journal of Research now recognizes that its primary audience should be readers interested in precision measurement and standards and we hope to orient the Journal to the interests and needs of that community. We regard the membership of NCSL as a very important part of our constituency. I hope that the Journal will become a necessary part of every measurement laboratory library and that you will include an announcement regarding the Journal of Research in one of your NCSL Newsletters.

Along with feature articles on measurement problems, we will publish the latest information on new developments in our calibration and standard reference materials programs, reports of meetings of interest to the measurement community and other news items of developments at NBS.

I also have the authority to publish occasional articles by authors who are not on the NBS staff. I therefore solicit papers appropriate to the Journal from members of NCSL. These should be concerned with important measurement problems and after review will be published in a style appropriate to a referred journal.


I am enclosing a copy of our latest issue, November-December, but since this issue does not yet fully reveal our intention to include more articles of interest to calibration laboratories, I am also enclosing a listing of the contents for the January-February and March-April issues.

Sincerely,
Karl G. Kessler, Editor
NBS Journal of Research

CONTENTS OF JANUARY-FEBRUARY ISSUE OF THE NBS JOURNAL OF RESEARCH

Feature articles:

The Continuity of the Meter: the Redefinition of the Meter and the Speed of Visible light.

The NBS Scale of Radiance Temperature

Detection and Sizing of Surface Flaws with a Squid-Based Eddy Current Probe.

Ideal Gas Thermodynamic Functions for Water.

Other Departments:

Conference Reports:


Report on meeting of Consultative Committee on Electricity.

News Briefs and Reports:

New Technical Developments
New Standard reference Data
New Services from NBS

CONTENTS OF THE MARCH-APRIL ISSUE

Feature Articles:

Microphone Calibration

Far Ultraviolet Detector Standards

Choice Sensitivity Weights in Precision Weighing

An article on statistical analysis

Conference Reports:

Fibre Optics Conference

More News Briefs and Reports.
GUIDELINES FOR FORTHCOMING VOLT/OHM
CHANGES

A Joint NBS - Industry - Government committee is being set up for the purpose of producing guidelines for the metrology community to help them properly adjust their instrumentation and values of their standards to comply with the changes in the U.S. Legal Volt (~9 ppm) and Ohm (~1.5 ppm) which will take place as of January 1, 1990. The committee's organizational meeting was held at the Measurement Science Conference, Irvine, CA, on January 28 and the first working meeting is planned to take place after the 1987 NCSL Annual Meeting and Conference to be held in Denver, CO, July 12-16, 1987. Guidelines will provide an explanation of the changes, their magnitude, and examples of making the changes under practical circumstances. All meetings of this committee are open and your participation is encouraged. Times and locations of the meetings will be announced via NCSL and the Precision Measurements Association. For further information, contact Norman Belecki, NBS, (301) 975-4223

CAPACITANCE MEASUREMENTS & STANDARDS

Gas dielectric standard capacitors in the range from 10 to 1000 pF are commonly used to maintain the unit of capacitance in industrial standards and calibration laboratories and were the heart of the NBS transport standard that was the basis for the capacitance MAP service. Since the service has been curtailed due to deteriorating performance of the transport standard, questions have been raised concerning the quality of these capacitors and the effectiveness of their calibration at NBS. Measurements of the capacitance of check standards at NBS and elsewhere suggest that it is feasible to maintain a local representation of the farad with a precision of 1.5 to 3 ppm with gas dielectric capacitors providing they are not moved. Calibration data from a large number of standard capacitors show that erratic behavior - changes in capacitance of 15 ppm or more between calibration - is not uncommon, and is likely due to mechanical and thermal shocking of the standards.

These capacitors are constructed with a number of parallel plates held in close proximity by support rods. The rods also provide electrical connections between the plates and the capacitor terminals. They are hung from a support structure which is mechanically attached to the shield of the capacitor. The capacitance is primarily a function of the number of parallel plates; their area, spacing, geometry, and thickness; the gas used as the dielectric; and to a lesser extent the position of the shield with respect to the plates. The capacitance changes with variations in any of the above. Thus thermal stress, i.e., variations in the temperature of the capacitor which cause metal to expand and contract, and mechanical stress, i.e., dropping, hitting, tilting, etc., which causes the plates and/or rods to shift with respect to one another or the shield, result in some change in capacitance. The capacitor may not return to its original value after the thermal or mechanical stress is removed due to hysteric effects. It is important to note as well that this structure is not supported at its bottom. The cantilever structure resulting when the capacitor is laid on its side can result in disastrously large geometric changes which are most likely not reversible. Never store standard capacitors on their sides.

A variety of tests have been done at NBS to evaluate the effects of stress on the value of gas dielectric capacitors during shipment from one laboratory to another. It is impossible to avoid at least some thermal and mechanical stress to the capacitor during shipment. Due to the effects mentioned above, the capacitor may not always return to the value it had before undergoing the stress. For extreme thermal shocks, i.e., an elevation to 150°F for 24 hours, a capacitor may change as much as 20 ppm and appear stable at this new value. Such effects are not taken into account in the uncertainty attributed to the value resulting from calibration at NBS since there is no feasible way to evaluate them. The size and direction of any shift can only be evaluated in the customer's laboratory by careful analysis of data taken to compare the standard before and after its journey to NBS with other standards left undisturbed in the laboratory and consideration of
the long-term historical data from calibrations at NBS and elsewhere.

To minimize the effects of shipment on standard capacitors, several things should be done. The customer should make sure that they are tightly packed, i.e., the capacitors do not rattle in the shipping container; they are surrounded by material which will provide good thermal and mechanical insulation; and the shipping method gets the capacitor to NBS in the least stressful way (short travel time usually helps). If accuracies better than 7 to 10 ppm are needed by the laboratory, carrying the standard to NBS (and back) by hand is strongly recommended. Examination of historical data reveals that it is not uncommon to encounter sudden large changes (> 10ppm) in capacitance values after years of stable behavior.

THERMAL CONVERTER CALIBRATIONS

The addition of a new automated system has resulted in shortening the queue for the calibration of thermal transfer devices and their ranging resistors. Instruments scheduled for calibration in June 1987 are now (early Jan.) being called in. Calibration laboratories can help eliminate the queue by sending their standards in promptly upon notification and informing Denise Prather (301-975-4221) if they have made other arrangements since being placed on the queue. The schedule will be updated and everyone informed of their status in the next month.

NEW TELEPHONE NUMBERS

All NBS telephone numbers have been changed as of 10 November, 1986 as a result of the installation of a new telephone system. The numbers given below should be used in lieu of (301) 921-2715 for contacting the Electricity Division regarding calibrations:

- Calibration Administration (Denise Prather) (301) 975-4221
- Calibration Technical (301) 975-4222
- Barry Taylor, Division Chief (301) 975-4220
- Norm Belecki, Group Leader (301) 975-4223
- Joe Kinard, AC-DC Difference (301) 975-4250

REVISED GUIDELINES FOR DESIGNING AUTOMATED OFFICES

While technology is seen by some as the answer to office productivity problems, it is widely recognized that many office workers are dissatisfied with the environment in their automated office, notes a new NBS report. The report discusses the problems and benefits of office automation and suggests ways to design automated offices that are functional and pleasant to work in as well as economical to develop and operate. It discusses details of planning and designing the office from acoustics to workstations and gives typical approaches for each. The report is the fourth in a series for the General Services Administration, which oversees most of the federal government's buildings. This updated report is a major revision of the earlier work and includes more extensive information on communication systems, intelligent buildings, and data processing center design. Revised Interim Design Guidelines for Automated Offices (NBSIR 86-3430) can be ordered from the National Technical Information Service, Springfield, VA 22161 for $16.95 prepaid. Order by PB# 87-105276/AS.

Contact: Jan Kosko, (301) 975-2762

NEWS BRIEFING TO MARK COMPLETION OF AUTOMATION LAB

NBS marked completion of its 4-year program to build the nation's most advanced research facility for automated manufacturing at a news briefing 10 a.m., Dec. 9, at its laboratories in Gaithersburg, Md. The briefing included remarks by Deputy Secretary of Commerce Clarence J. Brown on the importance of automation to industrial competitiveness, a review of current automation research at NBS, and special demonstrations of the facility at work. Due to the nature of the research, the facility usually is not available for photographers and demonstration.

Contact: Michael Baum, (301) 975-2762

ASSESSING ELECTROEXPLOSIVE DEVICE VULNERABILITY

Hot-wire electroexplosive devices (EEDs) are electrically fired explosive initiators. They are used as automotive air bag initiators, separation devices in aerospace applications (explosive bolts), and many other military, mining, and construction application. A new and rigorous approach for assessing an EED's vulnerability to pulsed electromagnetic interference is given in A Statistical Characterization of Electroexplosive Devices Relevant to Electromagnetic Compatibility Assessment (TN 1094). This method uses statistical theory and thermodynamic modeling to determine the probability that an electrical pulse of a given duration and power will detonate the EED, and to determine thermodynamic parameters. The "Firing Likelihood Plot" is introduced to represent an EED's characteristic in a readily interpretable manner. The report can be
MEASURING SHIELDING EFFECTIVENESS OF MATERIALS

The shielding effectiveness of a material is a measure of how well it is able to isolate a region from electromagnetic fields. Shielding is used to protect equipment from outside interference or to reduce unwanted emissions from equipment. While traditional metal shields have characteristics that are well understood, the recent use of more complex materials with less predictable shielding properties, such as plastic housings and composites, has made measurement of the shielding effectiveness essential. In *A Study of Techniques for Measuring the Electromagnetic Shielding Effectiveness of Materials* (TN 1095), NBS reports on an evaluation of several measurement approaches. Available from the Superintendent of Documents, U.S. government Printing Office, Washington, D.C. 20402, for $3.50 prepaid; order by stock no. 003-003-02735-9.

Contact: Collier Smith, (303) 497-3198

EL ECTROMAGNETIC COMPATIBILITY AND INTERFERENCE MEASUREMENTS

Electromagnetic compatibility/interference measurements are used to determine how electronic equipment undesirably generates or is affected by electromagnetic radiation. Reliable, accurate EMC/EMI measurements are essential to the design and operation of a broad variety of electronic equipment and products used in automotive, household, industrial, business, and military applications. *Electromagnetic Compatibility and Interference Metrology* (TN 1099) includes the text material for a short course in EMC/EMI measurements, and includes chapters on measurements made using transverse electromagnetic (TEM) cells, anechoic chambers, open fields, reverberating chambers, and EM probes. Other chapters deal with measurement of the shielding effectiveness of materials, out-of-band EMC problems, conducted EMI, and complicated electromagnetic environments. The publication is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $8.50 prepaid; order by stock no. 003-003-02760-0.

Contact: Collier Smith, (303) 497-3198

NBS USING SOUND WAVES TO DETECT FLAWS IN CONCRETE

NBS researchers have developed a nondestructive method to detect flaws in concrete. Known as "impact-echo", the technique works on the same principle as the sonar pings used to locate and determine the depth of a submarine. An impact on the concrete generates sound waves which are reflected by flaws inside the concrete. A receiver mounted on the surface of the concrete picks up the reflections, or echoes. The location of the flaw is determined by measuring how long it takes to receive the reflected echo. So far, the NBS researchers have successfully used the technique to find artificial flaws obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2.75 prepaid. Order by stock no. 003-003-02744-8.

Contact: Collier Smith, (303) 497-3198

NBS AND USAF SIGN MEMO OF UNDERSTANDING ON MILSTAR

NBS and the U.S. Air Force have reached agreement on a 2-year program to develop millimeter-wave metrology and standards in support of the Milstar Satellite Communications System. Milstar is the next generation of extremely sophisticated military communications satellites. NBS will receive a total of $2.8 million over fiscal years 1987 and 1988 to develop measurement services and standards support over a wide range of parameters including millimeter wave power, impedance, noise temperature, antenna gain, and phase noise. The work will be carried out principally in the 19-22 and 42-46 GHz range. The program will enable NBS to provide interim (special test) measurement services to the three military branches, Milstar contractors, and their subcontractors.

Contact: Collier Smith, (303) 497-3198

PRECISION MEASUREMENT GRANTS AWARDED

NBS has awarded $30,000 Precision Measurement Grants to Frederick J. Raab of the University of Washington Department of Physics for experiments involving the behavior of gravity at the quantum mechanical level of atomic particles, and to Daniel R. Stinebring of Princeton University Department of Physics for an experiment to detect "primordial" gravity waves by observing the timing of very rapid pulsars. Raab's proposal bears on one of the Grails of physics, a unified theory of forces that combines gravity with electromagnetism and the nuclear forces. Stinebring's experiment should be sensitive enough to detect the Doppler variation in pitch of the pulsar signal – which is roughly E-flat – caused by gravitational waves jostling the relative positions of Earth and the pulsar. It thus could serve as a test of some of the leading theories on the generation of primordial gravitational waves. NBS Precision Measurement Grants are made annually to scientists in academic institutions for studies in precision measurement and the fundamental constants of nature.

Contact: Michael Baum, (301) 975-2762

NBS NEWS
embedded in a number of different concrete slabs. In addition, they have been able to detect pockets of unconsolidated concrete and the depth of cracks which are perpendicular to the surface. They also have been able to distinguish a hollow metal duct from one that is filled with grout. The NBS team plans to test the technique on other structural elements such as rectangular beams and round columns. Also, they want to investigate its potential for pavements. A report on the technique, Impact-Echo: A Method for Flaw Detection in Concrete Using Transient Stress Waves (NBSIR 86-3452), can be ordered from the National Technical Information Service, Springfield, Va. 22161, for $24.95 prepaid. Order by PB #87-104444/AS.

Contact: Jan Kosko, (301) 975-2762

NBS STEP GENERATOR OFFERS IMPROVED FEATURES

Three NBS researchers have developed a calibration standard for transient waveform recorders that is an improvement over existing commercial instruments in either accuracy or variability of voltage levels. Transient waveform recorders are used to measure rapid voltage pulses in applications such as research into automotive engine performance or the testing of electric power equipment for its vulnerability to lightning. These instruments also play key roles in nuclear fusion research and weapons testing. Developed by NBS researchers Howard Shoewetter, Donald Flach, and T. Michael Souders, the device generates precise, fully programmable voltage steps which exhibit fast transitions and exceptionally smooth settling to the final voltage value. Technical details about the step generator's design are available from T. Michael Souders, B162 Metrology Building, National Bureau of Standards, Gaithersburg, Md. 20899; phone: (301) 975-2406.

Contact: John Henkel, (301) 975-2762

SPECTRAL IRRADIANCE SCALE USING SILICON DETECTOR

Researchers in the NBS Radiometric Physics Division have established an experimental scale of spectral irradiance for the wavelength range 400-700 nanometers based on an absolute silicon photodetector. Spectral irradiance and the related scale of luminous intensity are widely used in the photographic, lighting, defence, and aerospace industries for measuring the output of light sources. The new scale makes use of interference filters and a 100 percent quantum efficient light detector invented by researchers from NBS and United Detector Technology, Inc. The new scale is independent of, and has the potential to be easier to use than, either of the traditional scales based on the thermal physics of blackbodies or absolute thermal detectors. From 500 through 700 nanometers in the visible, the new silicon-detector-based scale agrees with the traditional blackbody scale used at NBS to within +0.5 percent to -0.7 percent with a standard deviation of 0.3 percent. When converted to luminous intensity (the scale used to relate irradiance to human eyes), the agreement between the two methods is even better.

Contact: Michael Baum, (301) 975-2762

ATTENUATION MEASUREMENTS ON DEFORMED OPTICAL FIBERS

The optical attenuation of lightguides is one of the most important parameters to system designers. In addition to inherent attenuation of a given fiber, designers must take into account the added losses caused by the perturbations of bending, twisting, stretching, and overlapping of uncabled fibers. NBS has investigated these losses in short lengths of a variety of multimode fibers, using optical time domain reflectometry. The results of the studies showed that bending and microbending are the sources of most of the losses, that tension causes up to 4 dB/N km of loss (depending on the type of fiber), that twisting losses are negligible, and that overlapping causes losses somewhat less than bending does. These findings are presented in Attenuation Measurements on Deformed Optical Fibers (NBSIR 86-3052), available from the National Technical Information Service, Springfield, Va. 22161, for $26.90 prepaid; order by PB #87-132-289.

Contact: Collier Smith, (303) 497-3198

CODATA ANNOUNCES NEW RECOMMENDED VALUES OF THE FUNDAMENTAL PHYSICAL CONSTANTS FOR INTERNATIONAL USE

Chemists, physicists, engineers, and others in science and technology have a new, more accurate set of values for the fundamental constants now that work is completed on the 1986 Adjustment of the Fundamental Physical Constants. These are the basic quantities used in physics and chemistry worldwide for scientific investigations.

The 1986 adjusted values are recommended by the Committee on Data for Science and Technology (CODATA), an interdisciplinary, scientific committee of the International Council of Scientific Unions with headquarters in Paris.

Dr. David R. Lide, Jr., CODATA president and director of the Office of Standard Reference Data at the
Commerce Department's National Bureau of Standards (NBS), says, "The new set of adjusted values for the fundamental physical constants will contribute to improved data in nearly all fields of scientific research."

NBS works through CODATA to ensure the international coordination of scientific information used by laboratories throughout the world.

The 1986 CODATA report, which gives the new set of recommended values, is the first revision to the 1973 CODATA report that established the first internationally adopted set of values. The new set was developed over a 5-year period under CODATA sponsorship by physicists Dr. E. Richard Cohen at Rockwell International Science Center and Dr. Barry N. Taylor at NBS. The scientists received guidance on their work from other members of the CODATA Task Group on Fundamental Constants that includes representatives from Canada, France, Japan, West Germany, the Soviet Union, and the United Kingdom.

The adjustment includes the new definition of the meter in terms of the distance traveled by light in a given time, measurements linking atomic lattice spacings to optical determination of the Avogadro constant, and measurements of the quantization of the electrical conductance in certain semiconductor devices - the quantum Hall effect discovered by Nobel laureate Klaus von Klitzing in 1980.

While there are changes in all of the 1973 recommended values, the major ones include decreased values for the Planck constant, the elementary charge, and the electron mass, and increased values for the Avogadro constant, the Faraday constant, and the Josephson frequency-voltage ratio. Most importantly, throughout the 1986 set of recommended numerical values, the uncertainties are now typically about 10 times smaller than those in the 1973 set.

CODATA was established in 1966 to promote, on a worldwide basis, the compilation, evaluation, and dissemination of numerical data in all fields of science. Its membership includes 18 nations and 15 international unions. The member countries include the United States, the Soviet Union, Japan, China, the major industrialized European nations, and several developing countries.

Copies of the 1986 Adjustment of the Fundamental Physical Constants, CODATA Bulletin 63, may be purchased in North America for $15 prepaid from Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, N.Y. 10523. Elsewhere, the bulletin may be obtained from Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 0BW, United Kingdom.

NEW RECOMMENDED VALUES FOR FUNDAMENTAL CONSTANTS

Researchers sponsored by the Committee on Data for Science and Technology (CODATA) have completed the 1986 Adjustment of the Fundamental Physical Constants. These are the basic quantities used in physics and chemistry worldwide for scientific investigations. The 1986 set of recommended values is the first revision to the 1973 CODATA report.

OPTICAL FIBER MEASUREMENT SYMPOSIUM PROCEEDINGS

The 1986 Optical Fiber Measurements Symposium, held in September 1986 in Boulder at NBS, brought together over 300 representatives from 17 countries to present 34 papers. Topics of the 29 contributed papers spanned the full range of measurements necessary to specify an optical fiber, with a heavy emphasis on dispersion and mode-field diameter measurements in single-mode fibers. The five invited papers summarized the state of the art and looked to related and future measurement problems in the characterization of sources, detectors, specialty fibers, and planar waveguide devices. Summaries of the papers are presented in the Technical Digest: Symposium on Optical Fiber Measurements 1986 (SP 720), available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, for $8 prepaid; order by stock no. 003-003-02772-3.

Contact: Collier Smith, (303) 497-3198

UNITED KINGDOM AND NBS SIGN AGREEMENT

NBS Director Ernest Ambler signed an agreement with Paul Dean, Director of the United Kingdom's National Physical Laboratory (NPL), which recognizes the equivalence of the U.K. and U.S. national standards for temperature measurement. NBS and NPL collaborate in research to verify and improve a variety of measurement standards, both bilaterally and through the International Bureau of Weights and Measures.

VOLTAGE AND RESISTANCE

Starting on January 1, 1990, national units of voltage and resistance throughout the world will likely be adjusted so that they will be highly consistent with each other and with the internationally accepted system (SI). Although this will require an increase in most national voltage units of about 8 ppm (about 1.5 ppm for the U. S.), the benefits of international uniformity and consistency with the SI will no doubt outweigh the costs of implementing the changes.
NBS is making a concerted effort to work with industry and interested members of the metrology community to ensure a smooth transition to the new legal units. Barry Taylor of NBS and Klaus Jaeger (Lockheed representing NCSL) have authored a paper to be published in the June 1987 issue of IEEE Transactions on Instrumentation and Measurement, which summarize all of the responses received by NBS in a recent survey of industry concerning the impact of the proposed changes.

NCSL and NBS have formed an Ad-Hoc Advisory Committee to help develop plans and guidelines for the efficient transition to the new legal units. The first meeting of the committee will be held on January 28, 1987, at the Marriott Hotel in Irvine, CA. For further information, please contact Norman B. Belecki at (301) 975-4233.

NBS RESEARCH CITED PROMINENTLY IN NOBEL PHYSICS PRIZE TO IBM

Research done at NBS in the 1960's and 1970's figured prominently in the recent award of the Nobel Prize for physics to two IBM scientists. The award was made for development work on the scanning tunneling microscope, which yields extraordinarily detailed pictures of atoms and their bonds. While it has just begun to play a role in the study of materials and their surfaces, the microscopic technique has shown tremendous promise for computer makers and wide range of other industrial and biological developments.

The citation from the Royal Swedish Academy of Sciences prominently notes NBS' work on the scanning tunneling microscope. It cites NBS physicist Russel Young, now retired, who pioneered the technique. He conceived the basic operation principles for the new microscopic method, designed and built the first prototype instrument, and demonstrated the vacuum tunneling phenomenon. In addition, the first laboratory measurements of the extreme sensitivity of the vacuum tunneling phenomenon, an essential part of the method, were made by another, NBS physicist, Clayton Teague, who still works at NBS. The IBM scientists developed an instrument which operated in the scanning tunneling mode and discovered the instrument's capability to yield images at the atomic level.

COOPERATIVE PROGRAMS DESCRIBED

Dear Colleague:

As the nation's physical sciences and engineering measurement laboratory, the National Bureau of Standards conducts research that affects virtually every segment of the economy. In planning and carrying out our research, we collaborate and consult frequently with many of you in private companies, universities, and other government agencies.

We would like to increase this interaction. Through cooperative programs with U.S. companies, universities, and government agencies, we can ensure that our research and services meet the needs of U.S. science and industry. We can also improve and speed up the technology transfer.

We want to work with you to expand the use of NBS-developed methods and technology through cooperative technology transfer. We plan to maximize the use of NBS facilities, permitting proprietary research where appropriate, so more research dollars can be used for actual research rather than for purchasing equipment.

As part of this endeavor, we have just published the enclosed guide to Cooperative Research Opportunities at NBS. This publication explains a variety of successes NBS has had in conducting cooperative research. These programs include research consortia, individual Research Associate programs, and joint research centers.

I encourage you to review the programs described in this guide and call us to discuss the possibilities of conducting collaborative research in an area that is of concern to both of us.

Ernest Ambler
Director

Cooperative Research Opportunities at NBS
AIA Liaison Report

The main AIA-QAC WSC #1 Committee concerns have been with the proposed changes to Amendment (1) of both MIL-S-7742B and MIL-S-8879A by the Johnson Gage Company. A copy of the September 12, 1986 presentation at Wright-Patt AFB is available. Another meeting was held in Washington recently with a USAF group, Johnson Gage, and F. Contrell (McDonnell Douglas – St. Louis) representing the AIA dissenting position. The apparent result was negative for the AIA position.

Another point which came from the October, 1986 AIA QA Committee meeting related to calibration of employee’s personal tools as controlled by MIL STDs. It seems that the Director of QA of USAF Contract Management (Colonel William Lounsbury) interprets the MIL STD in that all personally owned tools must be calibrated if not prohibited from use by the contractor. Detail is also available in this.

The annual meeting of the QAC WSC #1 Metrology Standards and Calibration Committee is tentatively planned for May, 1987 at Grumman in Bethpage.

CORM Liaison Report

The 1987 CORM Conference and Annual Meeting will be held at the National Bureau of Standards, Gaithersburg, Maryland on Thursday and Friday, the 28th and 29th of May, 1987.

Problems and successes for high accuracy radiation measurements from space will be the topic covered in two half-day sessions. The sessions will be divided into Earth Science measurements and Space Science measurements, and will deal with topics such as: approaches for accomplishing a measurement accuracy of one percent over a decade of ultraviolet monitoring; calibrations and characterization algorithms for area array-based sensors; high resolution observations for investigation of solar physics processes; technical obstacles in sensing the primordial radiation energy of the earth-atmosphere system with multiple satellite systems; and radiometry for astrophysical applications. The developer of these sessions is Dr. Bruce Guenther, Code 673, NASA/GSFC, Greenbelt, MD 20771. Phone (301) 286-5205.

Activities relating to daylighting measurements at CORM ’87 include an invited talk on daylighting for the general membership, a session of technical papers on daylighting, and a working group meeting. Those interested in presenting technical papers or wishing to obtain further information should contact the session organizer: Theodore W. Cannon, Solar Energy Research Institute, 1616 Cole Boulevard, Golden, Colorado 80401.

ISA/IMEKO

ISA/86 International Conference and Exhibit was held in Houston, Texas. A copy of the program was forwarded to Bob Weber, 1987 NCSL Conference Committee, for review.

ISA – Mid America Conference will be held at the Rosemont/O'Hare Expo Center, Chicago, Illinois on March 17-19, 1987.

ISA/87 International Conference and Exhibit will be held at the Anaheim Convention Center, Anaheim, California on October 4-8, 1987.

IMEKO XI will be held in conjunction with the ISA/88 International Conference and Exhibit at the Astrodome in Houston, Texas on October 16-21, 1988. IMEKO is planning 40 sessions at the conference with a broad spectrum of authors from around the world. These will deal with the development and application of the latest advances in such fields as fiber optics, microprocessors, metrology, and instrument technology.

Dr. A. McCoubrey of NBS and Bill Simmons representing NCSL attended the IMEKO U.S. Paper Selection Committee Meeting held on October 15, 1986 at the ESA/86 Conference. A total of 362 papers have been received from the following categories: 22% Metrology, 20% Practical Application of Measurement, 28% Sensors and Data Acquisition, 12% Signal Conditioning and Processing, 8% Higher Education and Training, 10% Signal Transmission and Output Information.

CPEM Liaison Report

The activity of the Conference on Precision Electromagnetic Measurements (CPEM), in this country is limited to getting speakers and promoting attendance for CPEM ’88 to be held in Japan. If you or your colleagues are interested in presenting a paper or even attending the conference, Oskars Petersons will gladly help you.

The conference will be back here in 1990 and with the success of the ’86 conference behind it, I’m sure you’ll be hearing from the planning committee long before that. Please, consider now just what role NCSL should be playing in the big picture. Do we want to be a co-sponsor? How much financial help should we give them? What other ways can we (Continued on page 47)
WELCOME TO OUR NEW NCSL MEMBERS

Valuetic, S. A.
Framboyanes 2845 P.O. Box 2867
Monterry, N.L. Mexico
Delegate:
Francisco J. Guzman
(74-04-25) 72-12-85

Midland Ross/Grimes Division
550 St. Rt. 55
Urbana, Ohio 43078
Delegate:
Ray Knoll
(613) 562-1431, X2574

Delta Technical Products Co.
3714 W. Belmont Ave.
Chicago, IL 60618
Delegate:
Frank L. Froegel
(312) 478-1134

Thermo Electric (CANADA) LTD.
12 Rutherford Road South
Brampton Ontario, Canada L6V 3J2
Delegate:
Wes Lewis
(416) 451-8813

AT&T Technologies, Development Engineering
7725 W. Reno
Oklahoma City, Oklahoma 73125
Delegate:
Ron E. Groom
(405) 491-3265

AT&T Network Systems, Quality Control
7725 W. Reno
Oklahoma City, Oklahoma 73125
Delegate:
Cathy M. Lowes
(405) 491-4825

New-Tech-Cal
2510 Main St.
P.O. Box 40
Cato, New York 13033
Delegate:
William J. Burnett
(315) 626-6651

James McGuiness & Associates
267 State Street
Schenectady, New York 12305
Delegate:
Kenneth M. Romaniski
(518) 393-3635

Westinghouse AESD
P.O. Box 158
Madison, PA 15563
Delegate:
James E. D. Allshouse
(412) 723-5249

Mitel Corporation
350 Legget Drive
P.O. Box 13089
Kanata, Ontario K2K 1X3
Delegate:
John McNamara
(613) 592-2122, X4022

Central Pharmaceuticals, Inc.
120 E. 3rd Street
Seymour, IN 47274
Delegate:
Grant M. Ringstrom
(812) 522-3915

Genisco Memory Products Div.
10874 Hope Street
Cypress, CA 90630
Delegate:
John Svelund
(714) 220-0720

NBS - CEEB
Bldg. 220, Rm. B338
Gaithersburg, MD 20899
Delegate:
Judson C. French
(301) 975-2220

Amana Refriger, Inc.
Amana, Iowa 52204
Delegate:
Harold S. Hauck
(319) 622-2586

Day & Zimmerman Inc.
Lone Star Division
Tekarkana, TX 75501
Delegate:
Jerrell W. Gray
(214) 838-1326

Age Instruments, Inc.
P.O. Box 15784 STN 'F'
Ottawa, Ontario, Canada K2C 3J7
Delegate:
Ellis G. Ashworth

Apple Computer Inc.
20325 Mariani Ave.
Cupertino, CA 95014
Delegate:
William C. Maurer

Martin Instrument Co.
1020 E. School St.
Owatonna, MN 55060
Delegate:
Monte Martin

The Loeffler Group Inc.
6650 West Central Ave.
Suite D-4
Toledo, OH 43615
Delegate:
William R. Loeffler, PhD

Size Control Co.
299 Bond Street
Elk Grove Village, I11. 60007
Delegate:
L. Balunas

General Dynamics Land Systems
P.O. Box 1743
Warren, Michigan 48090
Delegate:
G. T. Winkowski

Avantek
481 Cottonwood Dr./M46
Milpitas, CA 95035
Delegate:
Rusty Jarzombek
support this growing conference? These and many other questions have to be answered and the sooner the better.

ANSI Liaison Report

The ANSI Standards Review Board has taken no action on consideration of ASQC Standard M1-1986, Calibration Systems, as a national standard. "The problem of a large number of unresolved negative ballots is being considered" was given as the reason for no action.

The ASQC Standards Review Board has spent a considerable time to determine that there were no unresolved negative ballots before submitting it to ANSI. A communications breakdown appears to be at the root of the problem.

ANSI did not respond to inquiries and, during a meeting of the ASQC Standards Committee, it was noted that ASQC standards procedures are outdated 2-10 years with regard to revised ANSI procedures. While action items were assigned to bring present ASQC procedures (and possibly ANSI procedures) into alignment, other action has been initiated to get the status of ASQC M1-1986 off dead center.

PMA Liaison Report

PMA has accepted NCSL's invitation to display the PMA booth at the 1987 NCSL Conference in Denver, Colorado, in July. Stephen Williams, PMA Director from the Colorado Section, will oversee the setup of the PMA booth, and will seek volunteers to man it.

A feasibility study is being made to determine whether it is practical to create a new PMA section in Colorado Springs, Colorado.

Bob Couture, longtime editor of the PMA Newsnotes, has resigned because of pressures of personal and professional business. He has promised his future support and involvement. Bob Myers is serving as interim editor until Mr. Couture's successor is selected.

The PMA Board of Directors are working to develop a new marketing program that will analyze PMA's position and objectives, and determine what groups of people should be serviced by PMA.
THE DANISH CALIBRATION SERVICE AND METROLOGY

BY

KIM CARNEIRO
Danish Institute of Fundamental Metrology
c/o National Agency of Technology
Tagenørv 135
DK-2200 Copenhagen N
Denmark

VERNER ERICHSEN
The Danish National Testing Board
Tagenørv 135
DK-2200 Copenhagen N
Denmark

TOMMY ERLAND MADS EN
SAS Standards Laboratory in CPH
SAS Engineering CPHTK
Copenhagen Airport
P. O. Box 150
DK-2770 Kastrup
Denmark

Abstract

The Danish Organization of Calibration and Metrology is described. Calibration is governed by the Danish National Testing Board according to an accreditation scheme for testing and calibration, and it is carried out at private and public laboratories at a fully reimbursable basis, with very little economic support from the State. At present 15 laboratories hold 20 calibration accreditations and examples are given of their capabilities. Legal Metrology is governed by the Council of Metrology and executed by the Secretariate for Metrology. Research in metrology is to be carried out by the newly founded Danish Institute of Fundamental Metrology in collaboration with existing research laboratories.

INTRODUCTION

In establishing a well functioning and up to date service network of metrology and calibration, Denmark faces several problems. The country is small (5.2 million inhabitants) and hence only limited resources can be allotted to any public service, included metrology. Danish industry is widely diversified so that the demands on the capabilities of calibration services is not significantly different from those of bigger countries. Finally, consumers' protection is well established in Denmark, steadily increasing the public quest for adequate product specifications.

The Danish solution of the problem of providing metrology support is based on a high degree of decentralization and privatization. A calibration service has been established according to the parliamentary act of 1973 (1). According to this, calibration may be carried out by any public or private institution on a self-financed basis, provided it meets the requirements of the Danish National Testing Board. Several years of experience demonstrates that the calibration services provided are reasonably adequate at a national level and measurement capabilities compare favorably with those of other countries. However, traceability to international standards are at present provided solely by foreign national laboratories.

Regarding legal metrology, legislative authority is delegated to the Council of Metrology according to an act of parliament of 1982 (2), and it is executed through the Secretariat for Metrology at the National Agency of Technology. Two years of experience indicate that this organization provides an adequate and flexible response to the rapidly expanding needs of society in the field of metrology.

The newly founded Danish Institute of Fundamental Metrology (DFM) is to maintain national standards and reference materials, to coordinate these objectives with foreign laboratories, and to carry out research in metrology. Its organizational chart is given in Figure 1.

THE DANISH NATIONAL TESTING BOARD

The Danish National Testing Board was established by a special Act in 1973 for the purpose of promoting and coordinating technical testing in Denmark. The main task of the board is to administer an accreditation scheme for testing and calibration laboratories.

The aims of the accreditation scheme are to provide a common basis for engaging all qualified testing resources regardless of ownership etc., to cover the existing demand for technical testing, and to ensure that the test results are officially recognized in Denmark and in other countries. Furthermore, it is to ensure qualified laboratories access to obtain official certification by proving that they are technically competent and generally unbiased, and to raise the level of performance for technical testing by promoting the development of a qualified, research-based and industrially related testing activity in accordance with the requirements of society.

The Scheme is voluntary and self-financed through annual fees from accredited laboratories. Assessment, surveillance and reassessment of laboratories are carried out by teams of experts from science and industry assisted by technically educated personnel from the Testing Board's Secretariat in the National Agency of Technology.

Currently 54 laboratories hold in total 105 accreditations out of which 15 laboratories hold 20 accreditations for calibration (11 mechanical, 5 electrical, 2 thermometry and 2 within other fields).

Accreditations are time limited, normally for 3 years, but can be renewed. The scopes of the accreditations vary from one specific standard method to a comprehensive technical
field with reference to certain groups of products and types of testing, provided the testing is performed in accordance with standards or similar generally recognized methods and instructions. One laboratory may very well be given several accreditations.

The calibration institutes at present face the problem of insuring adequate traceability for their measurement capabilities. This problem is imposed in principle by the lack of central umbrella institutions in the Danish Metrological System and in practice by the actual absence of an operation national institute. This gives rise to a variety of traceability paths as illustrated for mass and force in Figure 2. Force calibrations are performed at two Danish institutes which in common obtain traceability disseminated from PTB in West Germany. On the other hand, traceability of mass is disseminated from one of three institutions (SF in Sweden, NPL in England or PTB); but one of the Danish institutes then provides further dissemination to another calibration institute. DFM is foreseen to play an active role in simplifying the dissemination from traceable standards.

In the field of electrical quantities, SAS Standard Laboratory in the Copenhagen airport disseminates traceable standards to the other four calibration laboratories. The best measurement capability uncertainties for all five laboratories are as an example shown in Figure 3 for de voltage and resistance. It should be noted that Denmark has adopted the concept of "worst case" addition of estimated uncertainties, i.e. linearly adding the various contributions. It should also be pointed out that the following two features appear from Figure 3: firstly, the best calibration laboratories operate at a level which compares favorably with foreign calibration services, and secondly, calibration laboratories can be established at a variety of accuracy levels to meet the needs of individual, often in-house, customers.

NATIONAL COUNCIL OF METROLOGY

According to the new Act, a National Council of Metrology has been set up with the following responsibilities: to lay down regulations concerning metrology, measuring instruments and metrological control, to provide and maintain national standards of measurements and reference materials, to provide the metrological resources necessary for achieving the objectives and to arrange for appropriate and coordinated utilization of public and private laboratories, and finally to manage and to coordinate the Danish participation in international metrological cooperative activities.

The Act is meant to respond to society's growing need for improved measuring techniques and calibration. Trade in industry feels the need because of increased mass production, increased standardization as well as requirements for documented measurements, and narrow tolerances. Many companies acknowledge that export markets sharpen their requirements with respect to documentation for product quality and of the applied measurement techniques.

DANISH INSTITUTE FOR FUNDAMENTAL METROLOGY (DFM)

According to the Act, the institute shall be established as an independent institution financially based primarily on grants from the Council of Metrology.

In pursuance of the Act, the overall scope of activity for the institute shall be as follows: to provide traceability of measurements to those standards, to initiate and coordinate cooperation in metrological research and related activities with other laboratories, and to assist the Council of Metrology in achieving its objectives in general.

The institute is currently building its staff and will start its activities during the fall of 1986 in temporary laboratories at the Technical University of Denmark at Lyngby. The full staff is estimated to be about 10 scientists.

It is the intention to aim at the greatest possible interaction between DFM and other parts of the metrological organization shown in Figure 1. Hence, a number of "primary laboratories" will be established supported by the Metrology Council. Here the Council will utilize existing research capabilities at universities, service laboratories and industrial laboratories, where limited economic support can bring selected units to a fundamental level. It should be noted that such laboratories already participate in international metrological research. It is felt that the Danish decentralized system has several advantages over a big central institute - in particular for a small country with limited resources.

LEGAL METROLOGY

The new legislation has remarkably expanded the legal scope for laying down public regulations in the field of metrology. The 1950 Act only authorized regulations on measurements of length, volume and mass when carried out in public trade. Now the legal scope for metrological regulations is extended to cover all international units and all purposes for carrying out measurements.

As a consequence of the new legislation and its repeal of the Act on Weights and Measures of 1950 the institution "Justervaesnet" (Bureau of Weights and Measures) has terminated its activity by the end of 1982. Instead the Council of Metrology has assumed the responsibility "legislator" in the field of general and specific public regulations on metrology, measuring equipment and metrological control. When preparing the new act it was seen as an advantage to have one body to issue all relevant regulations, but on the other hand to separate the regulatory and executive function.
Danish Metrology

The latter functions have been placed with an Agency of the Ministry of Industry concerned with technology and technological development in general, including testing and accreditation of testing laboratories – namely the National Agency of Technology.

The Agency of Technology is not envisaged to carry out pure technical activities itself. It is, however, in pursuance of an executive order issued by the Minister of Industry entitled to authorize laboratories accredited by the National Testing Board, or governmental or municipal laboratories, to carry out activity in the field of metrological control and supervision.

The Agency of Technology itself is charged with the authority to issue pattern approvals of new measuring equipment. The testing and other scrutiny of the equipment for which pattern approval is applied will be referred to testing laboratories accredited by the National Testing Board.

CONCLUSION

The Danish calibration and metrology organization is in several respects a novelty. It is privatized and decentralized as opposed to large central bodies found in most countries although it does not completely remove the problems of adequate dissemination of traceable standards within the country. It circumvents the general problems of public spending, since it is largely self-financed. The parts of the Danish organization which have been implemented appear to be well functioning and to provide adequate services. However the Danish Institute of Fundamental Metrology still has to find its functioning place in the scheme.

References


<table>
<thead>
<tr>
<th>Quantity</th>
<th>Unit</th>
<th>Equipment</th>
<th>Parameter</th>
<th>Traceability Chains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>weights</td>
<td>kg</td>
<td>152 -&gt; 162 -&gt; SP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NPL -&gt; BIPM</td>
</tr>
<tr>
<td>Force</td>
<td>Newton</td>
<td>loadcells etc.</td>
<td>N</td>
<td>9 -&gt; 72 -&gt; PTB</td>
</tr>
</tbody>
</table>

Figure 2. Examples of traceability chains for measured quantities, shown for the quantities mass and force. Numbers indicate the respective authorizations.

![DC Voltage and Resistance Graph](image)

Figure 3. Examples of recognized capabilities, shown for dc voltage $V$ and resistance $R$. Uncertainties are estimated worst cases, as described in the text. Different symbols refer to different laboratories as indicated by the appropriate authorization number.
CALIBRATION SERVICE IN ITALY (SIT)
ACTIVITIES IN THE FIELD OF ELECTRICAL QUANTITIES

E. Arre*, S. D’Errunilio**, R. Perusi***

Abstract - An up-to-date description of workings and operative sectors of the California Service in Italy (Servizio di Tartura in Italia - SIT) is given. In particular, the operational procedures applied and the capabilities performed in the field of dc and if electrical metrology are analyzed.

INTRODUCTION

Traceability fulfills a major need in industry, as it is an essential condition for participating in multi-functional scientific and technical projects and for facilitating international trade. In fact, the present competitiveness of industrial products is closely connected to the metrological level of the instrumentation used in product quality control and this level can be guaranteed only by ensuring measurement traceability to the units of the SI system, as realized and maintained through unique national standards by the primary metrological Institutes.

To achieve a complete dissemination of the SI units in a country, it becomes necessary to integrate the calibration activity of the primary Institutes with all other national metrological resources. Therefore, a secondary organization has to be established, the so-called Calibration Service, composed of a number of industrial laboratories, both private and state owned, delegated to issue calibration certificates via a correct metrological chain or hierarchy of standards starting from the national standards.

For that reason, since 1970 several Calibration Services have been established in Western Europe, with a large degree of conformity as a result of the cooperation program initiated in 1975 and now known as Western European Calibration Cooperation (WECC). The main aspects of development and operation of one of them, the Calibration Service in Italy (Servizio di Taraturaj in Italia - SIT), are here presented, mostly from the viewpoint of the dissemination of the SI units for dc and if electrical quantities.

ITALIAN SYSTEM FOR SI UNITS DISSEMINATION

Implementation of the System

The establishment of the SIT was promoted at the end of 1975 by the Italian National Research Council (CNR) through its Metrology Commission. At the beginning of 1979, the SIT was able to begin the implementation of its voluntary network of approved secondary laboratories, or Calibration Centers, which operate in concert with the four Italian primary Institutes IMGC, IEN, ENEA, and ISS. The essential procedures to establish and develop this network consist of:

- approving as Calibration Centers only laboratories which can guarantee continuously traceable measurement capabilities;
- continuously monitoring and improving the capabilities of the approved Centers.

For each Center and measurement sector the measurement capabilities are established using well-defined approval procedures. Five requirements to be fulfilled are subjected to evaluation through documents, contacts, visits and measurement intercomparisons (audits):

- reliable measurement devices (first-line, second-line, and working standards, auxiliary apparatus);
- structure and environmental conditions of the laboratory suitable for maintaining standards and executing the calibration;
- traceability of the first-line standards to the national standards of the concerned primary Institutes;
- staff qualified in the measurement of interest;
- experimented and written procedures for assessing uncertainties of measurement and the traceability to the first-line standards of the second-line and working standards, of the instruments and measurements dealt with by the Center.

In some cases, capabilities for measuring a quantity are required to be established in more than one measurement sector. This term is related to the application of a specific set of instruments and procedures for measuring a quantity over a specified measurement range and at stated uncertainty levels.

These capabilities are defined and checked experimentally by carrying out the “first approval” procedure. Subsequently, they are steadily controlled according to the “maintenance” procedure and at the end of a two-year term they are checked again and renewed (“renewal” procedure).

IMGC = Instituto di Metrologia “Gustavo Colonnetti”
IEN = Instituto Elettrotecnico Nazionale “Galilio Ferraris”
ENEA = Comitato Nazionale per la ricerca e lo sviluppo dell’energia Nucleare e delle Energie Alternative
ISS = Instituto Superiore di Sanita
Moreover, if required and possible, they are extended to additional quantities, to new measurement and frequency ranges and to reduced levels of uncertainty ("Extension" procedure).

The measurement capabilities of each Center are reported in the approval table, specifying for each quantity:
- the subdivision and the number of measurement sectors.
- the instruments or types of measurements that can be dealt with.
- the measurement range and in case of the electrical quantities, the frequency range.
- the corresponding best level of uncertainty the Center can claim in its certificates.

As a rule, the uncertainties are estimated according to the Recommendation adopted by CIPM in 1981 [2] and taking into account the incorporation of recent national and international work into laboratory practice [3,4,5]. Typically for the electrical quantities, the uncertainties are expressed as two-standard-deviation estimates, according to a WECC document [6].

The measurement sectors where certificates are issued by the primary Institutes and/or by the SIT's Centers have been grouped as follows:

01) dimensional and angular quantities
02) mass, density, flowrate
03) force and related quantities
04) time and frequency
05) dc and if electrical quantities (up to 1 MHz)
06) hf electrical quantities (above 1 MHz)
07) magnetic and dielectric quantities
08) photometric quantities
09) acoustic quantities
10) thermal quantities
11) ionizing radiations

IMGC is responsible for sectors concerning the quantities in 01-02-03-10, IEN for those in 04-05-06-07-08-09, ENEA and ISS for those in 11.

At present SIT activities are coordinated by a Committee, comprised of representatives of primary Institutes and of the Calibration centers. Technical Secretariats operate in the context of each primary Institute. Moreover, two Working Groups on Mechanical and Thermal Quantities (Subgroups Length and Angle, Force and Pressure, and Temperature) and on Electrical Quantities are also operating. They report to the Committee, which is comprised of both members of the Committee and the Calibration centers, and operate especially for promoting the mutual control of metrological levels inside the service and the drafting of national standards concerning special items such as calibration procedures of end-gauge blocks, reference standard for the procedures of dimensional calibrations [3], and calibration intervals (the last document describes an algorithm for shortening down to T/3 or lengthening up to 2T for each instrument the interval T suggested by the manufacturer, on the basis of the results obtained in the previous calibrations and in the present one).

International Corporations

SIT cooperates with the Calibration Services of other countries. In the framework of the activities coordinated at the European level by WECC, [7] SIT signed in 1981 and 1982 with the German and British Calibration Services (DKD and BCS) mutual-recognition declarations attesting technical equivalence of certificates issued by their respective Calibration Centers. Moreover, on the occasions of two Italy-USA joint seminars held in 1984 and 1985 on "Calibration Services and Laboratory Accreditation", discussions have been started with a view towards possible future mutual recognition of laboratory accreditation programs in both countries. As a first step of this cooperation, six documents were signed at the end of the latter seminar attesting to the equivalence of the realization of the units of length, time electrical voltage, electrical resistance, electrical capacitance, and temperature in Italy and in the USA.

Development of the Activities

It is of some interest to furnish some data describing the development of the SIT activities [6,7]. The progressive number of the recognized Centers 5-12-16-20-22-27-33 at the end of 1979-80-81-82-83-84-85 respectively (at present there are 30 Centers in operation, as a result of three withdrawals at their request). The number of measurement sectors covered by the operating Centers were 84-120-132 at the end of 1983-84-85 respectively. Table 1 gives the status at the end of 1985; for each quantity the total number of measurement sectors and the progressive numbers of the recognized Centers are indicated. The analysis of the data referred to the last five years shows that the number of calibration certificates issued by the primary Institutes is nearly constant (of the order of 1200/year), whereas the number of SIT certificates issued by the SIT Centers was 530,723,982,1591, and 2140 in 1981-82-83-84-85 respectively. Usually the SIT Centers perform a large number of calibrations outside their recognized capabilities: this number was over 6000 and 9100 in 1984 and in 1985 respectively.

The personnel involved in technical certification activities during 1984 and 1985 have been estimated equal to 27 and 34 respectively for the primary Institutes (operation of SIT, calibration of the first-line standards of the Calibration Center, audits, measurement and test activity) and equal to 56 and 67 for the SIT Centers (recognition procedures, audits, SIT calibrations, and calibrations outside SIT).

As concerns auditing activity, fourteen audits and intercomparisons for 9 quantities were organized in 1985.
Italian Metrology

according to the procedures for first approval, extension, renewal and maintenance: participation of SIT Centers was 55, with an average of about 4 Centers/audit. With regard to technical exchanges between primary Institutes and Calibration Centers in 1985, assessment visits to SIT Centers involved 74 day-persons, while stays at the primary Institutes of personnel of SIT Centers involved 36 day-persons.

DISSEMINATION ACTIVITY FOR DC AND LF ELECTRICAL QUANTITIES

Methods and standards for assessing traceability

The methods and the standards used by the primary Institute (IEN) in assessing traceability in this field have been described recently in [10]. Owing to the needs of high accuracy throughout several electrical quantities and measurement number of users towards the approved Centers and to concentrate the dissemination activity of IEN towards the approval and maintenance of Centers with the minimum uncertainties. Consequently, these Centers can utilize their capabilities at a very high level to satisfy the demand of both the most qualified users and the Centers approved with larger uncertainty (Figure 1). This is obtained acting along the metrological chain, which starts from the primary standards maintained by IEN, by reducing both the number of transfers and the uncertainty contribution due to each of them. The number of transfers is limited by comparing each first-line standard of the Center with one belonging to a higher level, avoiding any intermediate intercomparisons. Moreover, new methods are coming into use today: a transportable standard with stable characteristics, made available by IEN, is circulated among the Centers and compared with their first-line standard and thereby the whole measurement system at the Center is calibrated. In any case the minimum number of transfers for the calibrations performed by the highest level Centers is two.

The uncertainty of each transfer in the metrological chain depends on several factors, to which the SIT procedures pay major attention. They can be grouped as follows:

- measurand definability
- measurement method and procedure
- standards and instruments used
- environment and influence quantities
- metrological skill of the operators
- number of measurements performed

In order to assess the levels of traceability, it is necessary to estimate the contributions to the total uncertainty of the following components:

- the IEN capability of measuring the quantity of concern in the specified ranges of values and frequencies.

- the comparison procedure between the IEN primary standard and the first-line standard, which is the measurand in this first transfer.

- the behavior of the first-line standard between two successive calibrations.

- the procedure and the instruments used in the successive transfer from the first-line standards used.

An example of metrological chain is shown in Figure 2 for the quantity dc voltage, where for each transfer is indicated the uncertainty reached in the calibration of the instrument below in the chain. An approved Center has usually two standard-cell enclosures, which are alternatively calibrated at IEN every six months. Each of them is assumed as a first-line standard for six months and a second-line standard for the next six months. This practice has been followed for the Centers approved with the best uncertainty of $5 \times 10^{-6}$ until 1984 [11]. In 1985 six SIT Centers, expected to be able to attain a traceability level of $3 \mu V$, were involved in an audit scheme based on 4-standard-cell enclosures [12]. A compatibility figure can be defined by:

$$\text{CF} = \frac{U_{\text{center}} - U_{\text{IEN}}}{s_{\text{center}}}$$

where $U_{\text{center}}$ is the mean e.m.f. of the four standard cells measured by a Center, $U_{\text{IEN}}$ is the mean e.m.f. derived from the linear fit of the IEN measurements, and $s_{\text{center}} = 3 \mu V$. From the final report on this audit [13] it follows that CF ranged from 0.1 to 0.4. Generally, values of $\text{CF} < 1$ expressed measurement capability and $\text{CF} < 0.5$ in the results of an audit scheme is an indicator of a properly assessed traceability. Consequently, the traceability level of $3 \mu V$ can be considered reached in this case.

Development and results

Table 1 shows that the field of dc and lf electrical quantities that is covered by 13 of the 30 SIT Centers, and contains 53 of the 132 measurement sectors. The diagrams of Figures 3 and 4 indicate the best recognized capabilities for the two recognized measurement sectors, i.e. dc voltage and dc resistance. The reported uncertainties represent the lowest values that the approved Center can claim in its certificates.

The numbers of certificates issued for electrical quantities by IEN and by the SIT Centers are indicated in Table 2.

CONCLUSION

In spite of its youth, SIT has already developed quite well defined structures and procedures. It has contributed considerably to the development of the metrological capabilities of several industrial laboratories and to the diffusion of correct measurement procedures. In addition, it has accumulated a large amount of technical data in assuring a
documented and continuous traceability of industrial laboratories to the national standards of SI units.

Nevertheless, also in the sector of the electrical quantities several topics need further consideration. These are mainly recognition procedures, the calibration methods for new-bred electronic instruments, the statements of uncertainty, rules for the calibration procedures and the certificates (already having a uniform lay-out), and the participation of the SIT Centers in preparing standards for specific measurement sectors. In addition, a growth of the Service is necessary in terms of numbers of recognized Centers, both in big and medium-size firms, and aiming at a satisfactory geographical distribution in the country. Finally, for the recognized Centers belonging to major firms, it would be desirable to expand the metrological sectors covered, to improve the uncertainty levels, and to increase their calibration volume.

REFERENCES


### Table 1. Accredited Centers for each quantity

<table>
<thead>
<tr>
<th>Quantity and number of measurement sections</th>
<th>Accredited Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (3)</td>
<td>01 04 06 07 12 18 23 25</td>
</tr>
<tr>
<td>Plane angle (2)</td>
<td>04 06</td>
</tr>
<tr>
<td>Force (4)</td>
<td>02 17 23 30</td>
</tr>
<tr>
<td>Resilience (5)</td>
<td>02 17 23</td>
</tr>
<tr>
<td>Strain (2)</td>
<td>02 17</td>
</tr>
<tr>
<td>Hardness (3)</td>
<td>02 17 23</td>
</tr>
<tr>
<td>Pressure (7)</td>
<td>04 10 24 25</td>
</tr>
<tr>
<td>Frequency (6)</td>
<td>05 06 15 19 22 27</td>
</tr>
<tr>
<td>DC voltage (5)</td>
<td>04 09 10 14 15 16 21 22 27 31 32</td>
</tr>
<tr>
<td>DC resistance (10)</td>
<td>04 09 10 14 15 16 21 22 23 31</td>
</tr>
<tr>
<td>DC voltage ratio (7)</td>
<td>04 05 10 14 15 16 21 22 23</td>
</tr>
<tr>
<td>DC current (5)</td>
<td>04 09 10 14 15 16 21 22 31</td>
</tr>
<tr>
<td>AC voltage (4)</td>
<td>05 06 15 21</td>
</tr>
<tr>
<td>AC current (3)</td>
<td>05 15 21</td>
</tr>
<tr>
<td>Capacitance (5)</td>
<td>05 10</td>
</tr>
<tr>
<td>Active power (2)</td>
<td>06 19</td>
</tr>
<tr>
<td>Active energy (2)</td>
<td>21</td>
</tr>
<tr>
<td>HF power (1)</td>
<td>06 19</td>
</tr>
<tr>
<td>Temperature (10)</td>
<td>09</td>
</tr>
<tr>
<td>Luminous flux (5)</td>
<td>09</td>
</tr>
<tr>
<td>Temperature (10)</td>
<td>10 11 20 24 28 29</td>
</tr>
<tr>
<td>Exposure (1)</td>
<td>29</td>
</tr>
<tr>
<td>Exposure rate (1)</td>
<td>29</td>
</tr>
</tbody>
</table>

### Table 2. Calibration certificates for electrical quantities.

<table>
<thead>
<tr>
<th>Year</th>
<th>IEN</th>
<th>SIT</th>
<th>Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>144</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>240</td>
<td>184</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>314</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>300</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>200</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>136</td>
<td>651</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Typical metrological chain for an electrical quantity in the SIT system

Figure 2. Typical metrological chain for the quantity dc voltage,

Figure 3. Best recognized capabilities for the dc voltage

Figure 4. Best recognized capabilities for the dc resistance
Philip J. May has been appointed the new Coordinator of Region 3. I would like to thank the NCSL Board for giving me the opportunity to serve as Regional Coordinator for the past two years.

On Wednesday, January 21, 1987, a Region 3 meeting was held at the Patuxent Inn in Lexington Park, Maryland. Tom Tena, Assistant Technical Director, was the host. The program included four talks on ionizing and optical radiation metrology. The speakers discussed current NBS radiation measurement services and new work in progress. Elmer Eisenhower, Chief of the Office of Radiation Measurements, described several current laboratory accreditation programs now active in the radiation area. In the afternoon, Tom arranged a tour of the Chesapeake Test Range and the metrology laboratory of the Patuxent Naval Air Test Center.

MEETING AGENDA

General Meeting

"NBS Ionizing Radiation Measurement Services" - Dale Hoppes, Chief, Radioactivity Group

"Measurement Quality Assurance and Laboratory Accreditation for Ionizing Radiation" - Elmer Eisenhower, Chief, Office of Radiation Measurement

"UV and Soft X-ray Measurement Services" - William Ott, Chief, Radiaton Physics Division

"NBS Radiometric Measurement Services and New Low-Background Infrared Measurement Program" - Don McSparron, Group Leader, Measurement Services Group, Radiometric Physics Division

2:00-4:00 Tour of the Patuxent Naval Air Test Center

ATTENDEES:

John Adams  
Naval Aviation Logistics Ctr., Patuxent, MD

Cecil Barbee  
Duke Power, Charlotte, NC

Elmer Eisenhower  
NBS

Jim Fairfax  
Naval Air Test Center, Patuxent, MD

Edward Greer  
Naval Air Test Center, Patuxent, MD

Bob Halliburton  
Oak Ridge National Lab, Oak Ridge, TN

Carl Holland  
Naval Aviation Logistics Ctr., Patuxent, MD

Dale Hoppes  
NBS

Bob Horne  
Mantech Services Corp., Lexington Park, MD

Sandor Horvath  
Naval Air Rework Facility, Norfolk, VA

Al Jones  
Naval Aviation Logistics Ctr., Patuxent, MD

Don McSparron  
NBS

Philip May  
Bionetics Corp., Hampton, VA

Art McCoubrey  
NBS

Ron Nassar  
Naval Air Test Center, Patuxent, MD

Bill Ott  
Duke Power, Charlotte, NC

Tony Readling  
NBS

Joe Simmons  
ManTech Services Corp., Lexington Park, MD

Tom Tena  
CASSI, Gaithersburg, MD

Peter Unger  
Naval Air Test Center, Patuxent, MD

Steve Vellines  
Naval Surface Weapons Center, Silver Spring, MD

Ted Wilkie  
Naval Aviation Logistics Ctr., Norfolk, VA

Paul Willenborg  
ManTech Services Corp., Lexington Park, MD

INTERNATIONAL REGIONAL DIRECTOR'S REPORT

Canadian Section - 6th. Annual Meeting

90 persons attended the 6th Annual Canadian Section Meeting held November 26 and 27 at the National Research Council of Canada, Montreal road, Ottawa. Six Canadian member organizations participated in the equipment and services display. The meeting, organized by Canadian Coordinator Duane Brown, included:

"NCSL - An Introduction", Video Tape

"A Comprehensive Approach to Metrology", An informed view of the Canadian scene highlighting the need for...
education in the science of metrology — Wally Buitts, Canology Group Inc., Cambridge.

"The Uncertainty Budget". What is it? How does it affect us? A major contribution by Dr. Andy Dunn, NRCC.

"NRCC’s Laboratory for Basic Standards". Dr. Jacques Vanier, NRCC followed by afternoon tour of the Physics division laboratories.


National Measurement System Development — Graham Cameron, Quality Engineering Test Establishment, Ottawa.


Visits to NRC Electrical Engineering laboratories.

The 6th Canadian meeting dates conflicted with Thanksgiving, making attendance impossible by President Nemeroff and others. We will try to schedule 1987 dates in advance, to avoid future conflicts.

Minutes will be distributed to BOD later in January.

ORGANIZATIONAL DEVELOPMENT

The matter of meeting with international NCSL member organizations interested in establishing sections was discussed on two occasions with the President, who may incorporate certain interested areas in his upcoming visit schedule. The current membership is in the order of 80 member organizations.

FAR EAST

On January 13th I was visited by Dr. Raymond Sangster of Raytheon Service Co., Burlington, Massachusetts, who is currently on assignment in Taiwan. We spent some time discussing how a centre of NCSL activity might be initiated in that part of the world. Dr. Sangster will provide the writer with an approach that could facilitate development of a nucleus of NCSL activity. Discussed status of People’s Republic of China membership with Steffen Peiser of Raytheon Services and subsequently with President Nemeroff and Secretariat Armstrong, which resulted in latter’s correspondence to the President.

ISRAEL

A set of minutes covering the 6th Canadian Section Meeting is going forward together with other items which may be of value to the development of a section in Israel.

APPRECIATION

On November 5th I attended a retirement event for Vic Bussey, President of Guideline Instruments Ltd., Smiths Falls, Ontario and presented an NCSL Certificate of Appreciation for "The major contribution he and various members of the Guideline organization have made to the development of the NCSL organization and to the worldwide metrology community."

On January 9th I provided a message of appreciation, which was presented at the retirement event for Dr. Andy Dunn of National Research Council Canada. The message highlighted Andy’s contributions to NCSL and noted NCSL’s 1984 recognition of his efforts through the William A. Wildhack award.

BUDGET

Provided input for 1986 Treasurer Davidson for the 5-year budget plan. I recommended Jan. amount for the Canadian Section and a separate budget item for the rest of the international region, with the anticipated "start up" funding which could be required every second year for other sections in the region.

REGION 8

Dec. 3, 1986
Stardust Hotel
San Diego, CA.
Richard Ringard
Coordinator, Region 8
San Diego Section

After welcome by Dick Ringard and self-instructions, ESD problems were discussed. During these discussions, it was mentioned that manufacturers should state the sensitivity of parts on the package.

Rolf Schumacher thought industry should set classifications and standards for ESD sensitive parts. Hal Clark, of Valhalla Scientific, recommended surprise audits of vendor’s ESD programs, stating that there is not much use in having ESD program at manufacturer and user if the middleman is "sloppy" in the handling of ESD parts. Valhalla has seen a 3 to 1 reduction in field failures since a stringent ESD program has been instituted.

Another important item mentioned was the fact that "pink poly" prevents static buildup, but passes along a static charge,
so metallized mylar is preferred. Stan Warren, from Wavetek, was concerned with the increase in cost that this brings to the product. However, with increased usage, the price per unit (bag) will come down from its present level.

Handbook 263 was mentioned by Hughes representatives as the one government ESD document they refer to.

Rolf will find out if IEEE or ASTM are working on static standards. William Fry said Gidep has a large amount of information on ESD.

After the morning break, the group "tackled" the question of "in situ" calibration and got many varied comments. The consensus of opinion seemed to be that it is being used more often, but 90% of all test equipment still goes to the lab for calibration. Rolf said that Rockwell does 60% in situ.

The question of software control was raised. It seems to qualify as a topic for the next meeting.

The lab certification question triggered a lively exchange of ideas. Rolf told the group about four sessions on lab accreditation that were held at the NCSL conference. Although unable to attend, he heard that very little progress was made.

One point brought up was the fact that European countries are now starting to ask for imports to meet certain standards. After lengthy discussions of world and "local" accreditation problems (mostly off record), it was decided to try & form an ad-hoc committee for cooperative auditing of suppliers of calibration services.

Tom Nowell and Dick Ringard volunteered to serve at the first ad-hoc committee meeting to be held in January of 1987. The magic answer will be long in coming.

The afternoon was spent discussing various topics such as CORE audits; the still unresolved volts and ohms change; and the latest attempt at a MIL STD 45662 rewrite. NCSL has been told it will be consulted.

GD representative, Tom Nowell talked about a system for use of shelf stored equipment, i.e. when does the clock start?

Richard Ringard
The meeting was hosted by Ralph Bertermann of G. D. Searle, in Skokie, Illinois. There were thirty three people in attendance.

Ralph Bertermann opened with an introduction of the days agenda.

A brief discussion of NCSL matters began with Art Vogt, of ITT Research Institute, and Dave Duff, of Eli Lilly. They discussed the sectional concept of creating new regions. Some of the advantages stated for the sectional concept being easier management, and the ease of travel for NCSL members.

Dave Upton of Ruska Instrument Corporation, then gave a presentation of Precision Pressure Standards. His discussion covered the following topics:

1. General Pressure Terminology
2. Ruska Instrumentation and Concepts

He followed with demonstrations on the Fused Quartz Bourdon Tube Pressure Transducer, the 6000 Series direct Reading Gauge/Controller, a Dead Weight Piston Pressure Gauge, and a Differential Pressure Null Detector.

John Sullivan, from MKS Instruments Inc., presented a talk on Vacuum Measurements. He covered the recent advances in total pressure (vacuum) measurement. He compared the accuracies, ranges and the advantages and disadvantages of various vacuum transducers (i.e., Capacitive, Pirani, Thermocouple, McLeod, Spinning Rotor Gauge). He completed his presentation with a discussion on the calibration capacitance manometers.

Bill Fitzgerald, from Baxter Travenol, concluded the days presentations with a talk on Validating Calibration Processes. He discussed the following topics.

1. Sterilization Distributive Measurement and Control System
2. Traceability of Process Measurement (Back to NBS)
3. Measurement Assurance
4. Thermocouple Calibration Process
5. Application of Measurement Uncertainties to Process Limits

The days activities concluded with a tour of the Metrology Lab at Searle and a complete tour of the R & D facility, showing the various steps a pharmaceutical compound goes through on the way to becoming a product.

I would like to thank Darrell Klein for preparing these minutes.
and tables for solids and liquids. Moreover, as noted above, the accuracy and precision of the data used to compute these tables rarely will warrant this. Thermodynamic functions and transport properties are printed to more significant figures than the data upon which they are based. New printed functions will be different, for most substances, only in the nonsignificant digits. The effect of these proposed changes on technology will be minimal. Even in the case of the steam tables, it is not expected that these changes will significantly alter the technological use of these tables. It is expected, however, that the next overall consideration of the thermodynamic and thermophysical data that are used for the construction of the next generation of thermodynamic tables (including steam tables) will incorporate the changes that are being considered.

Technological use may mean any of the following:

The old table will be used but interpreted on the new proposed scale.

The old table will be used but the temperatures are converted to the new table.

No attention will be paid to the new scale.

An example of the scientific changes that would occur as a result of the adoption of the new scale can be found in the use of the steam tables to compute the molar volume of saturated water vapor from the Clausius-Clapeyron equation in the form:

\[
V_{\text{vapor}} = V_{\text{liquid}} + \text{latent heat} \left( \frac{dT_{\text{vapor}}}{dP_{\text{sat}}} \right) 
\]

If the vapor volumes were recalculated on the new scale, they would be changed by a factor which is approximated \( \frac{dT_{90}}{dT_{68}} \). Near 373K this factor is approximately 0.9996. Such a change in the vapor density (-0.04%) could be measured using available experimental techniques. Comparable changes in the tables for the speed of sound and the constant pressure heat capacity, as derived from a correlation of PVT data would occur upon conversion to the proposed scale. These quantities are now measured to 0.01% accuracy in several laboratories.
NCSL BOARD OF DIRECTORS
1987

4.0 PRESIDENT*
Edward Nemeroff
Datron Instruments Inc.
4125 S.W. Martin Hwy.
Stuart, FL 33497
(305) 283-0935

5.0 EXECUTIVE VICE PRESIDENT*
Gary Davidson
TRW/OSG S-2767
One Space Park
Redondo Beach, CA 90278
(213) 535-1684

20.0 - 60.0 VICE PRESIDENTS
20.0 Bob Weber
Lockheed Missiles & Space Co.
Dept. 0/48-70, Bldg. 195 A
P.O. Box 3504, Sunnyvale, CA 94088-3504
(408) 756-0270

30.0 Bill Simmons
Barrios Technology
1331 Gemini St.
Houston, TX 77058
(713) 483-3583

40.0 Delbert H. Caldwell (Code 312)
NWS Seal Beach Det.
Corona Annex
Corona, CA 91720-5000
(714) 736-4247

50.0 Joe D. Simmons
National Bureau of Standards
816 Physics Bldg.
Gaithersburg, MD 20899
(301) 975-4201

60.0 John Martin
Westinghouse NES, Forest Hills
P.O. Box 855
Pittsburgh, PA 15230
(412) 829-3703

6.0 PAST PRESIDENT*
R. B. (Pete) England
General Dynamics, Pomona
Mail Zone 4-32, P.O. Box 2507
Pomona, CA 91769
(714) 868-4519

7.0 SECRETARY*
Selwyn (Smitty) Smith
RCA Solid State Div.
Route 202
Somervile, NJ 08876
(201) 885-6103

8.0 TREASURER*
Roland Vavken
Rockwell International, D120 031-HC02
3370 Miraloma Ave.
Anaheim, CA 92803
(714) 762-3560

9.0 NBS REPRESENTATIVE TO THE BOARD
G. A. Uriano, Director
Measurement Services B352
National Bureau of Standards
Gaithersburg, MD 20899
(301) 975-2036

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

71.0 - 79.0 DIRECTORS
71.0 Richard Drews (Regions 1 & 2)
Martin Marietta Measurement Systems
1636 W. Oak Ridge Rd.
Orlando, FL 32809
(305) 356-4873

72.0 Anthony Anderson (Regions 3 & 4)
Guildline Instruments, Inc.
4403 Vineland Rd., Suite B-10
Orlando, FL 32811-7335
(305) 423-8215

73.0 Ralph Bertermann (Regions 5 & 11)
G. D. Searle & Co.
4901 Searle Pkwy.
Skokie, IL 60077
(312) 982-7611

74.0 Chester J. Crane (Regions 6 & 8)
Teledyne Microelectronics
12964 Panama St., MS-15
Los Angeles, CA 90066
(213) 822-8229, Ext. 2449

75.0 James Ingram, Jr. (Regions 7 & 9)
Inwil Metrology
34037 Mello Wy.
Fremont, CA 94535
(408) 756-0276

79.0 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
Telegy, Inc.
1119 Industrial Rd.
San Carlos, CA 94070
(415) 594-1700

20.0 VP Operations — Robert Weber
21.0 BUSINESS SYSTEMS
Roland Vavken (Acting)
Rockwell International, D120 031-HC02
3370 Miraloma Ave.
Anaheim, CA 92803
(714) 762-3560

22.0 MEETINGS AND PROGRAMS
M. J. (Moe) Corrigan, Jr.
Lockheed Electronics Co., Inc.
1601 U.S. Highway 22, MS-724
Plainfield, NJ 07061
(201) 757-1600, Ext. 3023

23.0 PUBLICATIONS
Thomas D. Knowles
ITT Avionics Div.
100 Kingsland Rd.
Clifton, NJ 07014
(201) 284-3230

24.0 ADMINISTRATIVE GUIDELINES & BY-LAWS
Dean A. Brungart
Teledyne Systems Company
19601 Nordhoff Street
Northridge, CA 91324
(818) 717-6872

30.0 VP Marketing — Bill Simmons
31.0 NEWSLETTER
John Minck
Hewlett-Packard Co.
SPD 5U, Box 10151
Palo Alto, CA 94303-0889
(415) 857-2060

32.0 MEMBERSHIP
John Curtin
Anritsu America, Inc.
15 Thornton Rd.
Oakland, NJ 07436
(201) 337-1111

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

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

40.0 VP Lab Mgmt. — Delbert Caldwell
41.0 calibration System Management
Selden McKnight
Hughes Aircraft Co., MS 801, H-18
P.O. Box 11337
Tucson, AZ 85734-3733
(602) 295-4800

42.0 MEASUREMENT ASSURANCE PROGRAMS
Arno Ehman, M/S H-02-C
Beckman Instruments Inc.
2500 Harbor Blvd.
Fullerton, CA 92834
(714) 773-3475

43.0 NATIONAL MEAS. REQUIREMENTS
Klaus Jaeger
Lockheed Missiles & Space Co.
Bldg. 195A, Org 48-75
P.O. Box 3504
Sunnyvale, CA 94088-3504
(408) 756-0289

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

45.0 CALIBRATION INTERVALS
Howard T. Castrup
Science Applications Int'l.
300 S. Park Ave., Suite 950
Pomona, CA 91766-1596
(714) 623-6711, Ext. 205

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

50.0 VP Industrial Technology — Joe Simmons
51.0 BIOMEDICAL & PHARMACEUTICAL METROLOGY
Douglas Smith, Dept. 736-M4
Abbott Laboratories
1400 Sheridan Rd.
N. Chicago, IL 60064
(312) 937-4929
<table>
<thead>
<tr>
<th>52.0 AUTOMATIC TEST &amp; CALIBRATION SYSTEM COMMITTEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ken Carrington</td>
</tr>
<tr>
<td>Bionetics Corp. Mail Stop 330</td>
</tr>
<tr>
<td>Arnold AFS, TN 37389-9998</td>
</tr>
<tr>
<td>(615) 454-5698</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>53.0 PRODUCT DESIGN &amp; SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>James Hartley</td>
</tr>
<tr>
<td>Tennessee Valley Authority CPSC</td>
</tr>
<tr>
<td>Chattanooga, TN 37401</td>
</tr>
<tr>
<td>(615) 677-4317</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>54.0 UTILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raymond D. DiSandro</td>
</tr>
<tr>
<td>Philadelphia Electric Co.</td>
</tr>
<tr>
<td>2301 Market St., N4-1</td>
</tr>
<tr>
<td>Philadelphia, PA 19101</td>
</tr>
<tr>
<td>(215) 841-4900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>60.0 VP Education &amp; Training — John Martin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joan Wingo</td>
</tr>
<tr>
<td>Barrios Technology Inc.</td>
</tr>
<tr>
<td>1331 Gemini</td>
</tr>
<tr>
<td>Houston, TX 77058</td>
</tr>
<tr>
<td>(713) 483-3578</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>61.0 TRAINING AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joan Wingo</td>
</tr>
<tr>
<td>Barrios Technology Inc.</td>
</tr>
<tr>
<td>1331 Gemini</td>
</tr>
<tr>
<td>Houston, TX 77058</td>
</tr>
<tr>
<td>(713) 483-3578</td>
</tr>
</tbody>
</table>

71.1 REGION 1                                     |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Harry Haymes</td>
</tr>
<tr>
<td>Sanders Associates</td>
</tr>
<tr>
<td>95 Canal St., NCA1-0137</td>
</tr>
<tr>
<td>Nashua, NH 03061-2004</td>
</tr>
<tr>
<td>(603) 885-4913</td>
</tr>
</tbody>
</table>

71.2 REGION 2                                     |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>William Brenant</td>
</tr>
<tr>
<td>Loral Electronics Corp.</td>
</tr>
<tr>
<td>1440 Story Ave.</td>
</tr>
<tr>
<td>Bronx, NY 10473</td>
</tr>
<tr>
<td>(212) 378-2300 Ext. 376</td>
</tr>
</tbody>
</table>

72.1 REGION 3                                     |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Philip J. May</td>
</tr>
<tr>
<td>Bionetics Corp.</td>
</tr>
<tr>
<td>20 Research Dr.</td>
</tr>
<tr>
<td>Hampton, VA 23666</td>
</tr>
<tr>
<td>(804) 865-0880</td>
</tr>
</tbody>
</table>

72.2 REGION 4                                     |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>John P. Riley</td>
</tr>
<tr>
<td>NASA, ST-PEI-38</td>
</tr>
<tr>
<td>Kennedy Space Center, FL 32899</td>
</tr>
<tr>
<td>(305) 867-4737</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>62.0 TRAINING INFORMATION &amp; DIRECTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dave Lorenzen</td>
</tr>
<tr>
<td>McDonnell-Douglas Corp.</td>
</tr>
<tr>
<td>5301 Bolsa Ave.</td>
</tr>
<tr>
<td>Huntington Beach, CA 92647</td>
</tr>
<tr>
<td>(714) 896-4574</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>63.0 ADJUNCT TRAINING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard Drews (Acting)</td>
</tr>
<tr>
<td>Martin Marietta Measurement Systems</td>
</tr>
<tr>
<td>1636 W. Oak Ridge Rd.</td>
</tr>
<tr>
<td>Orlando, FL 32809</td>
</tr>
<tr>
<td>(305) 356-4873</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>64.0 EDUCATION LIAISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate Webster</td>
</tr>
<tr>
<td>Cortez III</td>
</tr>
<tr>
<td>5111 W. 164th St.</td>
</tr>
<tr>
<td>Brookpark, OH 44142</td>
</tr>
<tr>
<td>(216) 362-0040</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>65.0 METROLOGY COMPENDIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clifford Koop</td>
</tr>
<tr>
<td>Rockwell-Collins</td>
</tr>
<tr>
<td>P.O. Box 728, M/S 137-152</td>
</tr>
<tr>
<td>Cedar Rapids, IA 52498</td>
</tr>
<tr>
<td>(319) 395-5554</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>73.1 REGION 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. D. (Dave) Duff</td>
</tr>
<tr>
<td>Eli Lilly &amp; Co., MC263, 32/W</td>
</tr>
<tr>
<td>303 McCarty Street</td>
</tr>
<tr>
<td>Indianapolis, IN 46285</td>
</tr>
<tr>
<td>(317) 276-2973</td>
</tr>
</tbody>
</table>

73.1.1 NO. OHIO/MICHIGAN SECTION, Region 5         |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne Zucker</td>
</tr>
<tr>
<td>The Standard Oil Co.</td>
</tr>
<tr>
<td>Research Center, E320C</td>
</tr>
<tr>
<td>4440 Warrensville Center Rd.</td>
</tr>
<tr>
<td>Cleveland, OH 44128-2837</td>
</tr>
<tr>
<td>(216) 581-5959</td>
</tr>
</tbody>
</table>

73.1.2 SO. OHIO/INDIANA SECTION, Region 5          |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amos (Max) Green</td>
</tr>
<tr>
<td>Technology Applications, Inc.</td>
</tr>
<tr>
<td>5100 Springfield Pk, Suite 500</td>
</tr>
<tr>
<td>Dayton, OH 45431</td>
</tr>
<tr>
<td>(513) 256-6633</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>73.2 REGION 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanford (Sandy) Breault</td>
</tr>
<tr>
<td>Minnesota Mining &amp; Mfg.</td>
</tr>
<tr>
<td>544-02 SM Center</td>
</tr>
<tr>
<td>St. Paul, MN 55144</td>
</tr>
<tr>
<td>(612) 733-4764</td>
</tr>
</tbody>
</table>
## REGIONAL COORDINATORS (cont’d) 1987

<table>
<thead>
<tr>
<th>Region</th>
<th>Section</th>
<th>Coordinator</th>
<th>Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>73.2.1</td>
<td>TWIN CITIES SECTION, Region 11</td>
<td>Sanford (Sandy) Breault (Acting)</td>
<td>Minnesota Mining and Mfg. 544-02 3M Center St. Paul, MN 55144 (612) 733-4764</td>
<td></td>
</tr>
<tr>
<td>73.2.2</td>
<td>CHICAGO SECTION, Region 11</td>
<td>Arthur Vogt</td>
<td>IIT Research Institute 10 West 35th Street Chicago, IL 60616 (312) 567-4499</td>
<td></td>
</tr>
<tr>
<td>74.1</td>
<td>REGION 6</td>
<td>Robert B. Willett</td>
<td>Rockwell-Collins MS 405-110 1200 N. Alma Rd. Richardson, TX 75081 (214) 996-7070</td>
<td></td>
</tr>
<tr>
<td>74.1.1</td>
<td>DALLAS SECTION, Region 6</td>
<td>Robert B. Willett (Acting)</td>
<td>Rockwell-Collins MS 405-110 1200 N. Alma Rd. Richardson, TX 75081 (214) 996-7070</td>
<td></td>
</tr>
<tr>
<td>74.1.2</td>
<td>DENVER SECTION, Region 6</td>
<td>David R. Workman</td>
<td>Martin-Marietta Aerospace P-9622, P.O. Box 179 Denver, CO 80201 (303) 977-8470</td>
<td></td>
</tr>
<tr>
<td>74.1.3</td>
<td>HOUSTON SECTION, Region 6</td>
<td>Randy Wear</td>
<td>John Fluke Mfg. Co. 2602 Lively Ln. Sugarland, TX 77479 (713) 240-5995</td>
<td></td>
</tr>
<tr>
<td>74.2</td>
<td>REGION 8</td>
<td>Rolf B. F. Schumacher</td>
<td>Rockwell International/Autonetics Department 120 031-10C02 3370 Miraloma Avenue Anaheim, CA 92803 (714) 762-0265</td>
<td></td>
</tr>
<tr>
<td>74.2.1</td>
<td>LOS ANGELES SECTION, Region 8</td>
<td>Robert (Bob) Smith</td>
<td>Metrology Lab EVT-26 Ford Aerospace &amp; Communications P.O. Box A Newport Beach, CA 92663 (714) 720-4820</td>
<td></td>
</tr>
<tr>
<td>74.2.2</td>
<td>SAN DIEGO SECTION, Region 8</td>
<td>Richard Ringard</td>
<td>Ringard Metrology Suite L, 5644 Kearny Mesa Rd. San Diego, CA 92111 (619) 277-5515</td>
<td></td>
</tr>
<tr>
<td>74.2.3</td>
<td>PHOENIX-TUCSON SECTION, Region 8</td>
<td>Lee J. Walters</td>
<td>Motorola G.E.G. MS H1179 8201 E. McDowell Rd. Scottsdale, AZ 85257 (602) 949-3613</td>
<td></td>
</tr>
<tr>
<td>74.2.4</td>
<td>SALT LAKE SECTION, Region 8</td>
<td>Elden (Pete) L. Hansen</td>
<td>Morton Thiokol, Inc. Brigham City, UT 84302 (801) 863-8313</td>
<td></td>
</tr>
<tr>
<td>75.1</td>
<td>REGION 7</td>
<td>Paul P. Chong</td>
<td>ESL Inc., MS303 495 Java Dr. Sunnyvale, CA 94088-3510 (408) 738-2888 Ext. 5207</td>
<td></td>
</tr>
<tr>
<td>75.2</td>
<td>REGION 9</td>
<td>Val Gersbach</td>
<td>John Fluke Mfg. Co., Inc. P.O. Box C9090 Everett, WA 98206 (206) 356-5473</td>
<td></td>
</tr>
<tr>
<td>79.0</td>
<td>INT’L DIRECTOR REGION 10</td>
<td>J. Graham Cameron</td>
<td>Dept. of National Defence Quality Engineering Test Estab., QETE 7 Ottawa, Ontario, K1A 0K2 Canada (819) 997-3411</td>
<td></td>
</tr>
<tr>
<td>79.1</td>
<td>CANADA REGION</td>
<td>Duane Brown</td>
<td>Guildline Instruments Ltd. 21 Gilroy St. Smiths Falls, Ontario, K7A 4S9 Canada (613) 283-3000</td>
<td></td>
</tr>
</tbody>
</table>