One prepares for the Presidency of NCSL by updating the Long Range Plan, the principle project of the Executive Vice President. It is the Exec. V.P.'s duty to thoroughly review where NCSL has been, where it is now, and more importantly, where it is going. Now that I have completed that year of contemplation, evaluation, and prediction, I would like to share some of my thoughts with you.

The NCSL membership has continued to grow beyond all expectations. There are now over 335 members representing organizations with ever diversifying technical disciplines. What a wealth of talent our organization represents!

The NCSL organization of Board, Committees, and Regions remains strong. With the assistance of Past Presidents, a dedicated Board of Directors, Committee Chairmen, and Regional Coordinators are providing up-to-date information on the subjects which concern you the most. Through the newsletters, our annual conferences, and regional meetings, subjects such as NBS Reorganization, Voluntary Lab Accreditation, Measurement Assurance Programs, Automatic Test Equipment, Calibration Laboratory Management, and Education and Training remain priority items of discussion.

There has been a strengthening of direct interchange between NBS and NCSL. Laurel Auxier, John Minck, and I met with Dr. Ernest Ambler, Director of NBS, and key members of his staff on January 23, 1978 (I hope to have another such meeting this year). Dr. Thomas A. Dillon, Deputy Director of NBS, Dr. John D. Hoffman, Director of the National Measurement Laboratory, and Dr. John W. Lyons, Director of the National Engineering Laboratory, met with the NCSL Board of Directors on October 3, 1978, to discuss the NBS reorganization, and the need for strengthening communications for the mutual benefit of NCSL/NBS (more information in the BOD minutes). Certainly much of the credit for this overall strengthening of NBS/NCSL interchange should be given to Dr. Bascom Birmingham who is serving most capably as the Sponsor's Delegate.

It must be obvious to you that I am enthusiastic about the current and potential value of NCSL to your organization, and to you in the everyday operations of your laboratories. The maximum return on your NCSL investment depends entirely on your participation. Do you attend and participate in your regional meetings? Do you seek answers to your everyday operational problems through the NCSL Directors, Regional Coordinators, and other members? Do you volunteer to serve on NCSL Committees of particular interest to you? Do you share your expertise with other NCSL members who could benefit by it? What type of help do you expect from NCSL? When you do realize benefit from NCSL, do you communicate it to your management? I sincerely hope that after you consider these questions, the answers will lead to more fruitful participation in the National Conference of Standards Laboratories. As John Lee has said on many occasions, the fifty dollars annual membership dues is the best bargain around. Take what NCSL has to offer and I'm sure you will agree.

Appreciation: The 1978 NCSL Conference was a huge success due to the untiring efforts of our Co-Chairmen Sam Davidson and Dr. Brian Belanger. Congratulations to you both for a job well done!

Ronald E. Kidd
President
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ANDREW J. WOODINGTON — 1922-1978

A sad note was sounded at the opening of the 1978 Measurement Science Conference when it was reported that Andy Woodington was shot and killed in Pomona on November 2, 1978.

Andy was a respected colleague whose name and personality is stamped on years of Measurement Industry work. He contributed in any way he was needed, from Joint Measurement Conference Chairman to working in the trenches on routine committee work. His name threads through years of membership in NSCL, ISA, IEEE, ASQC, PMA, MSC, and other civic affairs, often in organizational and management roles.

After Korean War duty, Andy joined the Convair Division of G/D in roles involving production engineering and calibration facilities for the Atlas installations. He continued in Quality and Reliability work with G/D through 1976 when he moved to work with the Navy Metrology operation. He was BSEE graduate of Purdue University.
LET'S HAVE A SINCERE ROUND OF APPLAUSE FOR OUR RETIRING EDITOR WILBUR ANSON AND ASSISTANTS!!

In September 1975, Mike Suraci prepared to take over as President and announced his retirement as Newsletter Editor. There was a concentrated search for a new newsletter editor.

The position promised nothing but hard work and frustration in flogging recalcitrant Committee Chairmen, Regional Coordinators, Board Members to supply copy by tight deadlines. The winner got to work all this in with his regular job, and in addition, had to figure how to use local secretarial and graphic support services without encroaching too much on their time.

Fortunately for NCSL, Wilbur Anson of NBS stepped forward again to volunteer for this mostly thankless job. Wilbur had three previous years of editing the Newsletter so he couldn't plead total ignorance to its impact on his life. But it is obvious to all of us that Wilbur has again done a tremendously valuable service in his latest three years as Editor.

NCSL appreciates that dedication as well as the crucial support of the NBS Boulder management in Wilbur's work. The NCSL Newsletter is the life blood of the NCSL system because it is the regular link between Board, committees, regions and members.

Sincere appreciation goes to the other people Wilbur enlisted at NBS to actually turn out the publication. Over the 3 years all of these individuals contributed.

Wilbur will now devote more time to regular duties at the NBS Boulder Electromagnetic Division.

(L to R) Margaret Woolley, Sharon Foote, Sheila Aaker, Arlene Miller all assisted in 1975-77.

Phyllis O'Rourke handled Editorial Assistant duties for the last 3-4 issues.
FRANK McGINNIS RECEIVES NCSL WILDHACK AWARD

Frank McGinnis, Director of Product Assurance at Sperry Rand Corporation of Great Neck, New York, has received the 1978 Wildhack Award from the National Conference of Standards Laboratories (NCSL). The award is presented annually by NCSL to recognize outstanding contributions to the field of metrology and measurement science consistent with the goals and programs of NCSL.

The award is named for William Wildhack, who was instrumental in founding NCSL. Wildhack was a staff member of the National Bureau of Standards (NBS), the sponsor of NCSL since its beginning in 1961. The Wildhack Award, consisting of an inscribed plaque and a $1000 honorarium, was awarded at the 1978 Annual NCSL Conference Banquet, October 4, 1978, by John Minck, immediate past president of NCSL.

McGinnis is a well-known figure in the electronics, missile, and space fields and has served on numerous Industry Association—DOD committees concerned with measurement standards, quality, and reliability.

McGinnis is chairman of the Industry—DOD Joint Service Automatic Test Equipment Project (AIA, NSIA, EIA, WEMA, and Shipbuilder’s Council). He played a key role in its successful conference at San Diego in early 1978. This project is making a major effort to identify and solve problems associated with large automatic measurement systems now widely used in aerospace and military system maintenance.

He has served as Chairman of the Aerospace Industries Association Quality Control Committee, and from 1965 to 1968 served on the National Academy of Science Advisory panel to the National Bureau of Standards.

McGinnis is a Fellow of the American Association for the Advancement of Science, the American Society for Quality Control, a member of the European Organization of Quality Control, IEEE, a licensed professional engineer and other groups. He received a B.E.E. from Cooper Union in New York and his 36-year professional career has been served all with Sperry.

At the banquet presentation, Minck noted that 2 years ago the Wildhack award went to Dr. Ambler of NBS, recognizing his work as scientist and administrator. Last year, Doug Strain was honored as an entrepreneur and industry spokesman for measurement science.

Minck further observed that this year’s award was going to a member of the quality/product assurance community in recognition of their crucial interaction with measurement science. McGinnis’ work has conspicuously recognized and supported metrology. The metrology lab at Sperry was under his management for a period. He also served as Chairman of the Calibration and Standards Committee of AIA.

Appropriately, McGinnis can be considered to be the first appointing officer of NCSL since Lloyd Wilson, the first NCSL President, reported to McGinnis and was fully supported in his NCSL duties in 1961.

McGinnis’ committee management in aerospace automated testing has continued this high concern for measurement assurance and has zeroed in on significant problems involved with calibration of large automated test systems.
HIGHLIGHTS OF THE NCSL BOARD OF DIRECTORS MEETING
Oct. 2 & 3, 1978
NBS, Gaithersburg

President's Report
Mr. Boyle of DARCOM reports that the proposed revision of MIL-C-45662A has been terminated for the time being. Some minor changes may be proposed at a later date.

Laurel stated that his Secretary, Evelyn Milam, thanks NCSL for receipt of a hand calculator and Certificate of Appreciation for Secretarial Services.

Treasurer's Report

On the proposed Fiscal Year 1978-79 budget, Bob indicated the budget for the Newsletter had been increased due to inflationary costs in printing and paper. He also stated the budget for the President's expenses had been increased to accommodate the four BOD meetings scheduled in the new Fiscal Year.

Jim Valentino recommended that the $600 budget for Education and Training in the Fiscal Year 1978-79 budget be amended and increased to $1500. He stated there is considerable increased activity in NCSL Training Tapes. The amended budget was approved.

Secretary's Report
Hartwell reported on the results of the recent election for the year 1978-79:
Executive Vice President — James Valentino
Vice President, Administration — Hugh Starling
Vice President, Communications & Marketing — John Lee
Secretary — Douglas Doi

Directors: Maurice Corrigan, Jr. — Regions 1 & 2
Dennis Gallagher — Region 3
Jarmon McKinney — Regions 4 & Int’l
Sam Davidson — Regions 5 & 6
Hartwell Keith — Regions 7 & 8

He stated that the Election Committee reported the balloting for the election was extremely light, down 10 to 20% compared to previous years. In order to increase participation in the 1978-80 election, Hartwell solicited suggestions from the Board Members. After a lengthy discussion, a motion passed to have the Directors communicate appropriately with Regional Coordinators to encourage member delegates to respond to ballots in a timely manner.

Since the last BOD meeting twenty-six (26) new Member Organizations had joined NCSL. Hartwell expressed his thanks to the Board, Committee Chairman and Regional Coordinators, Liaison Delegates and past officers for their support and encouragement over the past two years. To a round of applause, Ron Kidd on behalf of NCSL thanked Hartwell for an excellent job.

Secretariat's Report
Ken Armstrong reported the distribution of a letter from Dean Brungart to all members regarding the “Calculator Program Interchange;” distribution of revised “By-laws” section; entered into the NCSL computer a list of 250 new laboratories for the next Directory; and completed mailing of promotional membership kits.

Video tapes and cassette-slide training aids continue to be increasingly popular. Due to the poor quality of some of the training aids, Ken was given an action item to develop a form to accompany training aids asking for comments on the quality of the tapes or cassettes received.

John Lee was given an action item to contact GIDEP concerning the publication of a list of available NCSL Training Aids in the GIDEP “Metrology Newsletter.”

Sponsor's Delegate Report
Bascomb briefed the board from material later given at the conference (see Address, page 19). In response to the Bureau’s request for input from NCSL, Ron Kidd stated that the Executive Committee will meet to establish an “Advance Technology Ad Hoc Committee.”

The Ad Hoc Committee established the following guidelines:
Jim Valentino will chair the committee, which will consist of the NCSL Executive Committee and selected NCSL members. The Committee Charter will read, “ENVISIONS, IDENTIFIES, EVALUATES, AND PRIORITIZES PROGRAMS OF MUTUAL INTEREST TO NCSL AND NBS.” The programs identified by the Executive Committee, but not listed in priority sequence, are:
• Develop MAP Handbook,
• Establish viable vehicle to disseminate NBS data management methodology techniques to NCSL
• NBS to provide direction and methodology of calibration of high performance/self calibratable instrumentation, including automatic test equipment.

Regional Reports
Region 1 — Director Moe Corrigan reported the region has been relatively inactive since the May BOD meeting. To conclude his May action item, Moe has sent a letter to all his regional delegates reaffirming the concern of the Board to the needs of the members. To date, he has received no response.
Another dual meeting is planned at the end of October and one in November of this year and one in the spring of next year.

Region 2 — Meeting report on page 35.

As an effective way to follow up on unpaid members, Moe recommended all Directors be given blank invoices with the computer run, thus eliminating need to contact Helen Valdez for action.

After a lengthy discussion, Ken Armstrong was given an action item stating that after the first quarter report is published listing the delinquent members, another run reinvoicing only the unpaid members would be sent out to the Directors. The Directors will then be responsible for marking the second invoice “Second Notice” and forwarding to the unpaid member as required.

Region 3 — Meeting report on page 35.

Region 4 — John Riley, the Regional Coordinator, reported 20 paid members, 11 of which are from the private sector. Their next meeting is being scheduled in conjunction with the April 1979 NCSL BOD meeting in Tampa, Florida. John stated that three (3) laboratories are presently participating in individual EMF MAP’s, and plans to invite an NBS representative to participate in the April regional meeting.

Region 5 — Cliff Koop, Regional Coordinator, reported they did not have a meeting since the May BOD meeting. He announced the next meeting was scheduled on Tuesday, Oct. 3, 1978 at NBS Gaithersburg. The region has 55 members with four members reported unpaid. Next meeting is scheduled for early spring 1979.

Region 6 — Paul Groos, Regional Coordinator, stated he was asked by IBM to speak at a Management Conference at Austin, Texas, on the 25th of October. He plans to take a liberal supply of NCSL Membership Kits, since the attendees have already shown a keen interest in NCSL.

Region 7 — Director Bob Lady reported for Steve Henneberry, the Regional Coordinator. Last regional meeting was held at John Fluke Mfg., Co. in May.

Region 8 — Meeting report on page 37. Director Bob Lady reported for Rolf Schumacher, the Regional Coordinator.

International Region — Regional Coordinator, Mac McKinney reported four new members since the May ’78 BOD meeting, bringing a total of 25 paid members from the International Sector.

Mac then brought up the question whether the International members should receive training tapes, etc. He was not aware of any restrictions concerning this issue. After a lengthy discussion, a motion was passed that the NCSL Training Aid Library will not be available to members in the International Region (excluding Canada) due to customs restrictions and cost. The calculator cassette exchange program is not affected by this motion. However, NCSL will advise the requestor where the training aids can be purchased.

Report of Vice President — Administration

Meetings and Program Committee. Chairman Sam Davidson reported that during the past year he had devoted most of his time to the 1978 NCSL Conference.

In 1979 he plans to provide regional coordinators with topics which would be of general interest for regional meetings. Sam asked that all Directors continue to have their regional coordinators send copies of their meetings to him. He further stated that the results of the 1978 Conference Best Session Questionnaire will help focus on topics of interest to the membership.

Honors and Awards Committee. Chairman Doug Doi reported that “1979” plates for the Membership Plaques and 1978-79 NCSL Letterheads had been ordered and distributed. Directors will be responsible for making letterhead distributions to their respective Regional Coordinators. A brief report on 1977-78 awards was made with a complete report promised after the upcoming conference.

Education and Training Committee. Chairman Hank Daneman reported that the committee’s approach has been to address four segments in the education and training area: 1) Short Courses — courses which could be run parallel with regional meetings; 2) Training available outside the auspices of NCSL — Hank distributed a listing of metrology courses and conferences; 3) Correspondence Courses — Hank has collected a series of courses which he eventually hopes to make available in a library; 4) Formal Education — the upcoming conference will address educational requirements of the future, regarding regulatory agencies. Hank stressed the need for a curriculum guide for post high school metrology courses. He then made a motion that the Education & Training Committee be authorized to prepare a no-cost proposal for preparation of a course guideline for metrology technicians. Motion passed.

Report of Vice President — Measurement Requirements

Graham suggested that future Conference Co-Chairman consider taping paper presentation but not workshops, which do not lend themselves to recording. As part of a previous Action Item, Graham recommended proceeding with the preparation of an RP for “The Audit Survey of a Company Providing a Calibration Service.” On behalf of the Laboratory Evaluation Committee, Dennis Gallagher accepted this recommendation.

National Measurements Requirements Committee. In the absence of Frank Flynn, the Committee Chairman, Graham Cameron presented a revealing and informative Final Report of the Committee’s Questionnaire (see page 41 of Newsletter). The questionnaire attempted to focus on the perceptions and problems of the NCSL membership concerning NBS support. In the coming year the committee intends to work with NBS to develop the necessary information and prepare additional questionnaires to further define specific problem areas.
Laboratory Evaluation Committee. Chairman Dennis Gallagher reported that his committee activities during the last quarter consisted of preparing for the 1978 Conference and keeping informed on the progress of the American Association of Laboratory Accreditation (AALA).

Incorporation of AALA was formally complete. At AALA's recent July meeting they elected officers, reviewed by-laws, and reviewed discipline standards for accreditation.

NVLAP has made available an advance copy of a Federal Register on Proposed Criteria for Accrediting Testing Laboratories that test thermal insulation material. This is the next to last step of seeking full accreditation. NVLAP performs its accreditation on a product basis, and AALA on a discipline basis.

Biomedical Committee. Chairman Andy Dickson reported that the charted goal of the committee has been the distribution of information which will assist our members in their work with regulatory agencies and biomedical standards organizations.

Since early this year the committee has been working towards developing a set of guidelines for recognition of metrologist proficiency. This effort is a direct result of the requirements of FDA's Good Manufacturing Practice regulation.

Recommended Practices Committee. Chairman Bob Weber reported that the committee has primarily concerned itself with the draft version of RP2, Evaluation of Measurement Control Systems and Calibration Laboratories. Coordination comments to draft #3 were relatively limited except for comments from George Rice, Rockwell International.

Bob stated it is the committee's intention to incorporate existing coordination comments and print RP2, then go back to consider comments from Rockwell at a later date. On behalf of his committee, Bob moved that the "tentative" status of published NCSL Recommended Practices be eliminated. Following coordination and Board approval, the new RP's would be published; routinely reviewed and revised as required. Motion passed.

Position Paper on Metrological Competence

Andy Dickson, Chairman of the Bio-medical Committee, submitted a skeleton guideline on "Recommendations for Evaluation of Proficiency - Metrologist Medical Devices and Instrumentation," for review and comment by the Board. Andy stated he would like Board consensus on its acceptance before proceeding and possibly end up with a finished product which is not aligned with NCSL or NBS guidelines.

After considerable discussion by the Board, it was decided that a valid consensus of the Board could only be reached after monitoring the 1978 Conference Workshop concerning this issue.

Ron Kidd took an action item to get together with Andy after the Conference to generate some specific questions which could be asked of the Board to establish a general consensus. Andy then announced that Geron Smith of Yellow Springs Instrument Co., would be assuming Chairmanship of the Bio-medical Committee. Andy was then given a round of applause for his outstanding work as Committee Chairman.

Report of Vice President - Laboratory Management and Operations

Calibration Systems Management Committee. In the absence of Chairman George Rice, Dean reported on committee activities. Study of establishing and adjusting intervals between calibrations, completed and published in the Newsletter. Selected instrument surveys being developed with results being disseminated to participating organizations. Revision of NCSL's "Compilation of Government Specifications Affecting Calibration Laboratories" is proceeding slowly. Salary survey is planned for early next year.

Measurement Assurance Committee. Chairman Gary Davidson reported that the committee was completely reformed during the period of October to December 1977. Although progress has been slow, the Committee is still developing and trying to expand the regional MAP concept. A concept that can result in reduced costs, education, inter-company communication, and improved quality. The regional MAP concept has been presented at most NCSL regions by NBS personnel. After a year, only one additional MAP group has been started.

Some of Gary's observations concerning MAPS are: A regional group needs a dynamic leader responsible for coordination and implementation; start with two strong labs then expand, and a guideline is needed to eliminate coordination problems. Dr. Brian Belanger stated the NBS MAP handbook is forthcoming next spring.

Product Design & Specifications Committee. In Chairman Chuck Corbridge's absence, Dean reported that the committee has been reviewing two iterations of RP's. RP-3 is in the final stages and with a few minor corrections will be submitted to the Recommended Practice Committee. The third edition of the RP for Specifications was recently reviewed, and corrections made for a fourth iteration. Dean took an action item to mail copies of the RP for Specifications to the Board members for review and comment.

Calibration Laboratory Automation Committee. Chairman Pete Bigland submitted a written report and stated that a major portion of his time was spent on his assignment as NCSL representative on the Industry/Joint Services Automatic Test Project.

With the 1978 Cal Lab Automation Survey complete, the results will be published in the NCSL Newsletter. The data on users of automation systems will be entered in the next NCSL Directory. The Desk Calculator Interchange Program is off and running, with 18 members indicating a willingness to share program tapes. A questionnaire to query NCSL Conference attendees has been developed, seeking information on their needs and desires for NBS assistance in the area of automatic calibration.
Executive Vice President's Report

Ron Kidd presented a written report summarizing the activities and accomplishments of each of the committees during the past year, and expanded on selected activities verbally.

Long Range Plan - Round Table

Ron listed the objectives the Board had established for 1978 and asked for a review to determine if NCSL should continue on with these goals in 1979:

- MAP Programs - still of utmost priority, retain
- Expanded Management Study - an ongoing goal, retain
- Membership Goals - an ongoing goal, retain
- Education and Training - still extremely important, retain

NOTE: Due to lack of time, it was decided that the remaining goals listed below would be discussed at a later time.

- Calibration System Management
- Calibration Laboratory Automation
- NVLAP Awareness
- Top Management Awareness of NCSL Goals

Report of Vice President - Communications and Marketing

Vice President John Lee reported that with approximately fifty (50) "Membership Kits" remaining, a decision had to be made what NCSL intends to do in this area for 1979. After a discussion, John took an action item to prepare and stock 1979 Membership Kits.

John stated that the 1979 Brochures would be printed in a green cover and asked for inputs concerning any changes.

When the procedure for annual screening of the complimentary Newsletter listing complete, John took an action item to implement it in January 1979.

After a lengthy discussion and a majority vote by the Board, John took an action item to work with Bascom Birmingham and Ken Armstrong to prepare a NCSL Slide Presentation Outline at the next Board Meeting. He welcomed comments and suggestions for the preparation of the outline.

Newsletter Editor John Minck submitted a publishing schedule and reported that although he was starting with a zero backlog of material, he planned to publish four issues in the next fiscal year. He urged committee men and regional coordinators to submit all the material, pictures and input they can provide.

John will pursue an action item previously assigned to Ken Armstrong, to obtain a second class mailing permit for mailing the Newsletter.

Information and Directory Committee Chairman Jim Gilbert reported that of the 4515 copies of the 1977 Directory published, the remaining 140 would be made available to the conference attendees.

Although Jim's report estimated 1700 copies of the 1979 Directory would be needed, the Board amended the quantity upward to 2500 to account for the 300 membership kits required in 1979, and 500 additional copies for direct mailing.

To a round of applause on behalf of NCSL, John Lee thanked Jim for an outstanding job.

NBS Organizational/NCSL Roundtable

To start the informal round table discussion, Bascom Birmingham introduced the panel members from the Bureau: Dr. Tom Dillon, Deputy Director; Dr. John Hoffman, Director, National Measurement Laboratory; and Dr. John Lyons, Director, National Engineering Laboratory.

John Minck distributed a discussion outline which had key questions concerning the Bureau's recent reorganization, measurement services, and basic research.

Dr. Hoffman and Dr. Lyon stated that the initial shock waves of the recent major reorganization are over and the Bureau is now in the new structure doing quite well.

The funding for the Center for Absolute Physical Quantities was reported to be relatively stable. Although there had been a transfer of people to the National Engineering Laboratory, they could foresee no serious problems.

The panel touched on such key issues as: Measurement Services today and tomorrow; NBS involvement in industrial automation; impact of Senate oversight hearings on NBS; NBS budget posture present and future; and how NCSL and its member companies can assist NBS in anticipating changes in industry.

To a round of applause, John Minck on behalf of the Board thanked the NBS panel members for their most informative and enlightening presentation.

1979 Conference

Ron Kidd announced that Hartwell Keith will be one of the Conference Co-Chairpersons, the second will be from NBS.

The 1979 NCSL Conference is scheduled in Boulder, Colo. in the month of October. The 1978 Conference Questionnaire will help with the choice of the type of Conference it will be.

FDA Lectures

Dennis Gallagher reported on his participation in two FDA training sessions, which included the evaluation of metrologists engaged in the calibration of medical devices and instrumentation. He expressed his personal views to FDA that the emphasis in calibration should be on the existence of a procedure for qualifying and evaluating the competency of a metrologist's work.

Next Board Meeting

Ron Kidd announced that the next Board meeting would be held at Tulsa, Oklahoma, on the 25th and 26th of January, 1979, Rockwell International to be the host.
# NCSL TREASURER'S REPORT

Final Expense Budget Status Fiscal Year 1977-78
1 Oct 1977 thru 30 Sept 1978

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NCSL BUDGET FOR FISCAL YEAR 1978-79  
(October 1, 1978 thru September 30, 1979)

BUDGETED EXPENSES — Committee Accounts

<table>
<thead>
<tr>
<th>Account Description</th>
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<tr>
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<td>IB Honors and Awards</td>
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<td>IC Education and Training</td>
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BUDGETED EXPENSES — Operations

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ESTIMATED INCREASE (DECREASE) IN FUNDS

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<td><strong>$11,075.00</strong></td>
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Approved by action of NCSL Board of Directors on October 2, 1978.

Attendees:

R.E. Kidd, President, Microwave Assoc.
J. A. Valentino, Exec. Vice President, Sanders Assoc.
D.A. Brungart, Vice President, Teledyne
J.G. Cameron, Vice President, Canadian DOD
J. Lee, Vice President, Honeywell, Inc.
H. Statling, Vice President, General Electric Co.
D. M. Doi, Secretary, Lockheed, California Co.
L. R. DeLapp, Treasurer, SRI International
B. W. Birmingham, Sponsor's Delegate, NBS
L. Auxier, Past President, Beckman Instruments
M. J. Corrigan, Jr, Director, Lockheed Electronics Co.
S. L. Davidson, Director, Schlumberger Well Services
D. H. Gallagher, Director, Leeds and Northrup Co.
H. C. Keith, Director, Ford Aerospace
J. C. McKinney, Director, U.S. Army Metrology Center
L. K. Armstrong, Secretary, NBS
R. M. Lady, Committee Chairman, Lockheed Georgia Co.
H. Daneman, Committee Chairman, H. L. D. Assoc.
G. Davidson, Committee Chairman, TRW/DSSG
R. B. England, Committee Chairman, General Dynamics

A. H. Dickson, Committee Chairman, Varian
J. L. Minick, Newsletter Editor, Hewlett-Packard Co.
J. N. Gilbert, Committee Chairman, Automation Ind., Inc.
R. L. Weber, Committee Chairman, Lockheed Missiles
J. P. Riley, Reg. Coord. (4), NASA/Kennedy
C. D. Koop, Reg. Coord. (5), Rockwell-Collins
P. J. Groos, Reg. Coord. (6) Rhodes-Groos Lab., Inc.
D. J. Greb, OMNI Liaison, Lockheed Missiles & Space Co.
Dr. E. Belanger, Co-Chairperson, 1978 Conf., NBS
M. Suracl, Past Officer, NCSL, Lockheed Missiles
Dr. T. A. Dillon, Guest, National Bureau of Stds.
Dr. J. D. Hoffman, Guest, National Bureau of Stds.
Dr. J. W. Lyons, Guest, National Bureau of Stds.
K. Leedy, Guest, National Bureau of Stds.
D. E. Edgerly, Guest, National Bureau of Stds.
H. M. Altschuler, Guest, National Bureau of Stds.
R. J. Couture, Workshop Chairman, Rockwell/Autonetics
The new top management team at NBS. (Dr. Ambler was absent due to illness). (L to R) Dr. John Hoffman, Director National Measurement Lab, Dr. Tom Dillon, Deputy Director NBS, Dr. John Lyons, Director National Engineering Lab.

Laurel Auxier goes over last minute conference details with co-chairmen Brian Belanger and Sam Davidson.

The Board asked for an informal review of the NBS reorganization status, budgets & priorities. Drs. Hoffman, Lyons, Dillon & Birmingham obliged with a very informative session.
Enjoying the atmosphere at the Kennedy Center restaurant are NCSL President Ron Kidd and wife Laura.

(L to R) Shirley & Sam Davidson (Sam was 1978 conference co-chairman) Bascomb Birmingham, Director of the Boulder Lab, Dot Delapp.

June & Graham Cameron, Dian & Dr. Brian Belanger, Office of Measurement Services, NBS

Carol and Dr. Tom Dillon, Deputy Director of NBS, past president Laurel Auxier. Ron Kidd, back to camera.

Dr. John Lyons, Director of the National Engineering Lab, NBS, Nancy and Cliff Koop, Bob Weber.
I am very pleased that you are again holding your NCSL National Conference here at NBS. It is a great pleasure for us at NBS to observe how NCSL has grown in size and prestige since its formation in 1961, and I would like to extend a hearty welcome to both old and new members of this fine organization.

I am not able to follow the day-to-day business of NCSL, as I did from 1968-69 when I served as Sponsor's delegate. I do follow, as Director of NBS, your changes in policy and general direction. I do this because your organization is a most important institution in assessing the accuracy and uniformity of measurements, which is our mutual business. And a most important business it is; one that is always growing and changing, as the demand increases for more complex, more rapid, more accurate and more efficient measurement systems.

Your membership of 326 constitutes a 50% growth since the 1976 meeting here at Gaithersburg. This growth is tangible evidence of the valuable coordination you provide to the measurement community. Your current membership rolls clearly indicate a broader range of measurement interests. In your formative years, NCSL membership was largely drawn from the aerospace and defense community. While these areas continue to have a real stake in the success of NCSL, you are now attracting a broad range of new members, utility companies, state weights and measures labs, and a growing number of organizations from other countries are now joining NCSL. I believe this growth and diversity confirms the vitality of NCSL and the effectiveness of its leadership, past and present.

An example of the growing base of NCSL membership falls in the area of medical device manufacturers. The "Good Manufacturing Practices" regulation promulgated by the Food and Drug Administration has prompted many manufacturers to call us for information. What they usually ask for is help in locating technical and management information related to establishing and operating a calibration laboratory. Naturally, one of the best pieces of advice we give them is to review the NCSL membership kit that we mail. We also advise them to join NCSI, since you are one of the best sources of such information, and many of these manufacturers are now NCSL members.

As you diversify your base of membership, we should continue to broaden the NCSL ties to NBS with emphasis upon the newer areas of interest. This is an important theme which I will amplify later in my remarks.

Before doing that I would like to bring you up to date on what has been happening at NBS. For a change, we have positive budget news for the next fiscal year. Our Congressional appropriation will be around $87M, a 24% increase over last year. This healthy increase can be attributed to a number of factors. First, we submitted vigorous justifications of on-going programs, and requested increases for programs of broad national interest. These requests had top-level support within the Department of Commerce, especially on the part of Dr. Baruch, the Assistant Secretary for Science and Technology. Our Statutory Visiting Committee, a group that examines NBS in depth and reports each year to the Secretary of Commerce, also made a very strong case for expansion of our programs. There was also strong support for basic research by the President. In his State of the Union address he said "I am recommending a program of real growth of scientific research..." He also said "I am determined to maintain our nation's leadership role in science and technology". This determination reflects his appreciation of the importance of science and technology to economic growth.

There are areas of increase, such as non-destructive evaluation and automation technology, whose programs will be of interest to NCSL members. But the budget item I consider the most significant is that of competence building. I have felt for some time that our response to new legislative assignments has been made at the expense of long term scientific excellence. To reverse this situation we have been given $1.3M in 1979 for building our competence. This money will be used to establish or strengthen centers of excellence. These groups will then be available to apply their expertise to problems throughout NBS. We envision a 5-year program of competence building that will put this activity at about 15% of our total appropriation. This program is a very healthy trend for NBS, one that will maintain us as a first-rate scientific institution. The ultimate pay-off will be the ability to operate at the forefront of science and engineering, including many areas that concern NCSL.

This strong interest in basic research on the part of the government is also paralleled by a desire to move strongly in support of technology and industrial innovation.

From our vantage point at NBS we have been able to see during the last decade a strong and in many ways justified con-
cern over the adverse side of technology. Oil spills, air pollution, and urban noise have been common topics. On the other hand the positive effects of technology such as economic growth, jobs, productivity, and standard of living have not received much, if any attention. That imbalance is now disappearing, and the President has initiated a Domestic Policy review of the impact of the Federal government on industrial innovation. The day-to-day conduct of this study is under the direction of Jordan Baruch, the Assistant Secretary of Commerce for Science and Technology. The study will produce by next April a set of policy options for the President's consideration, and will cover such areas as procurement, regulation, patents, and trade policy.

Jordan Baruch has also proposed a cooperative venture between government, industry, and universities aimed at developing technologies common to a particular industry. The feasibility of such a program, in which NBS could play a major role, is now being studied. I am happy to say that the emphasis is on voluntary cooperation, which as we believe seems to work best in the long run in a pluralistic society such as ours.

Another major event of the past year was a reorganization of NBS, the first in 13 years. One of my objectives was to restructure the Bureau more closely along functional lines. We have achieved that goal by creation of a National Measurement Laboratory and a National Engineering Laboratory. The Institute for Computer Sciences and Technology continues largely unchanged. The reorganization also gave us the chance to bring together similar competences that were scattered throughout the Bureau. Finally, we were able to streamline by reducing the number of formal units from 249 to 106. This reduction facilitates the transfer of people into new and challenging assignments without the need for vast amounts of paperwork. I believe this reorganization has put NBS in position to better meet the needs of our clientele, including NCSL.

There are a number of points I would like to make regarding NCSL and the new NBS structure. First, Bascom Birmingham, Director of our Boulder Laboratories, will continue to provide extremely valuable service as Sponsor's Delegate to NCSL.

We have also established, within the National Measurement Laboratory, the position of Associate Director for Measurement Services. Art McCoubrey, whom many of you know well, heads this group. Their job is to act as focal point for our efforts to provide measurement services and for our efforts to ensure that U.S. interests are fully represented in international measurement standards activities. Reporting to Art are three offices that have close ties to NCSL.

One such group is the new Office of Domestic and International Measurement Standards, headed by Dave Edgery. Among other things, it coordinates our participation in the International Organization for Legal Metrology. When the United States joined OIML in 1972, NBS was given responsibility for coordinating U.S. involvement. To do our job well requires the strong support and participation of many groups. I know that many OIML activities, in particular the work of OIML pilot secretariat 24, "Principles of Metrolological Control," are of direct interest to NCSL. I'm pleased that NCSL members are cooperating with us in our work to formulate meaningful U.S. inputs to OIML decisions.

There is a second group under Art McCoubrey that is of direct interest to NCSL, and that is the Office of Measurement Services. This office, now under Brian Belanger, has long been one of the primary focal points for NCSL within the Bureau. OMS is responsible for setting policy for and administering our calibration services and Measurement Assurance Programs, which of course brings it into close contact with NCSL.

In addition, the Office of Measurement Services has taken on a new responsibility that should interest you. Their new project is to coordinate improvements in the management and use of precision measurement and test equipment throughout the Federal government. This new responsibility evolved from a General Accounting Office report that called attention to the need for better coordination among civilian agencies. The Office of Management and Budget, in responding to this report, asked NBS to take on such an activity. In encouraging such cooperation, the Office of Measurement Services will work through an interagency committee established for this purpose.

NCSL members will be asked to participate in special workshops at NBS to explore technical or management issues related to precision measurement within the Federal Government. Both OMB and GAO believe that Federal agencies should utilize private capabilities whenever feasible, and this of course includes those NCSL members willing to perform work for Federal agencies on a fee basis. Federal facilities requiring calibrations may not always know where to obtain such services. We are encouraging such facilities to make use of the NCSL Directory as a good source of information on commercial capabilities and to consider NCSL membership. In this environment, development and use of NCSL recommended practices becomes even more important.

The Office of Weights and Measures, led by Al Tholen, also reports to Art McCoubrey. The state and local weights and measures units served by this Office are, like yourselves, broadening their scope. Some of them are developing measurement capabilities in areas such as pressure and radiation, and are interested in working with local industry. There may be natural areas of cooperation between NCSL and state measurement officials that could be developed.
Of course, there are reorganized groups in all parts of NBS whose work is of interest to NCSL, and I can cite but a few in my remarks today.

- We have brought together in the Center for Electrical and Electronic Engineering 3 units whose functions are interrelated. These are the electromagnetics activities at Boulder, plus the semiconductor standards and measurement work and the high voltage and electrical instrument standards work here at Gaithersburg.

- The Center for Mechanical Engineering and Process Technology provides many important measurement services in the dimensional and mechanical areas and is developing a program in automation technology.

- The Center for Absolute Physical Quantities provides traceability to electrical units and temperature, and conducts research on fundamental physical constants.

These groups and others provide the traditional kind of calibration service that is so valuable to NCSL. But, as I said earlier, the growing scope of your interests may well call for broader ties to NBS. Bascom Birmingham recently wrote to the Directors of our two Laboratories asking them to encourage the participation of their staff members in NCSL activities. Several areas for interaction came readily to mind. For example, we have a very large Standard Reference Materials program. These materials, certified by NBS as to chemical composition or physical property, are used by the purchaser to calibrate instruments or to validate measurement systems and methods. Where feasible, this approach can save the down time normally associated with calibration at NBS. It also has the added advantage of providing an assessment of measurement performance in the environment in which the system is used routinely. SRM's, such as steels, glasses, ores, clinical materials, and hydrocarbon blends, have traditionally been viewed as a good way of establishing traceability to NBS in the areas of chemical and biological measurements. The use of SRM's for traceability in physical measurements is becoming more important. A good example is the extremely high level of interest in the SRM linewidth standard for the integrated circuit industry.

NBS is also responsible for the National Standard Reference Data System. In this System a network of Data Centers, both at NBS and outside, evaluates data from the world literature and publishes compilations of recommended values. These compilations provide users with the best available data for reference data banks and for calculations and modelling. Areas covered are energy and environment, industrial processes, materials utilization, and physical science. The same numbers are valuable as benchmarks for critical measurements. Again this is an area of NBS activity that might be worth your time to explore.

Pollution measurements are becoming a matter of increasing concern to many NCSL members. The work of our Office of Environmental Measurements, and our Center for Analytical Chemistry, in the Measurement of \( \text{SO}_2 \), \( \text{NO}_2 \), Hydrocarbons, and mercury, for example, will be of direct interest to many of you, and I urge you to become familiar with their programs and call on them if you need help in this area.

I notice that laboratory accreditation is an important subject at this conference. Norman Somes, who developed the session on laboratory accreditation at this meeting, heads our official Testing Laboratory Evaluation Technology. I want to stress to any of you who may be unfamiliar with the Department of Commerce's National Voluntary Laboratory Accreditation Program (NVLAP) the voluntary nature of this federal program, since there may be some misconceptions about this point. Commerce will only develop an accreditation program where a consensus of the concerned industry exists that such a program is needed. Thus DOC accreditation of metrology and calibration of metrology and calibration labs can only come about if you want such a program. Cooperation between our program and your Laboratory Evaluation Committee can only help us both, and I know we can approach it in that spirit.

I could go on with other examples, but I believe my point has been made. Your needs are growing and in many cases NBS has a program that may help you meet those needs. Our interaction can be even more fruitful in the future than it is now, but only if we both make the effort to identify and develop new areas of cooperation. I promise that we at NBS will do so.

It is clear to me that NBS measurement services must evolve to keep pace with changing user needs. New programs will be started as old ones phase out. For example, many years ago NBS calibrated almost every fever thermometer used in the United States. What a ludicrous thing it would be if we were doing that today. At the time there was a real need to do so, as accuracy was in doubt. But industry picked up new techniques and began manufacturing thermometers in accordance with a voluntary standard, accuracy went up, and NBS phased out this service.

I'm sure that at least some of the calibrations we now offer will go the way of the fever thermometer, and new services will take their place. The rate of change is likely to accelerate as new developments affect measurement technology. Deciding which services should be in our catalog is a difficult task. We are grateful to the NCSL National Measurement Requirements Committee for conducting a survey of user needs for NBS services. Their results are the kind of help we need as we assess present services and plan for the future. And I would also like to emphasize that we should not only be concerned about direct services from NBS but also cooperative programs such as the MAP.
Our new dissemination mechanism that we are enthusiastic about is the Regional Measurement Assurance Program. I’m sure many of you have heard of the Southern California Standards Interchange Program and how this program has significantly upgraded the confidence level in the accuracy of participants’ dc voltage measurements. Your past president, Laurel Auxier, has co-authored a paper on this concept that is fast becoming a classic.

We feel that MAP programs, when fully developed, provide a cost-effective means for upgrading measurement quality and confidence in participating labs. Certainly many labs already do first quality work. To them, the advantage of the MAP approach is the ability to demonstrate their accuracy relative to national standards. But the real test of a new product such as MAP is customer acceptance. Gary Davidson of TRW, chairman of your Measurement Assurance Committee, reports that most who have tried MAP have become enthusiastic converts.

Another area that we are responding to is that of automated test equipment (ATE). This is a fast growing, dynamic field that is changing the nature of metrology in many areas. We are now being asked what must be done to make some extremely complex ATE systems traceable to NBS. The problem, of course, is that ATE must be considered as a system involving sensors, information processors, software, and built-in reference standards.

We have formed a technical task force to define a proper NBS role in ATE/micro-processor based instrumentation. Many of our people are working closely with the Industry Joint Services Automatic Test Project. We ask your help in determining what sort of measurement services will be needed in 5 to 10 years as a result of the ATE revolution and the increasing availability of “smart” instruments. Measurements made on a dynamic basis at high speeds lead to new problems in the quantitative assurance of accuracy and quality.

Another concept that I have tried to stress is cooperation. Whether government and industry can become less antagonistic and more cooperative in the application of science and technology to strengthen our economy remains to be seen. I am optimistic. One of the reasons for my optimism is the excellent experience we have had at NBS in working cooperatively with institutions such as yours. I hope you have a great National Conference and I hope you enjoy every minute here at NBS.

HIGHLIGHTS FROM THE MEMBER DELEGATE’S MEETING

Incoming NCSL President, Ron Kidd, opened the meeting by extending a warm welcome to all member delegates and attendees to the 1978 Conference. He indicated that the purpose of the meeting was to give everyone an opportunity to talk to the Board of Directors, Committee Chairmen, and Regional Coordinators and express their thoughts, recommendations, criticisms.

Panel Moderator John Minck, along with Dr. John Hoffman, Director, National Measurement Laboratory, and Dr. John Lyons, Director, National Engineering Laboratory, participated in a question and answer session.

As an introduction, John Minck gave an overview of the previous day’s BOD meeting with NBS top management, and reported on the reorganization, and budget posture of the Bureau. He urged the membership to get more involved in their company concerns and relay these concerns to NCSL or NBS. John stated that inputs could be forwarded to Frank Flynn’s committee or to Dr. Brian Belanger’s office. Several typical questions from the floor follow:

Q. What can be done by a company who finds that a particular calibration service, required by a regulatory agency requires traceability, where in fact the Bureau does not have the capability to perform the measurement?

A. Dr. Lyons recommended writing to the Assistant Secretary of DOC or Secretary of Commerce or NBS for an official statement.

Q. Do regulatory agencies consult with the Bureau as to the practicality of a requirement, before imposing it? If not, can we get the Bureau involved in assisting industry in an interface and advisory basis to assist us so we are not encumbered with a measurement NBS cannot perform?

A. Dr. Hoffman reported on one or two specific areas where the Bureau was consulted. If the problem is converted into a “measurement question” it will end up at the Bureau where a definitive statement can be made.

Laurel Auxier presented awards and certificates to outgoing board and committee persons.

Mac McKinney, International Region Coordinator extended a special welcome to the Member Delegates and attendees who traveled from outside the U.S. to attend the conference. There were twenty-two (22) from the international region representing seventeen (17) different countries.
1978 ANNUAL CONFERENCE

A SAMPLING OF AWARDS & CERTIFICATES PRESENTED AT THE MEMBER DELEGATE’S MEETING

Ken Armstrong (r), NBS Boulder, Secretariat, received the coveted Dept. of Commerce Bronze Award

Hugh Starling (r), GE Co., Director

Hartwell Keith, Ford Aerospace, Secretary

Hank Daneman, HLD Assoc., Education and Training Committee

Jim Valentino, Sanders Assoc., V-P Administration

Bob Delapp, SRI, Treasurer

Gary Davidson, TRW, Measurement Assurance Committee

Sam Davidson, Schlumberger Co., Meeting and Programs Committee
Featured speaker at the banquet was Dr. Jordan Baruch, Assistant Secretary for Science and Technology, Department of Commerce. Dr. Baruch did an excellent job of weaving together high technology trends, business principles, international economics and common sense in a very entertaining and informative way.

Another award for Dr. Brian Belanger who was conference co-chairman.

President Laurel Auxier presents an award to conference co-chairman Sam Davidson. Carol Dillon and Ron Kidd look on.

Helen Valdez of NBS, Boulder, receives a certificate of appreciation from Sam for serving as conference registrar. Helen has been of great service to NCSI as secretary to the secretariat at Boulder.

Sam Davidson presents a certificate to Dian Belanger who organized and ran the guests program which was highly acclaimed.

Frank McGinnis of Sperry, Co. is presented his plaque and one thousand dollar honorarium for the 1978 Wildhack Award by John Minch.
GENERAL FOCUS OF NBS MEASUREMENT SERVICES
B. W. Birmingham
Director, Boulder Laboratories, NBS

Introduction

Dr. Arthur McCoubrey has asked that I express his regrets at not being able to address you at this time as was indicated in the program for this NCSL workshop. He is in Yugoslavia on Government business this week, so he asked me to say hello to his many friends in this NCSL audience and to extend his best wishes. In his absence I shall be discussing the general focus of NBS Measurement Services today.

Let me discuss national measurement needs in terms of three principal considerations: “New Requirements of Our Evolving Measurement System,” “Constraints” on NBS operations, and “How NBS Can Respond.”

New Requirements of our Evolving National Measurement System

First, let us consider some “new requirements of our evolving national measurement system.” Some of these were also mentioned by Dr. Dillon in his keynote talk.

Anyone with even a peripheral involvement in the technical community these days recognizes that new technologies such as very large-scale integrated circuit technology, automated test equipment (ATE), high speed digital systems and microprocessor-based instrumentation, are evolving so rapidly that we are just beginning to learn what questions to ask. As an example, we have already been asked the question, “What constitutes an adequate calibration methodology for ATE that will provide meaningful traceability to national standards?” I wish I could say that we have a satisfactory answer for that one, but as yet we do not.

A specific example of a new requirement generated by very large-scale integrated circuit technology is the need for linewidth standards for micron and submicron structures. Design engineers anticipate ICs the size of your thumb that will incorporate as many as $10^9$ devices. The realization of this integration depends on line-width standards that ultimately approach the thickness of a single molecule. The best we can do at present is a few microns, and the next step is the development of a submicron standard. That’s one area where I’m pleased to say we have proceeded beyond the question stage and into the problem-solving stage.

Energy systems represent another challenge to standards development. The needs here include standards for dynamic plasma diagnostics — diagnosis of fusion plasma in the time domain of $10^{12}$ seconds. Practical magneto-hydrodynamic (MHD) systems depend on the development of large superconducting magnets that will not only produce — but also withstand — the self-destructive forces of 8 to 12 Tesla fields.

Here we are talking about material standards that haven’t yet been defined.

Communications are increasingly a function of satellite relay systems and the present usable spectrum is saturated, so using higher frequencies is an imperative step. The standards for earth-terminal calibration are pushing the state of the art of antenna measurement, attenuation, and even the Bureau’s superbly accurate Type IV power meter. Earth terminal calibration at higher frequencies also makes radio stars only marginally useful as point-source radiation power standards in space. Their most likely replacement appears to be satellite-based standard radiometers or Orbiting Standards Platforms. This presents another whole new set of measurement problems, and we will need ways to calibrate the orbiting standard and determine an appropriate calibration interval. For obvious reasons, we can’t set calibration intervals on the basis of historical data for families of similar systems — there are no similar systems, nor can we bring the satellite into the standards laboratory for recalibration.

The measurement of systems performance, mentioned before in relation to satellite earth-terminal calibration, is also becoming a requirement in the marketplace for everything from microprocessor-controlled gasoline pumps to automated checkout systems in grocery stores that incorporate laser scanners and digital readout scales interfacing with computers.

As many of you are acutely aware, there is another measurement-intensive facet of our modern life, and that is Government regulation. Exemplary of regulation requirements are trace analysis for air and water quality; standards for atmosphere and climate monitoring, and measurement problems of electromagnetic interference — a problem with the same exponential growth as that of the electronic-controls and communications industries.

That’s a thumbnail sketch of some of the kinds of measurement problems that have evolved and are evolving as our National Measurement System grows and becomes more complex. In the examples I have discussed, we have need for higher accuracies in many of our present measurements, and NBS must expand its horizons beyond traditional metrology. We believe that planning for an appropriate and effective NBS response to these challenges is important not only to us in the Bureau, but to the whole measurement community.

Constraints

NBS’s response to the new and evolving needs of the National Measurement System is constrained by two major considerations. The first is a fiscal constraint, and the second is a con-
Department of Commerce
National Bureau of Standards
Washington, D.C. 20234

1978 ANNUAL CONFERENCE

The restraint of human resources which have not been available to address the many of the new requirements.

Even though we fared very well in the FY 79 Budget, which started October 1, we still face fiscal constraints in the years ahead. If you read the newspapers, you know that zero-based Budgeting is here to stay in the Federal Government. Also, the Administration is committed to balancing the Federal budget. The "Proposition-13 syndrome" seems to be surfacing in areas other than just California. As a result of these factors, it is clear that NBS will have to rank all of its tasks each year with the knowledge that those at the bottom of the list will be subject to harsh scrutiny.

The constraint of human resources is related to fiscal constraints, particularly those of past years that required diverting our scientists' attention from basic metrology research to the solution of immediate national problems. I believe there is no need to dwell on that, since it has been the subject of a great deal of public discussion during the past two years.

How NBS Can Respond

Within these constraints, NBS has already taken important steps to meet the challenge of the Nation's changing metrology needs.

Dr. Dillon, in his keynote address, described a dynamic, reorganized NBS that is responding to new challenges. You will recall that he specifically mentioned the evolutionary nature of a standards program that keeps pace with user needs. He mentioned fever-thermometer calibrations that have long since been phased out of the NBS program and taken over by manufacturers themselves under a voluntary standards program. He also noted that new developments affecting technology will accelerate this evolutionary process.

The accelerated evolutionary process demonstrates better than anything I can think of the need for teamwork between NBS and the laboratories of the nation represented in this NCISL gathering.

In cases analogous to the fever thermometer, we must formulate an orderly transition of measurement services from NBS to other laboratories to make room for higher priority tasks.

Satisfying our users' needs for greater accuracy in traditional and new measurement areas, without a corresponding increase in NBS resources, will require new, innovative techniques for delivery of our services and careful attention to priorities. If we are to create essential turn-over in NBS programs to maintain NBS at the frontiers of science and technology, the handwriting on the wall says that low priority tasks will have to be terminated from time to time.

The problem with setting priorities is that even our lowest priority services are important to someone. Recognizing that, our approach is to review the calibration services we offer in terms of how critical they are to users, how often they are used, and how readily they can be performed, using alternative techniques such as MAP's and SRM's as outlined by Dr. Dillon. Other alternatives include ratio measurements which do not require absolute measurements in terms of primary standards — the 6-port vector voltmeter is an example. Fundamental constants — such as wavelengths of krypton light for determining the meter — can provide another technique which requires less intensive NBS involvement.

NCISL can render a valuable service by providing NBS with inputs that help us in determining the priorities for the services we offer. You can help us strike a balance between our getting so bogged down in providing routine calibration that we cannot work in new high priority areas, and the other extreme where we ignore the ongoing traditional needs of the National Measurement System and possibly degrade the measurement capability in the U.S.

The key to providing adequate services needed by NCISL members during any transition is adequate lead time for planning. Realizing this, we will do everything in our power to avoid precipitous termination of services. The NBS goal is to make the time frame for even the most imminent changes at least one year. Areas that are candidates for possible future changes are those where a high degree of technical competence exists outside NBS or the technology transfer can readily be accomplished.

Using the criteria I have described, we have identified several measurement areas where future developments may — and I emphasize the word may — affect the services we now offer. The number of specific services thus far identified is relatively few — approximately 3% of the total calibration services presently offered.

At the present time, we are scrutinizing some high-resistance and ratio type calibrations in the electrical area. Attention is also being directed toward spectrophotometry and neutron measurement services. As time passes and our budget situation clarifies, and as we get more information from NCISL, we will examine all options available to us for minimizing any adverse impact, should any of these services ultimately become candidates for actual termination or reduction.

In addition to internal NBS options for reallocation of manpower, we can foresee a number of options involving people outside NBS that could help minimize the adverse impacts of future changes in NBS measurement services.

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We might transfer equipment ownership and provide any needed training to some other laboratory in cases where the diversity of users is small. For example, if the Army, Navy, and Air Force are the only users of some particular SP 250 item, we might be able to transfer that NBS equipment to one of the DOD prime laboratories.

We might make NBS calibration facilities available to others on a do-it-yourself or self-service basis with some consulting assistance from NBS as needed.

A user group like NCSL or some other agency might be willing to support a Calibration Research Associate at NBS.

Increased use of private metrology laboratories, on a fee basis, by civilian Government agencies, as mentioned by Dr. Dillon, constitutes another viable alternative to present NBS calibrations for certain types of services.

As we put our heads together with the NCSL leadership over the coming months, we will be examining these and possibly other options.

Earlier this week, we discussed the present situation with your Board of Directors and committed ourselves to working closely with NCSL to develop plans for minimizing any adverse impact of future changes in NBS services. We will keep the NCSL membership informed by articles in the NCSL newsletter, as new developments materialize.

In summary, the evolving National Measurement System is presenting demanding new challenges to the whole metrology industry, but particularly to the National Bureau of Standards. A proper response to these challenges within the constraints of available NBS resources — both fiscal and technical — requires some reprogramming. More than any time in our history, it is essential that we coordinate government and private resources to meet the national needs of more sophisticated metrology. The National Conference of Standards Laboratories can be one of the most efficient vehicles we have for effecting this coordination, and you may be assured that we are committed to strengthening our interface.

WELCOME TO OUR NEW NCSL MEMBERS

Aertech Industries, Inc.
825 Stewart Drive
Sunnyvale, Ca 94086
Delegate: Mr. George E. Jarzombek

Arkansas Power and Light
Arkansas Nuclear One
P.O. Box 608
Russelville, Ark. 72801
Delegate: Mr. Ray Tucker

Arkansas Nuclear One
P.O. Box 608
Russelville, Ark. 72801
Delegate: Mr. Ray Tucker

Henry Troemmer, Inc.
6825 Greenway Avenue
Philadelphia, Penn. 19142
Delegate: Mr. Wilbert D. Abele

Inst. Nac. de Tecnologia
Industrial, INTI-CID
Casilla de Correo 1359
(Correo Central)
1000 Buenos Aires, Argentina
Delegate: Mr. M. C. Hepburn de Santacapita.

National Aeronautics & Space Admin.
Goddard Space Flight Center
4700A Boston Way (Code 311A)
Launham, Maryland 20801
Delegate: Mr. Walter L. Owens

Pratt & Whitney Machine Tool Div.,
Automation & Measuring Systems
Charter Oak Boulevard
West Hartford, Conn. 06101
Delegate: Mr. George F. Kindl

Arkansas Nuclear One
P.O. Box 608
Russelville, Ark. 72801
Delegate: Mr. Ray Tucker

Royal Danish Air Force
Air Material Command
Electronics Division
P.O. Box 130
DK-3500 Vaerlose, Denmark
Delegate: Mr. Anders Bjerre Nielsen

Spelman High Voltage Electronics Corp.
7 Fairchild Avenue
Plainview, New York 11803
Delegate: Mr. Myron Kaufman

Transducers Inc.
12140 E. Rivera Road
Whittier, Ca 90606
Delegate: Mr. Ray Duquette

United Scientific Corp.
Superconducting Technology Div.
1400 D. Stierlin Road, P.O. Box 1389
Mountain View, Ca 94042
Delegate: Mr. Victor Hesterman

Vitro Dynamics Inc.
114 Beach Street, P.O. Box 285
Rockaway, New Jersey 07866
Delegate: Mr. Vincent C. DeMaria

National Aeronautics & Space Admin.
OP-4
Washington, DC 20546
Delegate: Mr. Harry Quong
This 1978 NCSL Workshop consisted of four sessions moderated by Bob Couture, of Rockwell International’s Electronic Systems Group at Anaheim, California. Nine panel members from various industrial and governmental organizations made formal presentations, four panel members per session. This assured session direction and dissemination of a wide variety of viewpoints with emphasis on panel-audience interaction. The names of the individual panel members and titles of their presentations are given at the end of this report.

As an aid to audience understanding of presentation details and to give the audience “something to take home” for further study, it had been planned to distribute all papers and handouts to the attendees at the start of each session. Due to a greater than expected audience turnout, however, nearly all of the 200 sets of the 100 plus-page handout packets were distributed to the attendees of the first three sessions; this necessitated a special post-conference reprinting of the handout material to some 50 requestors who attended the fourth session.

The objectives of this Workshop were for the panel members: 1) to identify and discuss the various methods used to “treat” or otherwise account for calibration and measurement errors and uncertainties; 2) to promote interaction with the individual members of the audience, and hopefully to persuade the attendees to challenge the panel and/or to relate their personal or organization’s approach to the subject; and 3) to gain a better understanding of the audience viewpoint relative to the subject—attaining consensus if possible.

Summary Results

In general, the audience indicated interest in the Workshop subject revealing their belief that calibration and measurement errors should be determinable and controllable. The individual attendee’s application of the particular methods used to determine and control these errors (or possible errors) in his work, however, varies greatly. As Jerry Hayes, Director, U.S. Naval Metrology Engineering Center, Pomona, California, so aptly stated during one of the sessions—“It seems that we have agreed to disagree!” Even so, the Workshop discussions uncovered much useful information.

A broad overview of the panel-audience interactions in this Workshop indicates that there are several general methods used to “treat” or otherwise account for calibration/measurement uncertainties. These, in the order of majority use, are:

1. A combination of one or more of the following,
2. accuracy ratio guidelines,
3. formal statistical error analysis, and
4. statistical tolerancing of complex systems.

Combination Methods – In the context of the “average” attendee who is responsible for assuring calibration integrity of a large inventory of M&TE, there is no single method which can be realistically applied to the entire instrument population. What happens then is that different people combine and apply the available “general” methods in various ways to fit their particular situation— as appears to be proper in terms of their own knowledge, pressures (including economics), and experience—like in any other human endeavor!

Accuracy Ratio Guidelines – It was readily apparent that most of the attendees felt more comfortable using some form of fixed accuracy-ratio over any of the other (more rigorous) methods. A simple rule-of-thumb accuracy-ratio requirement is generally believed to be an efficient and easily applied method in the case of large M&TE inventories provided the user is not restricted from using more appropriate methods when needed.

The application of accuracy-ratio methods is very straightforward in those cases where the standard-to-calibrated instrument accuracy ratios are approximately 4:1 or greater. It was indicated during the Workshop that the use of accuracy ratios in the order of 10:1 to 100:1 and even higher is common in a very large proportion of product testing situations due to the excellent accuracies provided by contemporary electrical-electronic instrumentation.

When the available standards accuracy (or calibrated instrument tolerance) necessitates less than 4:1 accuracy ratios, however, the manner in which the possible inaccuracies of the standards are accounted for becomes even more arbitrary. The audience generally indicated that in these cases, the basic rule-of-thumb accuracy-ratio method is modified in accordance with one (or more) of the following (no particular audience majority-usage or preference implied):

a. subtract the accuracy of the standard from the tolerance of the calibrated instrument,

b. add the accuracy of the standard to the tolerance of the calibrated instrument,

c. limit the accuracy of the calibrated instrument to something less than originally specified so as to attain a 4:1 accuracy ratio. Resulting specifications are sometimes termed “minimum-use”.

Application of this approach requires prior coordination with product design/engineering personnel for approval.
to de-rate instrument accuracy. When appropriate, this approach may also result in a different choice of instruments and in some cases even de-rated product design/test/ or engineering requirements when the initial requirements are found to have been grossly over-specified,
d. provide actual measured values with an uncertainty statement rather than nominal “within-tolerance” statement. (It should be noted that this modification is only practical in the case of devices having only a few measurement characteristics such as fixed standards.)
e. perform rigorous (not necessarily worst-case) error analysis in order to enhance reported accuracy of the particular measurement standard/system and thereby improve the standard-to-calibrated instrument accuracy ratio,
f. report the less than 4:1 accuracy-ratio problem to the cognizant Quality Assurance and/or customer representative and do nothing different,
g. develop statistical tolerancing techniques designed to optimize calibration requirements of complex systems, such as ATE, to avoid “impractical” accuracy requirements, etc., and
h. “ignore” the entire situation by not documenting any specific standard accuracies or instrument tolerances other than by casual reference to “manufacturer’s specifications”.

Formal Statistical Error Analysis — Discussion indicated that this method was very important and must be applied when the accuracy-ratio situation becomes much less than 4:1. This method is most often required when state-of-art calibrations of standards or instruments are necessary and especially when the standard-to-calibrated instrument accuracy approached a value near 1:1.

The audience appeared to be generally familiar with the method of statistical error analysis in establishing units of measurement uncertainties and the terms such as systematic and random error. A rough consensus of those in attendance indicated that this method should only be applied by personnel having practical measurements — engineering experience as well as the requisite mathematical and statistical background. (The lack of such personnel in many organizations may be a contributing factor in the heavy reliance on fixed-accuracy ratios.) One of the papers presented on this subject provided an outstanding treatise on the “Treatment of Errors in Measurement Systems”. Newsletter readers are encouraged to obtain a copy of this paper for use as a reference. As indicated by the authors in their Introduction:

“... The purpose of this paper is to survey the mathematical and statistical techniques used in the field of system error analysis. Methods in common use are evaluated for validity, mathematical rigor, and applicability. In addition, several new concepts are introduced and developed. These techniques are brought together to form a valid, unified approach to system error analysis.

“General guidelines, rather than detailed instructions, are presented. Therefore, all aspects of error analysis are not discussed to the same depth. However, it is hoped that a consistent overview will result from bringing together the more useful error analysis techniques and exposing others that have never been fully developed. . . . ”

A second excellent paper presented on the subject, entitled “Reviewing Measurement Uncertainty”, should also be obtained by Newsletter readers for use as a reference.

“... This paper presents a review of the theory of uncertainties in calibration. It also reviews the problems of starting the uncertainties of final results and combining the uncertainties in a hierarchy system. Examples of practical applications are discussed as related to the Metrology laboratory. . . . ”

In his conclusion, the author of this paper stated: “A hierarchy system of calibrations from higher to lower echelon testing laboratories establishes an accuracy ratio which increases commensurately with the ranking of the laboratories. If the necessary requirements are satisfied for combining the NBS data and Metrology data (our present example) to get a weighted overall accuracy, it may then be possible to preserve the higher achievable accuracy at the echelon position of the end-user, as previously discussed in the examples. Metrology laboratories accumulate extensive calibration data on NBS and the Metrology calibrations of standards. This accumulation of data and experience in measurements makes it possible to obtain better confidence levels for estimated uncertainties.”

“In the absence of absolute criteria, it is most important that results be presented in sufficient detail to enable the reader to form his own judgement and make his own allowances for their inherent uncertainties.”

Statistical Tolerancing of Complex Systems — Workshop presentations and subsequent discussions relative to use of a systems engineering approach to the establishment of tolerances for complex systems having many components, such as ATE, was well received. This method didn’t generate as much controversy as might have been expected, since there seemed to be a general lack of prior awareness and understanding of the method on the part of the audience. This method is best summarized by the authors as follows:

“Statistical tolerancing, unlike worst-case tolerancing, allows you to establish economical component tolerances and thus minimize the cost for a specified system performance. Worst-case tolerancing, by assigning component tolerances on the basis of zero probability of system malfunctioning,
often requires expensive precision parts. Relaxing this strict policy, statistical tolerancing allows the malfunction probability to be a calculated small risk, thus saving a lot of money.1,2,3

"Moreover the statistical-tolerancing method can be used to 1. Determine the over-all tolerance of a complex system with just the high and low tolerances of its individual components.
2. Compute the risk involved quantitatively.
3. Allocate tolerances optimally among system components.
4. Establish the best calibration requirements for a complex measurement system . . . ."

We will just have to wait and see how this idea catches on in the future.

Other Observations
1. Fixed-accuracy ratios provide a convenient rule-of-thumb method; however, in the case of specific customer-required ratios, they should be negotiated between customer and contractor at the outset of the contract.
2. Also, while not specifically mentioned above as one of the available accuracy-ratio modifications, the Workshop included an excellent presentation and paper on the subject of "Accuracy Ratios Related to Consumer's and Producer's Risks." The Workshop handouts illustrated rather rigorously the concept of establishing accuracy-ratio requirements on the basis of optimizing the combined consumer/producer risks so as to obtain the most desirable trade-off of both factors. This subject was also well received; however, only a few attendees indicated awareness of the extent of usage by their organizations. Perhaps the Workshop discussions and handouts will create further interest in this technique.

Recognition of Panel Members
The individual panel members and the paper and/or subject they presented are listed below. It is appropriate that I take this opportunity to congratulate each of our panel members for their outstanding efforts and contributions which made this Workshop a success.

On behalf of the panel and myself I would also like to thank the leaders of our various organizations for allowing us to participate; and our attendees for their dynamic participation and votes which resulted in the designation of this Workshop as "Best Session".

In conclusion, the 1978 NCSL Workshop was a lot of work — but it was also one heck of a lot of fun!

Bob Couture
Rockwell International
Workshop Developer

Editor’s Note:
The session on accuracy ratios won the award for the most popular workshop by vote of the attendees. It is our intent to publish all these papers in the next newsletter.

"TOLERANCING FROM A SYSTEM ENGINEERING VIEWPOINT"
DALE BRADY
DOMINICK ODORIZZI

"ACCURACY RATIOS RELATED TO CONSUMER'S AND PRODUCER'S RISKS"
JOHN FERLING

"TREATMENT OF ERRORS IN MEASUREMENT SYSTEMS"
JERRY GLASSMAN
Note: Co-author (but not present) was Robert N. Rodriguez, also of the Navy MEC in Pomona.

"INSTRUMENTATION AND MEASUREMENT STANDARDS ACCURACY — PRACTICAL ASPECT OF UNCERTAINTY"
JIM HARTLEY

"ACCURACY RATIO REQUIREMENTS"
CLIFF KOOP

"REVIEWING MEASUREMENT UNCERTAINTY"
ALGIE LANCE

"THERE ARE NO MAGIC ACCURACY RATIOS IN CALIBRATION AND METROLOGY"
MAYNARD LAY

A review of: "THE CONSIDERATIONS OF MEASUREMENT UNCERTAINTY AND ACCURACY RATIOS AS RELATED TO MEDICAL ELECTRONICS MANUFACTURING AND THE F.D.A."
GERON SMITH
The 1978 Workshop on "Accreditation, Enforcement and Monitoring of Laboratories" included panel members J. Graham Cameron, Canadian Department of Defence; J.A. Gilmour, Testing Laboratory Registration Council of New Zealand; Duncan P. Thurnell, National Physical Laboratory, United Kingdom; John W. Locke, U.S. Department of Commerce; Gerald A. Berman and Norman F. Somes, National Bureau of Standards; and Roger J. Amorosi, American Association of Laboratory Accreditation. The workshop was moderated by Dennis H. Gallagher, Leeds & Northrup Company. Goals were to get an update on NVLAP, become familiar with the American Association of Laboratory Accreditation, AALA; and to hear how our friends from overseas handled the problems faced by both of these groups.

AALA was incorporated on July 12, 1978 and is now going about the business of establishing funding and developing final procedures for actual accreditation. AALA will be patterned after the Australian National Association of Testing Authorities, NATA, and the New Zealand counterpart Testing Laboratory Registration Council, TELARC.

Initial accreditation in a specified discipline will be based upon review of personnel, equipment, calibration, quality control, and operational procedures. Inspections will be performed by qualified, unbiased inspectors who will be paid for their services and expenses.

The plan to draw on what they consider to be a numerous collection of already available ASTM Standards for various disciplines and will be writing other standards as needed. They expect to accredit their first laboratory by October, 1979. Inquiries should be directed to Mr. G.R. Munger, Secretary/Treasurer, 703-524-8800.

NVLAP has published the Proposed Criteria for Accrediting Testing Laboratories that Test Thermal Insulation Materials in the Federal Register, September 29, 1978, pages 45290 through 45298. It is expected that the criteria developed for this program will be substantially transferable to subsequent programs for other products and thereby shorten considerably the time required to complete a new program. Estimates are that it should take only 6-8 months in most cases.

Although NVLAP accredits by "product" rather than by discipline, it is conceivable that the eventual definition of a discipline as used by AALA will be narrow and very similar to the NVLAP approach.

The question of acceptance of NVLAP accreditation by regulatory agencies in lieu of regular audits cannot be answered yet. NVLAP has been communicating with those agencies but it is obvious that acceptance will have to wait until NVLAP has been able to prove itself.

When the British Calibration Service was faced with this same test it was successful in minimizing regulatory audits, but only after about 2 years of actual operation in accrediting laboratories. Also based on overseas experience, an accrediting authority needs government backing and participation in order to get government acceptance. That has not necessarily been the case in this country and obviously AALA doesn't believe it. Another U.S. concern about the availability of unbiased inspectors was not an overseas problem and they feel confident that it will not be a problem here.

D. H. Gallagher
Leeds & Northrup Company
Workshop Developer

EDUCATION & TRAINING
(Education & Training Committee)

The 1978 Workshop were conducted by a panel comprised of Mr. Stanley Hale of the Bendix Corporation, Mr. Marlin Johnson of Johns Hopkins Laboratory, Mr. Dave O'Brien of The Duke Power Company, Mr. Phil Painchaud of the Metron Corporation, Mr. John Gilmour of TELARC (of New Zealand), Peter Sydenham of the University of New England (Australia), Mr. Hillary Taft of TVA and H.L. Daneman of H.LD. Associates. Comments and observations from the panel compared experience in the education and training of Metrology Technicians. The comments from the floor were related to present and future requirements for Metrology Technician training. These comments can be grouped into the following categories: demand, supply, curricula, experience in related fields, and proposals for future activities.

Demand for Metrology Technicians: There have been formal courses given from time to time and some of these have suffered from very limited enrollment. The course at California State Polytechnic University was one such example. Some explanations for these limitations in attracting candidates were that, (1) the range of options within this career is limited, and (2) the entry of recently educated technicians may be limited by job advancement practices dictated by union agreements.
Supply: There was general satisfaction with the use of retired military personnel and this has furnished a relatively continuous supply of Metrology Technicians. In other cases, Metrology Technicians advance from related jobs, such as electricians.

Content: Uncertainty as to the definition of Metrology Technician and his education were generally noted. As an example, the inclusion of analytical instrumentation in the field of apparatus to be calibrated by Metrology Technicians was opposed by some. Members of the pharmaceutical industry, however, made it a point to call attention to the current need for technicians trained in handling the range of instruments used in their industry. This includes process instrumentation, chemical and analyzers as well as electrical test equipment. Additional questions were raised on the inclusion of automatic test equipment and how training might be provided to cover such specialized apparatus. In summary, the consensus seemed to be that, (1) the role of the Metrology Technician was not adequately defined, (2) his path of advancement throughout his career not well established, nor (3) were his educational requirements capable of uniform and general definition.

Foreign Experience: New Zealand has certified training programs for technicians in general. This provides enough students so that each can select the particular branch of technology in which they become interested. Competency is established by an oral examination in which the assessor must draw out the individual's capability. The certificate authorizes the holder to officially sign reports of calibration.

The USSR has a formalized Metrology Technician program and, accordingly, has been chosen by the United Nations to teach people from developing nations. About one hundred technicians are enrolled in each six months training program which covers electrical, thermal, mechanical, and chemical technologies. The costs (including expenses of transportation) are borne by the USSR government. Approximately sixty percent of the enrollment are women. It has already been established abroad that women are better adapted by disposition for the painstaking work of calibration.

In Syria, technicians are licensed by the government. They require twelve months of training at four hours per day and after this first year are required to qualify by examination. This examination period, and any additional work required, can take as much as nine months longer before a license to practice is granted.

Technicians in Regulated Environments: The TVA has certified reactor technicians trained in-house. The technician school at TVA has three computer-controlled simulators to demonstrate reactor operation. They are required by union regulations to accept applicants with at least a six grade education. At this location, a simultaneous course was run with a live instructor heading one class and a TV simulcast for another. The result of this experiment was the definite conclusion that live instruction was superior to the use of TV, or other canned instruction.

There are three certificated classes of technicians involved with non-destructive testing. This classification scheme may be adaptable to Metrology Technicians.

The Federal Aviation Authority requires annual training for its technicians and this may vary from as little as two weeks to as long as six months per year of schooling. Should the federal government support the training of Metrology Technicians if its regulations require the employment of qualified personnel?

Proposals:

1. Courses of all types are needed to train technicians. These should range from short courses of three to four days to college level courses. In particular, two types of courses were requested:
   a. individual modules which can be adapted to each technician,
   b. two year post-high school course for entry level technicians.

2. The broadening of the technician base to include repair and maintenance as well as instrument design technicians might improve the possibility of establishing post-high school courses. These could then permit the graduate to choose from career opportunities in maintenance, design or calibration.

3. High school students (including girls) should be invited to attend some of the adjunct courses now planned to be given in parallel with regional meetings.

Submitted by:
H.L. Daneman
H.LD Associates
Workshop Developer

A personal note: I would like to express my thanks to the members of the Education and Training Committee who contributed to a most interesting variety of activities. Having completed two terms as Chairman, I now look forward to sharing the enthusiasm of Mr. Dave O'Brien, the new Chairman of the Education and Training Committee.

Hank
LEGAL METROLOGY AT HOME AND ABROAD

The session format provided for each of the five panelists to present an overview of their involvement in legal metrology, then allowed for a 15-minute question and answer period prior to the conclusion of the session.

Panelists were:

Dave Edgerly, Chief, Office of Domestic and International Measurement Standards, NBS Gaithersburg presented a 20-minute slide briefing to explain the organization, goals, and objectives of the International Organization for Legal Metrology (OIML). The chief output of OIML is model laws to be adopted by the member countries.

Don Greb, Lockheed Missiles and Space Company, (NCSL’s Representative to OIML) Sunnyvale, California, reported on an OIML meeting conducted 25 through 29 September 1978 in Ushgorod, Ukraine, USSR. Briefly discussed the State of California Measurement System (SCMS) in its role of legal metrology.

Jim Lyles, Supervisor, Weights and Measures, State of Virginia, Richmond, discussed the Weights and Measures systems used in commerce within the State of Virginia to include such verifications as the compliance of random packaged goods and standard packaged goods. The State of Virginia Weights and Measures Laboratories also provide calibration services to commerce and industry to establish traceability to the National Standards. Mass, volume, and length disciplines are the principle ones in which services are provided.

Al Tholen, Chief, Office of Weights and Measures, NBS Gaithersburg, and

Bud Wollin, Executive Director, National Conference on Weights and Measures, discussed NBS’s role in assisting State weights and measures activities in performing their functions. Reported that this month (October 1978) completes the distribution of the measurement standards to all 50 States plus Puerto Rico and the Virgin Islands. NBS is working with the State of Nebraska to establish pressure calibration services to serve that area of the United States.

Bob Callihan, Vice President Engineering, Fairbanks Weighing Division, Colt Industries (representing the Scale Manufacturers Association) presented some concepts which can improve legal measurements for both commerce and industry. “Subsequent Process Verification” is the principle building block of a legal metrology system which assures that equity in the marketplace may prevail on a reasonable, affordable basis. The attached exhibit on “Suggested Assignment or Roles in the U.S. System” was explained by Callihan.

Approximately 100 persons attended the four sessions, with eight of the attendees being from countries other than the U.S. Many questions were asked and it was felt that a better understanding of Legal Metrology was achieved by those who attended the sessions.

Walt Cassady, Session Developer
Tulsa Division—Rockwell International
What is a measurement assurance program (MAP)? What is a regional or group MAP? What is the current NBS philosophy regarding MAPs? What is the NCSL Measurement Assurance Committee doing? These were among the questions the panel attempted to answer for approximately 200 attendees at the Measurement Assurance Workshop.

Current NBS Philosophy

Two trends are clearly visible in the NBS approach to delivery of measurement services. Traditionally and continuing today, NBS reduces services in matured measurement areas and institutes services in new areas. In addition, NBS management is convinced that many if not most of their customers will someday have to maintain control of their measurement systems by operation of measurement assurance programs. Initially NBS will be heavily involved with the participants in such programs, but in the long term such programs will operate with minimal direct involvement by NBS.

It is becoming clear that it is not very cost effective to maintain the measurement system via traditional calibration chains with the large degradation of accuracy as one moves down the chain. With the budget constraints under which NBS operates, NBS can no longer upgrade the primary standards at a rate required to upgrade and use measurements in the traditional way. This will require greatly expanded measurement assurance services from NBS.

Two technological changes are taking place which will ease the difficulties of accommodating to these changes. First, the rapid introduction of automated measurement processes under microprocessor and computer control will make it financially possible to maintain measurement assurance programs at many levels of the measurement systems.

Second, the development of inexpensive “do it yourself” primary standards, such as “wave length”, length standards, SRM temperature standards, etc., will make it possible for Metrology laboratories to have access to primary standards with reduced involvement by NBS.

The future will be vastly different from our traditional way of operating our measurement systems, but it will be challenging.

Measurement Assurance Programs

There are currently MAPs offered by NBS in nine measurement disciplines:
- Mass
- Resistance
- DC Voltage
- DC Voltage Ratio
- Capacitance
- Electrical Energy (Watt-hour meters)
- Laser Power
- Temperature (Resistance thermometry)
- Gage Block

But what is a MAP? If you queried individuals at NBS and industry you would probably get many answers. The type of MAP to which this workshop addressed itself to would in general meet the criteria of the following definition:

A measurement quality assurance approach that allows one to demonstrate that the total measurement uncertainty arising from both random error and systematic error relative to national or other designated standards is quantified and sufficiently small to meet the requirements for the measurement process.

A MAP views the entire measurement process as a system. The standards involved, the measurement equipment, the operator, and the operational methods. As a result of the measurement process and analysis, three things are known:

1. The difference in the unit of measure between the standards.
2. The systematic error associated with the difference.
3. The random error associated with the difference.

If the random or systematic errors are quantitatively too high to meet accuracy requirements, the standards, measurement equipment, operator, or operational methods are inadequate.

Voltage MAP

The DC Voltage MAP is one of the more difficult MAPs but has many advantages over customary methods of DC voltage transfer.

Basically the DC Voltage MAP is carried out as follows:

1. A group of NBS transportable standard cells are compared to the national volt to determine their value.
2. The standard cells are shipped under power to the user laboratory.
3. The user laboratory compares the NBS transportable cells to his reference cells using valid statistical designs. All recorded measurement data are sent to NBS for analysis.
4. The NBS cells are returned to NBS under power.
5. The NBS transportable standard cells are compared to the national volt to determine the change in value since step 1.

As a result of the analysis from data taken in steps 1, 3, and 5, the difference between the national volt and the user laboratory is reported along with the random and systematic errors.

**Regional MAP**

Laurel Auxier of Beckman Instruments and past president of NCSL, and Woody Eieke of NBS got together about ten years ago and decided they could improve upon the voltage MAP with a regional MAP. With the regional MAP in Southern California the difference between the national volt and five user laboratories could be determined at one time. The five original participants were Beckman Instruments, Autonetics, Electrical Standards Repair Service, Lockheed, and TRW/DSSG.

When a regional MAP is started there is normally a one time experiment to see that the overall performance of all participants is adequate for participation in a regional MAP. This experiment consists of each participant intercomparing his transportable transfer standard to his reference standard, and the comparison of two other participant transfer standards to his reference standard.

All data from the experiment are sent to NBS for analysis. The analysis will detect any problems with the reference or transfer cells, the measurement equipment, or operational methods. NBS personnel will work with the participant to resolve any problems that were detected.

After the one time initial experiment, the regional MAP is carried out as follows:

1. The NBS transfer standard is compared to the national bolt, and each participant compares their transfer standard to their reference standard. All recorded data are sent to NBS.
2. The NBS transfer standard and the transfer standards from the participants are sent under power to one of the participants. This participant will act as the pivot laboratory.
3. The pivot laboratory compares the NBS transfer standard to each participants transfer standard and his reference standard. All recorded data are sent to NBS.
4. The transfer standards are returned to their point of origin.
5. The NBS transfer standard is then compared to the national volt and the participants compare their transfer standard to their reference standard.

As a result of the analysis of data taken in steps 1, 3, and 5, the difference between the national volt and the participants volt are reported along with the random and systematic errors. It should be noted here that the report of test from NBS as a result of the transfer has satisfied customer traceability requirements for the Southern California group's customers for the past eight years.

In addition to the regional DC voltage MAP, the aforementioned group is also participating in a regional MAP for resistance and capacitance. Here the process is slightly different than the regional DC voltage MAP:

1. A transportable NBS artifact(s) is compared to the national standard.
2. The artifact(s) is shipped to the first participant in the regional group.
3. The participant compares his reference standard to the NBS artifact(s). All recorded data are sent to NBS.
4. The participant sends the NBS artifact(s) to the next participant.
5. Steps 3 and 4 are repeated for each participant. The last participant returns the NBS artifact(s) to NBS.
6. NBS compares the transportable artifact(s) to the national standard.

As a result of the analysis of the data taken in steps 1, 3, and 6, the difference in the unit of measure between the national unit and the participants laboratory is reported along with the systematic and random errors. Again, any problems detected with the standards, measurement equipment, or operational methods will be detected. NBS personnel will work with the participants to resolve any problems that were detected.

There are many advantages to participants in a MAP or a regional MAP. Some of those discussed at the workshop include:

- Our measurement processes are statistically evaluated and reported. If the reported values are abnormally high, NBS works with the user to identify and solve operator, environment, or equipment problems.
- Creates awareness of measurement and data analysis techniques that can be utilized in maintenance of ref-
Initially several thin gs are required of interested par ticipants:
the chec k standard and balanc es over time and over varying
levels, training of staff at NBS, if necessary, inspection of equip­
ment, initial calibrations at the user's facility, and other steps
possible designs for use in the weighing process.

Participation increases expertise of measurement personnel by:
direct communication with NBS; awareness and resolution of measurement problems; and exposure
to state-of-the-art measurement and data analysis techniques.

Increases NBS awareness of industry needs by direct communication.

Can be used to assure our customers that measurement processes are in control.

MAPs could form basis for laboratory accreditation.

Should result in reduction of NBS expenses and work load by essentially servicing up to five companies at one time.

Inter-company cooperation provides for immediate back-up of standards.

Provides the United States with known standards spread throughout the country in the event of disaster, or other cause of loss of the national unit of measure.

Increases communication between companies.

Results in significant cost savings
a. NBS Charges
b. Transportation
c. Standards Downtime
   (1) Eliminates need for duplicate standards
   (2) Increases standards utilization
   (3) Reduces calibration scheduling problems.

Mass MAP

Initially several things are required of interested participants in a mass MAP. Briefly, there are discussions at the managerial level, training of staff at NBS, if necessary, inspection of equipment, initial calibrations at the user's facility, and other steps to ensure that the total measurement process is understood by both NBS and the participant. NBS calibrates the participant's starting standards and works with the participant on possible designs for use in the weighing process.

The participant periodically compares his standards with a check standard. All data is sent to NBS for analysis to: determine if an out-of-control condition exists, provide test reports, monitor the behavior of the check standard by control charts, and periodically update statistical analysis on the behavior of the check standards and balances over time and over varying

environmental conditions. As long as the analysis indicates an in-control condition, there is no need for the participant to re-compare to the national unit. For more details on this program, you may contact either Dr. James Whetstone of the Fluid Engineering Division or Mr. Jerry Keller who is the NBS coordinator for this program.

Gage Block MAP

This program is a little more formal in the sense that NBS has produced a monograph for this purpose which is intended to show the user how to set up a measurement assurance program on his own or with the cooperation of NBS. It gives measurement assurance philosophy that should be applicable to any measurement process; technical recommendations on gage block calibration procedures; and specific procedures and statistical tools necessary for establishing initial values for the check standards, monitoring the process, updating the parameters of the process and eventually linking the entire calibration output of the laboratory to NBS.

The emphasis is on trying to make the laboratories as independent as possible from NBS. A user can elect to either send his standard blocks back to NBS for recalculation or he may request that NBS send him two sets of calibrated blocks with which he will calibrate his own system. The monograph sets up the procedures in worksheet format so that all calculations can be easily handled by the laboratory's staff programmed for a computer. It also gives a recommended format for a laboratory wishing to issue its own test report and uncertainty statement.

This program takes into account the fact that not all laboratories have the same needs, and three different levels of program are outlined, each requiring greater investments of time, personnel and equipment. The simplest is for a laboratory that makes single measurements on a test set and wishes to monitor only a select set of sizes of blocks; the second is for calibrating a test set against two standard sets with four observations; and the third is for calibrating a test set against two standard sets in a trend eliminating design with eight observations.

NBS will still give technical advice when requested, and at least initially NBS is offering to help with computations and data analysis although the aim is still to make the labs as self-sufficient as possible. At the suggestion of someone from one of the industrial labs who was asked to comment on the monograph, NBS is planning to prepare another publication containing computer programs which would directly follow the format of calculations given in the monograph.

NCSL Measurement Assurance Committee

For the last year the Measurement Assurance Committee has focused its activities on development and expansion of the
regional MAP concept. As a result of the committee efforts, MAP concepts have been presented at most NCSL regional meetings, and several regional groups have been formed. The committee has and will continue to act as a focal point for the coordination of forming regional MAP groups. If you are interested in joining a group MAP, you may write to the committee chairman, Gary Davidson, TRW/DSSG, Building S., Room 1486, One Space Park, Redondo Beach, California, 90278.

Summary

MAPs are not a new concept, they have been around a long time, but there are many variations and therefore many misconceptions. Part of the problem here is that very little is written on MAP and very few people agree on what qualifies a program as a MAP. What was presented at this workshop were examples of programs that we think would qualify as a MAP; please keep in mind they are only examples. I think we can see that the examples offered in this workshop can benefit the measurement community and reduce their dependency on NBS. Additionally, with the proper tools and programs, the NBS workload could be reduced in existing programs to allow more rapid development of new programs and technologies.

I wish to express my sincere thanks to the panel: Mrs. M. Carroll Croakin, Statistical Engineering Division for Applied Mathematics — NBS, Mr. Norman Belecki, Electrical Measurements and Standards Division — Center for Absolute Physical Quantities — NBS, and Dr. Lee J. Kieffer, Office of Measurement Services — NBS. Their time and effort are greatly appreciated.

Gary M. Davidson
TRW/DSSG
Workshop Developer

A MESSAGE FROM THE NEW NEWSLETTER EDITOR — HELP!!

Wilbur’s work as Editor will be a hard act to follow. But follow we will with as much help from everybody as I can talk you into. I ask your patience, feedback, and as much publishable material as you can lay your hands on.

You’ll see an immediate change in the inside format of the Newsletter. While the old format had an inviting informality to it, our mailing charges and printing costs are rising inexorably. This new layout will help cut pages and yet should be just as easy to read.

But the proof of any product is how the public buys it. In this case, I’d like your frank opinions on the new format for both readability and content.

I’m thinking of several new departments, too. One would be to bring back the 2-3 page pictorial reports of member laboratories. I think these are important for several reasons. One, it’s good for all members to be aware of your lab’s capabilities and facilities. In a way it’s a little like visiting your lab. Two, we should all be aware of the positive value in promoting our lab’s capabilities within our own companies and organizations. Recognition in the NCSL Newsletter can’t hurt in your efforts to improve the visibility of your lab’s contribution.

Another department is an idea to provide short capsule descriptions of innovative uses of measurement mini-systems. The idea struck me as we visited Don Flaherty’s lab at Boeing a few months ago. In 3 separate applications they were using calculator-based systems to improve measurement times and accuracies; a gage-block comparator, a precise manometer calibrator and a photo-detector sensitivity profile system.

So my message is:

1) Give me some feedback;
2) Give me your facilities pictorial story; and
3) Give me descriptions of innovative applications of mini-systems.

John L. Minck
Newsletter Editor
FUTURE CHANGES IN MEASUREMENT SERVICES

Brian Belanger — Office of Measurement Services, NBS

The National Bureau of Standards offers a wide variety of calibration and related measurement services. These services are described in detail in NBS Special Publication 250 "Calibration and Related Measurement Services of NBS". New editions of SP 250 are issued periodically, the most recent edition was April of 1978. An appendix to SP 250 is published every six months (June and December) and lists the current prices for such services. This appendix also provides information on recent additions, deletions, or changes in services. (Copies of SP250 may be obtained by writing to or calling the NBS Office of Measurement Services — address later in this article.)

From time to time it is necessary for NBS to reduce certain activities to allow resources to be allocated to other activities of higher priority. NBS attempts to provide users of our services with information concerning possible reductions in services as far in advance as possible so as to give users adequate lead time to call to our attention adverse impacts of such reductions, and to seek alternative sources of support. (Circumstances beyond our control may necessitate reducing or terminating services with less lead time than we would like.) Notices in the NCSL Newsletter will provide NCSL members with the most up-to-date information available from NBS.

Due to changing priorities for NBS services and activities, the Electrical Measurements and Standards Division (EMSD) will, on December 15, 1979, curtail the calibration of certain resistive ratio devices and apparatus as noted in the table which follows:

<table>
<thead>
<tr>
<th>SP 250 Item</th>
<th>Title of Service</th>
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<tbody>
<tr>
<td>3.1 L&amp;M</td>
<td>Standard Resistors—High Resistance</td>
</tr>
<tr>
<td>3.1 N</td>
<td>Temperature coefficient Data—4 terminal standard resistors</td>
</tr>
<tr>
<td>3.2 A, B, D, E, F, G, H, I, J, K, L, M, N, O, P, S, T, &amp; U</td>
<td>Precision electrical Apparatus (e.g., various ratio type devices)</td>
</tr>
</tbody>
</table>

The ratio devices on the list were chosen for curtailment because: (a) as they are unitless, their calibration need not be performed using national standards, (b) there is no known legal or quasi-legal requirement for traceability in this instance, and (c) sources of similar calibrations exist in private industry. In the case of the other items being curtailed, they may be readily calibrated at the modest levels of accuracy that they warrant (due to their inherent properties) using commercially available equipment and, like ratio devices, suitable sources for their calibration exist in the private sector. These sources may be located through the National Conference of Standards Laboratories (NCSL) Directory of Standards Laboratories, the "electronic engineers master" (United Technical Publications) catalog, the "Electronics Buyer's Guide" (McGraw-Hill), the "Electronic Design's Gold Book" (Hayden Publishing), and, in some locations, the Yellow Pages telephone directory. Manufacturers of the equipment involved frequently provide calibration support. Copies of the NCSL directory may be obtained through:

Mr. Kenneth Armstrong
National Bureau of Standards
4001 Radio Building
Boulder, Colorado 80303
Telephone: (303) 499-1000 (3738).

For assistance in locating alternative sources of support or for other technical questions regarding the above items, please contact:

Mr. Norman Belecki
Electrical Measurements and Standards Division
Center for Absolute Physical Quantities
Metrology Building Mail Stop B146
U.S. National Bureau of Standards
Washington, DC 20234
(301) 933-2715.

It should be recognized that in many cases where NBS calibrations are not advertised in SP 250, special arrangements can still be made on a case-by-case basis (NBS workload permitting) if it can be shown that there is a critical need for an NBS calibration.

NCSL members who have a concern or general questions regarding the above matter should contact either Dr. Brian Belanger or Dr. Lee Kifffer at the address below:

Office of Measurement Services
Physics B362
National Bureau of Standards
Washington, DC 20234
(301) 921-2805.
OVERVIEW

The Board of Directors worked hard along with many other dedicated individuals this past year to bring about needed changes, make things happen and to be responsive to the membership. Results were mixed but overall positive.

NCSL continued to grow in 1978. Paid membership increased from 295 to 335. Foreign membership also grew from 16 to 23 members.

Complexion of the NCSL membership is shifting somewhat. In addition to the increase in foreign members, companies such as Eli Lilly, High Story Technology and Scott Environmental Technology are becoming commonplace. The challenge to NCSL: Meet the Needs of New Members as Well as the Changing Needs of Old Members.

The entire Long Range Plan was thoroughly reviewed and updated by Ron Kidd.

Selected National Measurement System Study reports were made available to member companies.

Major revisions to the bylaws were passed bringing them more in line with actual practice.

One of the brightest points this past year was that the Regions were very active, holding a total of 18 meetings. In my view, Regional Meetings serve an extremely important function in our organization, and is where the transfer of information, accomplishments, etc. really takes place.

An outstanding Workshop and Symposium was put together by Sam Davidson and Brian Belanger.

Participation at Board meetings continued strong by Board members, Regional coordinators, Committee chairmen and Committee members.

The proposed revision of MIL-C-45662A was closely followed and reported on to the membership. (The proposal has since been withdrawn.)

Bascom Birmingham, Sponsors Delegate, continued to keep the membership informed of major changes the Bureau's reorganization has brought about and also kept us abreast of OIML activities.

COMMITTEE ACTIVITIES:
Meetings and Programs 1A

The Meetings and Programs committee was relatively inactive this past year as its chairman, Sam Davidson, was extremely busy handling Conference Co-Chairmanship and Director responsibilities. The primary function of this committee is to prepare, coordinate and distribute suggested agenda topics for Regional meetings.

Honors and Awards 1B

Doug Doi completed another outstanding year as chairman of the Honors and Awards committee. As in the past, Doug handled the entire committee's activities by himself with excellent results. Doug has since been elected Secretary so has relinquished the Honors and Awards chairmanship for the coming year to Bob Lady, Lockheed-Georgia.

Education and Training 1C

The Education and Training committee, under the chairmanship of Hank Daneman, continued and expanded activities which were started last year. Included in their accomplishments were:

a. Completion of a course register which outlines what formal instruction is available.

b. Duplication of video tapes. NOTE: All video tapes are now available on both 1/2 inch reel-to-reel EIAJ standard and 3/4 inch cassette.

c. Developing a very successful workshop session for the Conference just completed.

d. Completed preliminary work on developing a proposal to commission outside sources to prepare a complete course for Metrologists.

National Measurement Requirements 2A

The activities of the National Measurement Requirements committee were confined to developing, compiling and distributing results of a questionnaire designed to provide general information relating to the NCSL memberships present and projected requirements versus NBS services.

Frank Flynn, committee chairman, has reported other questionnaires and activities are planned to further define NCSL membership requirements. These activities will be coordinated with NBS personnel.

Laboratory Evaluation Committee 2B

Dennis Gallagher, committee chairman, continued to channel the efforts of this committee toward keeping the membership informed of the various laboratory accreditation programs, i.e., NAVLAP, AALA, etc. Along those lines, Dennis also developed a workshop session and had several key individuals representing various organizations participate as panel members.
Bio-Medical Electrical Safety Standards Committee 2C

This committee, under the chairmanship of Andy Dixon, has been quite active disseminating information relating to regulatory agencies and Bio-Medical Standards organizations activities. The committee has also completed a proposed draft outline of recommendations on Metrologist proficiency. The document, if ultimately developed, could be used as a guide in determining compliance to portions of the FDA Good Manufacturing Practice Regulations. It may also form the basis for a universal document covering Metrologist in general.

Calibration Systems Management Committee 3A

Results of the survey on intervals, which the committee initiated, was published in the July Newsletter. Those results are far from conclusive, however, they do give some insight by which an individual can compare his own system. Development of questionnaires for: the survey of selected instrument experiences and salaries, and an update of the “Government Specification Affecting Calibration Laboratories” are at varying stages and will be pursued in the coming year, according to George Rice, chairman of this committee.

Measurement Assurance Committee 3B

This committee, under the chairmanship of Gary Davidson, was one of the most active in terms of membership involvement. The committee was completely re-formed and the objectives changed from that of promoting “Round Robin” to that of developing and expanding the “Regional MAP” program concept. NBS personnel, Brian Belanger, Norm Belicki and Woodie Eicke, gave presentations at six Regional meetings on Regional MAP’s. They have also met with individual prospective MAP groups, in counseling sessions, answering specific questions related to procedures, measurement techniques, instrumentation, etc. There are prospects for eight groups, however, only one has progressed to the point of making out purchase orders and actually have a start date. With the changes in NBS services, which have already taken place and more anticipated, activities and accomplishments of this committee become increasingly important.

Product Design and Specifications Committee 3C

This committee, headed by Chuck Corbridge, has been very active the past year striving to complete two projects carried over from prior year. The first one was to revise RPS “Calibration Procedures: Preparation Of.” All differences have been worked out and the committee has recommended it be turned over to the Recommended Practices committee for inclusion in the Information Manual. The second effort was to generate a “Recommended Practice for Specifications: The Preparation Of.” Excellent progress was also made on this project and the fourth cut will soon be submitted to the membership for critique via the Newsletter.

Calibration Laboratory Automation Committee 3D

Pete Engeland, chairman, has spent a good deal of his time this past year representing the NCSL on the Industry/ Joint Services Automatic Test Project, I/JSATP. Along with that assignment came a request that Pete write a paper, “Calibration, Repair and Software Support Responsibilities,” and conduct a workshop at the I/JSATP Conference, which he handled in fine fashion. The committee developed a questionnaire to survey NCSL users of ATE systems and published same. They launched a Desk Top Calculator Tape Interchange Program which has gotten off to an excellent start.

Newsletter Committee 4A

Wilber Anson, Newsletter Editor, handled this committee again this year in his usual professional manner. Four issues in all were published which allowed for timely distribution of information on NCSL activities, committee accomplishments, NBS trends and other interesting and useful topics.

Information and Directory Committee 4B

Jim Gilbert, chairman, again handled the affairs of this committee in fine fashion. Recommendations which he presented and since implemented are designed to simply and streamline the committee’s data collection and at the same time make its products more useful to the membership. Plans have progressed nicely for the 1979 Standards Laboratory Directory scheduled for publication January, 1979.

Recommended Practices Committee 4C

Primary efforts of this committee, under the direction of Bob Weber, have been to finalize all tentative Recommended Practices as appropriate. Tentative Recommended Practices 1 and 4 have been formally adopted. The committee has also been actively working with the Laboratory Evaluation committee on “Recommended Practices For Use in the Evaluation of Measurement Control Systems and Calibration Laboratories,” currently at the draft 3 review stage.

Conclusion:

As I mentioned at the beginning, the Board, as well as many others, have worked hard to make the past year successful for the organization and its members. In ending, I wish to express my thanks to all of those who did the work as it would be difficult, if not impossible, to single out each individual responsible for that success.
REPORTS FROM THE REGIONS

May 11, 1978
RCA, Mountaintop, Pennsylvania
Selwyn Smith
Region 2 Coordinator

The meeting was opened by M. Corrigan due to the absence of John Attanasio, Regional Coordinator. An introduction of the attendees was followed by the general rules by which our meetings are conducted.

The annual meeting is to be held in Washington D.C. at the National Bureau of Standards during October.

A Board of Directors’ letter notified the members of the NCSL Fellow Program. Opinions were requested to be presented and after discussion, Moe was asked to inform the Board that we feel negatively toward the Fellow Program and that the monies connected with it could be better used if directed toward education programs.

It was reported that the MAP’s program for voltage measurements is being started in this region and that the membership would be kept informed of the progress.

R. Palmer of Bendix Corporation presented a talk on an Automatic Calibration System which has been in use by his company for several years. Several members injected additional comments on automatic calibration systems of various manufacturers and all generally agreed on the contents and experiences as related by Mr. Palmer.

A roundtable discussion was opened on recruiting methods. Most delegates present indicated that hiring is at a standstill and has been for several years.

The Training Programs under investigation by Stan Hale of Bendix are progressing slowly and in need of volunteers. Anyone interested should contact Stan.

Unpaid dues were investigated and it was determined that most companies in arrears are the larger ones, and that the arrearages are caused by internal paperwork.

Elections were held for a new Regional Coordinator for the ensuing year. ‘Yours truly’ was nominated and elected unanimously.

The door prize was won by Dick Palmer.

ATTENDEES
M. Caravaggio RCA, SSD
H. Van Duyne JRL
J. Weiss ITT Avionics
K. Conrad AMP
J. Hopkins AMP
J. Welsh GE—RESID
T. Ferry ERADCOM
R. Manning Cannon Inst.
R. Palmer Bendix
G. DeRemer AEC
M. Corrigan Lockheed Elect.
E. Turner Turner Balance & Weights
S. Smith RCA, SSD

September 13, 1978
NBS, Gaithersburg, Maryland
Marlin Johnson
Region 3 Coordinator

Marlin Johnson, Regional Coordinator, chaired the meeting. He welcomed the participants and asked each to introduce himself. He then reviewed recent NCSL activity as follows:

1. The draft revision of MIL-C-45662A, Calibration System requirements, is being reviewed by DOD.
2. The Measurement Requirements Committee requests the submission of any new or future measurement requirements.
3. The Calibration Automation Committee is organizing a Calculator Program Interchange. A questionnaire has been distributed to survey interest, identify participants, and collect information on programs which are available.
4. The Education and Training Committee invites the identification and submission of training needs.
5. NCSL is still seeking a nominee for the NBS/NCSL Fellow program.

Additional items of general interest were discussed as follows:

1. A short discussion on the use of microfiche manuals emphasized the preference of most technicians to use conventional instruction manuals.
2. Another topic discussed was the use of videotape for training. It appears that few technicians will use videotape resources on their own, even when such resources are readily available. It was concluded that training may be a neglected area for many organizations where it should be a strong, ongoing program.
3. Two problems were noted by a regional member: an apparent lack of qualified technicians in the job market, and a reluctance on the part of management to pay salaries in the ranges sought by qualified technicians. A review of
salaries versus qualifications was mentioned as a possible topic for a future survey and/or workshop.

4. A library of Tektronix service information is now available in the GIDEPEP (Government-Industry Data Exchange Program) Metrology Data Bank.

5. Mr. Kern also displayed, for information only, the minutes of the July 26 meeting at NBS of the Interagency Metrology Committee for the Federal Coordination of PM and TE (Precision Measuring and Testing Equipment). Agencies represented included: NBS, DOD, DOT, DOE, FAA, and NASA.

After a 15 minute break, Mr. Woodward E. Eicke, Jr., of NBS, delivered a presentation with slides and a handout on the Measurement Assurance Program (MAP), followed by a question and answer session. The goal of the Regional Measurement Assurance Program is to maintain the accuracies of five or six regional laboratories through the certification of one of them which acts as a pivot lab in a program designed to minimize regional dependence on NBS.

After lunch, Mr. John Van Syckel, of Hewlett-Packard, gave us a slide presentation on SCAT, the automatic test system used by Hewlett-Packard in their regional service centers. The in-depth presentation included: reasons for automatic testing, areas of application, return-of-investment considerations, performance test, flow charts, alignment flow charts, board testing, equipment layout, stimulus and measurements, equipment specifications, block diagrams, software flexibility, test sequence segment, methods of accuracy enhancement, program development time, printout samples, and additional system benefits. One of the most important system benefits was felt to be that the skilled technician is relieved of the boredom of routine calibration and data recording. Knowledge of electronics theory is not required to operate the automatic calibration system, and the technician can be freed for troubleshooting other instruments and systems.

Mr. Johnnie Darden, of the Navy Eastern Standards Laboratory, described that Lab's use of three IEEE-488-1975 bus systems: a fully automatic accelerometer test system, and semi-automatic systems for measuring RF power and for testing standard cells. Mr. Darden handed out papers describing each system and answered questions.

Mr. Fred Kern, of NASA/Langley Research Center, presented a summary of automatic calibration systems in use at Langley. These included systems for calibrating the following instruments: amplifiers, multimeters, decoders, voltage controlled oscillators, pyrometers, digital thermometers, accelerometers, attitude gyros, pressure transducers, and up to six component strain-gauge force measuring balances. A handout booklet summarized system status, ranges, accuracies, software language, instruments tested, cost of system, problems, manpower savings, system output, operator, point-of-contact, and comments pertaining to each system. Pictures of system components, block diagrams, and sample printouts were also included.

Mr. Wayne Brandt, of Micro-Tel Corporation, distributed and discussed an application note on microwave attenuation measurement, which included a description of an automatic system for measuring attenuation over the range from .01 to 18 GHz.

Marlin Johnson announced that he has the name of a Bendix point-of-contact for anyone interested in an analog board testing system.

The meeting adjourned at 2:10 p.m.

ATTENDEES
Ron Armacost  Black & Decker
Wayne Brandt  Micro-Tel Corp.
James I. Cigler  Type II Lab., NARF, Norfolk
Johnnie E. Darden  NASA, Langley Research Center
S.F. Edwards  NBS
W.G. Eicke  Automation
Jim Gilbert  JHU APL
Marlin Johnson  NASA, Langley Research Center
Fred A. Kern  OMS, NBS
Lee Kieffer  Comsat Labs
Pat McCusker  Type II Lab, NARF, Norfolk
Rick Mills  Hewlett-Packard
George Tamaki  Hewlett-Packard
John Van Syckel  NSWC, White Oak
Ed Webb
Steve Will  Type II Lab., NARF, Norfolk
Richard A. Yazel  National Security Agency

The NCSL Gaithersburg conference to be held October 4-6 at the National Bureau of Standards is being co-chairmanned by Mr. Sam Davidson, so he was asked to go through the agenda for the conference. Sam explained that activities were being planned for the wives and families, such as tours of the Washington D.C. area.

October 2-4 will be used for a Board of Directors' meeting of the NCSL and is open to anyone desiring to attend. Sam went on to explain that the conference is going to be seminars and workshops, thus presenting the best of both worlds.

LABORATORY ACCREDITATION PROGRAMS:
Sam suggested that a possible topic of discussion might be
whether or not a laboratory accreditation program can work, and is it necessary? Sam also explained how NAVLAP came about and its anticipated effect on the electronics industry.

The NAVLAP program’s first task is to evaluate the testing programs of the thermal insulation and the ready mix concrete industries, and to issue accreditations for them. The NAVLAP program will accredit a laboratory only on a very narrow discipline and it appears that NAVLAP will not initially accredit overall laboratory capabilities. The question “is universal laboratory accreditation possible” still remains unresolved. Mr. Davidson went on to explain that a calibration laboratory had already applied to NAVLAP for accreditation, and that NAVLAP replied that they could not give an overall accreditation to a calibration lab because that was not the overall thrust of NAVLAP.

From a Region VI point of view, there is much confusion concerning NAVLAP, or any other universal accreditation program. A suggestion was made to get the state of Texas more involved and to follow the example of Oklahoma. Paul Groos stated that the state of Texas was sent notice of the meeting held at Tracer, Austin, and that the notice was followed by a phone conversation between the appropriate state agency and himself, where he was told that the state would have at least two representatives present. No one showed at the conference. Mr. Groos explained that, according to Dept. of Agriculture personnel, when the state receives funding for an accreditation team they may consider accrediting metrology labs.

The following points were made by the attendees of the meeting:

1. Consumer protection against calibration and repair laboratories that do not follow proper metrology procedures, that use sub-standard parts, etc.
2. Different audit teams standardizing their procedures for audits.
3. More programs in universities and colleges concerning metrology.
4. More standardization through MAP.
5. Standardization of metrology when dealing with Nuclear Regulatory Agencies.

MEASUREMENT ASSURANCE PROGRAM

Bill Simmons explained how Lockheed has participated in programs and how it has benefitted by using these programs.

A discussion was lead by Bill Simmons and Sam Davidson concerning the training of metrologists and technicians in the measurement science field. Of general interest was the lack of qualified personnel in the instrumentation and metrology fields. This shortage of people has created many problems from the hiring away of personnel, to law suits between rival companies, because of hiring practices, high technology secrets, and internal company information. During this round table discussion, it was established that all members would like to see more junior colleges and universities take a stronger interest in the measurement sciences. Sam explained to all present that NCSL has an active training committee with training aids for those members that desire this service.

After the meeting all participants were given a tour of the Tracer facility, including their calibration laboratory. Many thanks go to Mr. Larry Wynnus and to Mr. Tommy Weaver for the luncheon which Tracer provided and for their enthusiasm and interest in the NCSL.

ATTENDEES

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Jim Bailey</td>
<td>Bailey Electronics Co.</td>
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<tr>
<td>Carl Burkhardt</td>
<td>Eagle Signal Corp.</td>
</tr>
<tr>
<td>Bill Byron</td>
<td>Rhodes-Groos Laboratories</td>
</tr>
<tr>
<td>Sam Davidson</td>
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<tr>
<td>Edward Durbin</td>
<td>McDonnell Aircraft</td>
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<td>James Good</td>
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<td>Paul Groos</td>
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<td>Vince Kalinovsky</td>
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<td>Claude Miks</td>
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<td>Pat Morrison</td>
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<td>James Patterson</td>
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<td>Tom Scallorn</td>
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<td>Bill Simmons</td>
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<td>Robert Trolinger</td>
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<tr>
<td>Tommy Weaver</td>
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<td>John Whittington</td>
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</tr>
<tr>
<td>Larry Wynnus</td>
<td>Tracer Inc.</td>
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The Fifteenth Region 8 NSCL Workshop was held on Sept. 20, 1978, at Rochelle’s Restaurant in Long Beach, CA. Forty-seven member delegates, associates and guests represented 21 member and seven guest organizations. Rolf Schumacher, Rockwell International, opened the meeting at 9:05 a.m. with a brief welcome to the attendees.

Measuring Instruments with Known Patterns of Behavior and What Kind of Interval Adjustment Method is Best Suited for Which Instrument Type? — Bob Couture, Rockwell International, conducted this dual workshop during the morning part of the meeting. The purpose was to determine first what kinds of measuring instruments undergo changes
in their calibrated characteristics in accordance with a known pattern (presumably resulting from a known cause system) and then to find interval adjustment methods best suited for the various types of instrument behavior.

The attendees were able to name an impressive list of generic instrument types together with the typical behavior patterns for these instruments and the probable causes for these patterns. The named instrument types included thermocouples, standard cells, standard resistors, crystal controlled oscillators, capacitive manometers, bourdon type pressure gages, gage blocks, liquid-in-glass thermometers, and several more.

Gage blocks and similar mechanical gages which wear down as they are being used should be assigned successively shorter intervals, following an initial long interval, as they approach the end of their tolerance band. The trouble with this concept, it was pointed out, is to find a suitable initial interval. Opinions were divided on whether intervals should be assigned and changed for instruments as a family or class or individually. Intervals assigned to families should reflect the particular environment in which they are being used, or the use conditions, or both.

The round-table discussions were ended at noon for lack of time. Numerous suggestions and requests were made for methods to continue the collection of information and evaluation and analyses surrounding this approach to interval adjustments.

An ad-hoc working group for the study of instrument behavior and intervals, it was announced, has been formed under the auspices of the Navy Engineering Metrology Center in Pomona; most members of the group were also present at this workshop. This group will evaluate the collected information and possibly initiate further steps. Other actions are being considered at this time, and Region 8 members will be kept informed concerning a continuation of the work begun during this workshop.

OIML (International Organization of Legal Metrology). Dr. Brian Belanger, National Bureau of Standards, Gaithersburg, MD, described the importance and possible far-reaching consequences of the OIML. This part of the workshop was planned so as to make NCSL Region 8 membership aware of the efforts of NBS with the assistance of other government and private organizations; OIML is certain to have an impact on the work of calibration and standards laboratories in the future. Founded in 1955 under the leadership of European industrial nations, OIML tends heavily towards centralized and government controlled operations in the dissemination of the units of measurements, including the manufacture, approval, standardization, and use of measuring instruments. Its philosophy has been widely contrary to U.S. preferences of freedom of choice and consensus standards. The U.S. joined OIML in 1972 to participate in, and influence, the development of future OIML standards and recommendations. OIML regulations are already restricting trade. Dr. Belanger stressed the importance of participation by the private sector in the work of the U.S. delegations to OIML.

Measurement Assurance Programs with NBS. — Dr. Belanger then explained briefly the concept of Measurement Assurance Programs as applied by NBS. He defined a Measurement Assurance Program as “...a measurement quality assurance approach that allows one to demonstrate that the total measurement uncertainty arising from both random error and systematic error relative to national or other designated standards is quantified and sufficiently small to meet the requirements for the measurement process.” Its practical application involves a closed-loop feedback system. Measurement Assurance Programs exist for mass, resistance, dc voltage ratio, capacitance, voltage, electrical energy (watt-hour meters), laser power, and temperature (resistance thermometry). Additional programs are being developed for microwave power, pressure, length, liquid flow, radiosotopes, photo detection responsivity, and spectral irradiance.

Report from the NCSL Board of Directors. — Laurel Auxier, Beckman Instruments, NCSL President, gave a report from the NCSL Board of Directors and announced the newly elected slate of officers. The expected revision draft of MIL-C-46560 has not been released for comments but was shelved indefinitely.

The meeting was adjourned at 3:40 p.m. A special meeting on calibration interval adjustment methods in operation, the rationale behind them, exceptions and results, is planned for the first half of 1979. The next regular Region 8 meeting is scheduled for February 14, 1979.

ATTENDEES

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
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</thead>
<tbody>
<tr>
<td>Marvin Benz</td>
<td>APPRO-Hughes</td>
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<tr>
<td>Albert Starr</td>
<td>Aerojet Mfg. Co.</td>
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<tr>
<td>Lyle Gormley</td>
<td>Anaconda Telecommunications</td>
</tr>
<tr>
<td>Laurel Auxier</td>
<td>Beckman Instruments</td>
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<td>Jack Edison</td>
<td>Beckman Instruments</td>
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<tr>
<td>Arno Ehman</td>
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<tr>
<td>H. J. Stephens</td>
<td>California Inst. of Technology</td>
</tr>
<tr>
<td>Walt Moore</td>
<td>Jet Propulsion Lab.</td>
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<tr>
<td>Gus Wade</td>
<td>DCASMA — Pasadena</td>
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<tr>
<td>Gene Kullmann</td>
<td>DCASMA — Santa Ana</td>
</tr>
<tr>
<td>John Henderson</td>
<td>Dept. of the Navy, Western Standards Laboratory</td>
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<td>Hartwell Keith</td>
<td>Ford Aerospace &amp; Communic. Corp.</td>
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<td>M. Reyneke</td>
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<td>Darlo Clemens</td>
<td>General Dynamics—Electronics Div.</td>
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<td>Richard Shafer</td>
<td>General Dynamics—Convair Div.</td>
</tr>
<tr>
<td>Brian Belanger</td>
<td>Hercules, Inc.</td>
</tr>
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1978-79 TENTATIVE NEWSLETTER SCHEDULE

This proposed schedule for the newsletter should be noted by all Board Members, Committee Chairmen, Regional Coordinators, and all who might want material published. It keys on Board Meeting dates so that the most recent Board actions are reported.

<table>
<thead>
<tr>
<th>Board Meeting</th>
<th>Deadline Copy to Editor</th>
<th>Copy to Reviewers</th>
<th>Newsletter in Mail</th>
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<tr>
<td>Early Oct., '78</td>
<td>October 31</td>
<td>November 15</td>
<td>December 15</td>
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<tr>
<td>Jan. 25-26, 1979</td>
<td>October 31</td>
<td>November 15</td>
<td>December 15</td>
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<tr>
<td>April 26-27, 1979</td>
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<td>November 15</td>
<td>December 15</td>
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<td>July 26-27, 1979</td>
<td>October 31</td>
<td>November 15</td>
<td>December 15</td>
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<tr>
<td>Oct. 18-19, 1979</td>
<td>October 31</td>
<td>November 15</td>
<td>December 15</td>
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</table>

Material should be addressed to:
John Minck
Stanford Park Division - 5U
Hewlett-Packard Company
1501 Page Mill Road
Palo Alto, CA 94304
Telephone: (415) 856-2060
STATUS OF RF AND MICROWAVE CALIBRATION SERVICES AT NBS

R.A. Kamper, Chief, Electromagnetic Technology Division, National Bureau of Standards, Boulder, Colorado

About two years ago, in response to a reassessment of priorities at NBS, a decision was made to reduce the manpower assigned to the RF and microwave calibration services and to make a corresponding reduction in the workload by narrowing the scope of services offered. In choosing the list of services to be cut, we consulted our major calibration customers in the Department of Defense and in private industry, and preserved all services that were considered to be essential for maintaining traceability of RF and microwave measurements to NBS. The new, reduced, list of services is published in the June 1978 appendix to NBS Special Publication 250, "Calibration and Related Measurement Services of the National Bureau of Standards" (available from the Office of Measurement Services, NBS, Washington, DC 20234). Note that this list differs from a preliminary version published by Mr. B. W. Birmingham in the NCSL Newsletter of March 1977. Several services that had been proposed for cutting were kept on the list in response to comments we received from our calibration customers. We intend to maintain the services on this list as long as a significant need for them remains.

Any changes will be announced as far in advance as possible in the biannual appendices to NBS Special Publication 250 and in the NCSL Newsletter.

Unfortunately, the transition to the reduced level of calibration service maintained by a reduced staff was not a smooth one. A backlog for some services quickly built up, causing long delays. It was necessary to close down temporarily the calibration services for attenuation and reflection coefficient in rectangular waveguide (which are used infrequently) to free our limited manpower to cope with the services in higher demand. We regret the inconvenience that all this has caused.

The present situation is much better. The backlog has been cleared. The calibration services for attenuation and reflection coefficient in rectangular waveguide are being restored on the following schedule:

<table>
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<th>Waveguide Size</th>
<th>Date</th>
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<tbody>
<tr>
<td>WR-90</td>
<td>ready now</td>
</tr>
<tr>
<td>WR-62</td>
<td>ready now</td>
</tr>
<tr>
<td>WR-42</td>
<td>ready now</td>
</tr>
<tr>
<td>WR-15</td>
<td>ready now</td>
</tr>
<tr>
<td>WR-28</td>
<td>late Nov. '78</td>
</tr>
<tr>
<td>WR-137</td>
<td>late Nov. '78</td>
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</tbody>
</table>

All other advertised services are operating. When normal items are received for calibration we quote turn-around times varying from 30 to 60 days, and generally meet them except for occasional delays caused by failures of equipment. The only exceptions are some calibrations of large antennas that take a longer time. This is negotiated in advance. When unforeseen delays do occur we inform the customer as soon as possible.

If there are any complaints or suggestions regarding the RF and microwave calibration services at NBS, I would like to hear them directly.

NCSL ASSISTANCE REQUESTED FOR INFORMATION
ON IMPACTS OF NON-TARIFF BARRIERS

The National Bureau of Standards has requested the assistance of the members of the National Conference of Standards Laboratories in collecting information on the effects of standards as nontariff barriers to international trade. Some economists define nontariff barriers to include an intent to discriminate against imported products. However, differences between U.S. standards and those of other nations can also cause problems even though there is no intent to discriminate and domestic products are subject to the same standards as imported products. Further, requirements for pattern approval and procedures for demonstrating that products satisfy required standards can also create obstacles.

NBS therefore would like to learn of (1) any experience you have had in which standards have caused problems in international trade, either because of a deliberate intent to discriminate or because of differences from U.S. standards; (2) problems you have had with demonstrating that your products meet foreign standards, or (3) experience that indicates your firm, or your industry, has encountered no problems with standards or certification procedures. If you have something to report that may be of interest to NBS, please write to Dr. Edward L. Brady, Associate Director for International Affairs, National Bureau of Standards, Washington, D.C., 20234.
Background

The National Measurement Requirement Committee (NMRC) conducted a workshop at the 1977 NCML conference held in Boulder, Colorado on August 10 through 12. The title of the workshop was “Changes in NBS Calibration Services.” At the conclusion of the Workshop it was decided to prepare a questionnaire and to attempt to better focus on the perceptions and problems of the NCML membership concerning NBS support. The questionnaire was to provide general information to enable more detailed questionnaires to be prepared when required.

The questionnaire was distributed with the March 1978 issue of the NCML newsletter to all NCML members. A total of 63 replies were received.

Results

The replies to Part I of the questionnaire are tabulated in Attachment 1 to the report. This part of the questionnaire was intended to determine the NCML membership awareness and concern for the change in NBS’s services and their knowledge of and interest in MAPs. Ninety seven percent are aware that changes are occurring and 57% are concerned. Eighty-six percent indicate some degree of knowledge of cut backs in R&D efforts at NBS. Ninety percent feel that it is important for NBS to maintain a capability to advance the state of the measurement art. Surprisingly, 10% of the membership don’t consider it critical.

It appears that those who are presently involved in MAPs like them since 80% of those who are now involved in a MAP desire to become more involved in them. Of those not involved, 72% are interested in either more information on or actual participation in MAPs. Many replies contained comments indicating a need for more information on MAP services that are available from NBS. Since our questionnaire was distributed, more information has been made available by NBS. The 1978 Edition of NBS Special Publication 250 “Calibration and Related Measurement Services of the National Bureau of Standards” contains a description of available MAPs along with descriptions of routine calibration services, in each measurement section.

The majority (63%) of the NCML membership submitting replies find no problem with the services available from NBS. In fact, 24% do not use NBS services. Many of those who do not use NBS services indicate that they obtain calibration services from other facilities who do go to NBS for support of standards. The remaining 37% indicate that they are not now receiving essential support or that the service will soon be inadequate in a great variety of areas. Those areas which in my judgement require immediate attention are those where there are a large number of replies or a high percentage of replies indicating present or future problems. That is, where there are at least six replies that indicate a problem irrespective of the total number of users of the service or where 50% or greater of those that use the service indicate a present or future difficulty. Based on the above, the critical areas are as follows:

- 2.2 Vibration (6/14)
- 2.3 Humidity (6/13)
- 2.9 Aerodynamics (3/6)
- 4.2 Fields (4/5)
- 4.3 Impedance (6/19)
- 4.4 Noise Temperature (5/9)
- 7.5 Basic Radiometric Calibrations (6/8)
- 7.9 Pressure and Vacuum (9/18)

A summary of the remarks in the replies, relative to measurement services, is contained in Part III.

Future Actions

All replies will be made available to the NBS for their further evaluation. In cooperation with NBS, areas will be selected for further investigation and preparation of additional survey documents where required.

NUMERICAL SUMMARY

Part I

1. Some changes (mainly reductions) in measurement services by NBS have occurred during the past year or two. Indicate the degree to which you are aware of such changes.

2. Not aware of any changes
33. Have some knowledge of changes
28. Am generally familiar with changes

2. If you have some awareness of these changes, indicate your attitude towards them.

27. Changes have little or no negative impact on this facility
29. Some concern over these changes
7. Serious concern over these changes

3. Indicate the extent of your awareness of reductions in research and development activities in NBS in technical areas related to calibration services.

9. Not aware of reductions
48. Some awareness
6. Familiar with reductions

-41-
4. How important is it for NBS to maintain a research and development capability in areas related to measurement services?

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Use the Service</th>
<th>Present Needs</th>
<th>Not Now Needs</th>
<th>Adequate</th>
<th>Adequate</th>
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<tbody>
<tr>
<td>3.5 Electrical instruments (AC-DC)</td>
<td>26</td>
<td>24</td>
<td>2</td>
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<td>3.6 Instrument Transformers and Comparators</td>
<td>7</td>
<td>7</td>
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<tr>
<td>3.7 High Voltage and Energy Measurements</td>
<td>9</td>
<td>9</td>
<td>9</td>
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<tr>
<td>3.8 Magnetic Measurements</td>
<td>14</td>
<td>14</td>
<td>2</td>
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<tr>
<td>4.1 Attenuation</td>
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<td>4.2 Fields (Electromagnetic) and Antennas</td>
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<td>4.7 Phase Shift</td>
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<td>4.9 Voltage</td>
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<td>6.0 Cryogenics</td>
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<td>7.9 Pressure and Vacuum Measurements</td>
<td>18</td>
<td>14</td>
<td>8</td>
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</tbody>
</table>

5. NBS has worked closely with NCSSL members to develop measurement assurance programs (MAPs) to improve measurement quality control. MAPs can provide a higher level of confidence in the adequacy of the measurement process being controlled, but at least during the setup phase, they may cost more than normal calibrations. In view of the above, what is your present attitude toward MAPs?

- 20 We presently participate in one or more MAPs
- 16 Would like to make greater use of MAPs
- 3 Do not intend to expand MAP activities
- 43 We presently do not participate in MAPs
- 18 Need more information on MAPs to make a decision
- 13 Would like to get involved in one or more MAPs in the future
- 16 No intention of getting involved in MAPs

Part II

<table>
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<th>Parameter</th>
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<th>Not Now Needs</th>
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<td>1.7 Angular</td>
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</tbody>
</table>

- Part II
**REMARKS SUMMARY**

**Part III**

1.1 Mass, Volume and Density: (2) — Provision for testing a laboratory's starting standards at frequent intervals is needed. More versatile MAP program is desirable.

1.2 Weights and Measures: (2) — Turn around times too great. Better standards will be required to support flow power systems of \( \frac{1}{2} \) to 500 SCFM.

1.3 Length: (1) — Microwire width standards are not adequate.

1.6 Flatness, Straightness and Roundness: (1) — Capability to measure roundness to 0.25 microninch should be developed.

1.9 Image Optics and Photography: (1) — Neutral density calibrations are made with integrating sphere. Some industries use diffused surface. The two do not agree. Resolve and select one definition and make the standard instead of two system standards.

2.1 Acoustic Measurements: (2) — Need cheaper, better transfer devices. More time required as NBS reduces services.

2.2 Vibration Measurements: (6) — Increased accuracy required.

2.3 Humidity Measurements: (2) — Development of Portable/Reliable Standards needed. If reduced by NBS, we will have to spend more time and money to maintain accuracy.

2.5 Calibration of Force Transducers and Force Measurement Systems: (2) — We may need a correlation check on dead weight force at about 1,000 pounds. Require West Coast facility above 100K pounds present turn-around excessive.

2.7 Fluid Quantity and Flow Rate Meters: (2) — Turnaround especially on venturis, is excessive. Increased accuracy of test instruments such as turbine systems will require a higher accuracy calibration than now available.

2.9 Aerodynamics: (4) — An improved pressure standard is needed to support Air Flow Measurements below 1000 FPM.

2.10 Low Flow Air Flow. Increased accuracy required. Accuracy adequate; however, turnaround is excessive.

3.1 Resistance Measurement: (1) — High resistance needs better transfer capability.

3.2 Impedance Measurements: (2) — Need good, usable standards at higher frequencies.

3.4 Voltage Measurements: (2) — Dynamic characteristic — not now adequate. We are interested in ac-de difference (TVCs) MAP program possibilities.

3.5 Electrical Instruments (ac-dc): (6) — Dynamic characteristic — not now adequate. Lack of standards at higher frequencies for RFI. Need high frequency standards. Would prefer Regional MAP. Need better instruments in RFI problems.

3.7 High Voltage and Energy Measurements: (1) — 3.7P — Development of this service to provide better accuracy at all voltages; 500 volts to 300KV would be of benefit to us.

4.1 Attenuation: (3) — Would like better accuracy and more frequencies for future. Attenuation in frequency band WR 15 is required but not available. NBS Wave Guide Systems were dismantled and personnel shortages preclude timely reassembly.

4.2 Fields: (3) — R.F. excess noise ratio — not now adequate. The NBS test chamber is not in service. Once it is operating, service should be adequate. We have been told that this will be reduced. Our customers need this service.

4.3 Impedance (6) — Need better accuracy for 4.3 B, C, D, E, and 3T capacitance (OR1404, 1408 calibration to \( 10^5 \) Hz). Lack of transfer in high frequency. Need standard above 1 MHz. Lack of standards and transferability at frequencies above 250 kHz and 1 MHz. Waveguide impedance is required but it is not available. NBS Waveguide Systems were dismantled and personnel shortages preclude timely reassembly.
4.4 Laser Parameters: (3) - Aperatures too small, attenuation to 10^9 is required.
Would like a normal calibration service that would be less expensive than the MAP that is only available now.
MAP at extremely low energy levels at 1.06 mm required. Improvements in beam profile, peak power, and pulse shape measurements required. Energy measurements should be expanded to more wave lengths.

4.6 Noise Temperature: (4) - Require data on N standards to 18 GHz.
30 MHz calibration service not now available.
Would like coax noise calibration 10 MHz to 18 GHz.
Future to 26.5 GHz.
Need 60 MHz.

4.7 Phase Shift: (3) - Anticipate needs up to 94 GHz.
Low frequency phase measurement.
Will eventually be calibrated on NBS modified 100 kHz, 1F automatic network analyzer.

4.8 Power: (4) - NBS Boulder is not currently calibrating Coupler Bolometer Mounts.
Would like coax power to 26.5 GHz in future.
A MAP has just been started. We do not know if service will be adequate.
Anticipate needs to 94 GHz.

4.9 Voltage: (2) - Need more economic transfer method.
Need better, more economic transfer methods.

7.3 Resistance Thermometers: (4) - Standards too fragile
Need better transfer 0 to 400°C (.005°C).
Need better transfer/shippeable devices for 0 to 400°C (.005°C).
Would prefer regional MAP.
No rugged transfer and working standards, instruction with accuracy of at least 0.01°C, especially above 50°C.

7.4 Radiation Thermometry: (1) - Not sufficient information on 1R (heat gun) or area black body calibrations.

7.5 Basic Radiometric Calibrations: (4) - Need accuracy improvement in UV and 750-1100 nm regions and improved spectral resolution.
Would like spectral irradiance detector calibration to 16 micrometers. Currently provided by NUWSC.
Would like a detector calibration service 500 nm to 1700 nm at 10 µW level.
A primary black body radiance standard is required for a temperature between Zn and Au freezing points.

7.6 Basic Photometric Calibrations: (1) - Need increased accuracy on standard lamps.
Need to report accuracy on calibration of flashed opal glass plates.

7.8 Spectrophotometric Standards: (2) - Need better photometric accuracy standards; present standards have an application problem.
Spectral radiometry capability should be extended to cover the 1-15 µm range for DOD.

7.9 Pressure and Vacuum Measurements: (8) - Better transfers for near vacuum instruments.
Need better transfer standard for near vacuum.
Higher accuracy is needed on transfer piston gauges.
NBS does not calibrate standard leaks.
WSL leaks calibrated at Redstone.
Dynamic calibration service not offered.
Need to extend to 10^{-5} pascals.
Traceability to NBS required for less than 0.001 Torr.
Need better standards for high vacuum 10^{-3} to 10^{-5}.

8.1 Neutron Sources: (1) - Require expanded qualitative analysis of PuBe neutron source.

9.1 Computer Science Disk Calibrations: (1) - Service not offered for single platter disc.

9.4 Standard Reference Materials: (2) - Need viscosity samples.
Expansion would enhance usefulness.

Frank Flynn, Chairman
National Measurement
Requirements Committee

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Ford's Janice Sakurai Honored

If a Secretary's work is never done, what about the Secretary's Secretary? For each of 8 Board Meetings, NCSL Secretary Hartwell Keith and Janice have generated about 20 pages of minutes from 1½ day's worth of taped proceedings. In addition, the Secretary administers all new members and action item follow-up. NCSL gratefully recognizes Janice's contributions, and thanks Ford Aerospace Co. for their support. Janice reports that she enjoyed the work and contact with NCSL.
This first draft of the NCSL Metrology Course Register was collated by the Education and Training Committee from generally available sources of information. The NCSL will not be responsible for the accuracy of this data and recommends that anyone interested in any of these courses inquire directly to the Sponsor Agency for up-to-date information.

Any corrections or additions should be sent to Dr. D.R. O’Brien, P.O. Box 2178 Charlotte, N.C. 28242

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<tr>
<th>Sponsor Agency</th>
<th>Location</th>
<th>Dates Usually Offered</th>
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<td>National Bureau of Standards</td>
<td>Gaithersburg, MD 301-921-3806 R. F. Dziuba</td>
<td>April 24, 25, 26, 27, Annually - 40 days</td>
<td>225.00</td>
<td>Low Frequency Electrical Seminar</td>
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<td>Gaithersburg, MD 301-921-2121 Dr. Haylemann</td>
<td>Semi-Annually - 2 days</td>
<td>105.00</td>
<td>Calibration and Use of Piston Gages (Pressure)</td>
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<td>Gaithersburg, MD 301-921-2801 Dr. J. F. Schooley</td>
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<td>Precision Thermometry Platinum Resistance</td>
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<td>Precision Thermometry Thermocouples</td>
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<tr>
<td>Metron Institute of Measurement Technology</td>
<td>928 W. 9th Street Upland, Calif. 91786 W.L. King 714-734-5300</td>
<td>Correspondence 6 months Correspondence 3 months</td>
<td>325.00</td>
<td>Physical Measurements Dimensional Measurements</td>
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<tr>
<td>Tustin Institute of Technology</td>
<td>22 E. Los Olivos Santa Barbara, CA 93105 805-963-1124 Wayne Tustin</td>
<td>Correspondence 6 lessons or special 1 week seminars</td>
<td>60.00</td>
<td>Basic Vibration Theory and Instruments #103A</td>
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<td>Correspondence 3 lessons</td>
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<td>22 E. Los Olivos Santa Barbara, CA 93105 805-963-1124 Wayne Tustin</td>
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<td>Aerospace Vibration Testing Measurement, Analysis and</td>
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<td>Stein Engineering Services, Inc.</td>
<td>5602 E. Monte Ross Phoenix, AZ 85018 601-945-4603</td>
<td>March 14-19 Annually - 6 days</td>
<td>450.00</td>
<td>Measurement System Engineering</td>
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<td>Brinkmann Instruments, Inc.</td>
<td>Westbury, NY 11590 609-448-3000</td>
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<td>1144 Eddy Street</td>
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<td>Dual Technical Institute</td>
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<td>Appalachian Gas Measurements</td>
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## ANNOUNCEMENTS OF METROLOGY – RELATED COURSES

### MEASUREMENT SYSTEMS ENGINEERING SHORT COURSE, March 12–16, 1979.


Program is on how to obtain valid, cost-effective data in the field and in the laboratory through increased productivity of data acquisition systems and groups. The latest developments in the new Unified Approach to the Engineering of Measurements will be presented for the 18th year. Test requestors, designers, theoretical analysts and measurement groups are the audience for which these programs are designed. Electrical measurements of mechanical and thermal quantities are the major topics. All speakers have extensive industrial experience. Numerous experimental demonstrations are included.

### SHORT COURSE NO. 261A

**TITLE:** Minicomputer Technology.

**DATES:** January 22–33, 1979.

**LOCATION:** George Washington University, Washington DC.

**DESCRIPTION:** This course is designed for engineers, technicians, and others working with minicomputers who need a better understanding of this rapidly growing field. The presentation will cover the organization, operation, and programming of minicomputers with examples drawn from currently operating systems.

**FEE:** $275 (the fee for both 261 A&B is $600).

### SHORT COURSE NO. 261B

**TITLE:** Design and Selection of Minicomputer Systems.

**DATES:** January 24–26, 1978.

**LOCATION:** George Washington University, Washington DC.

**DESCRIPTION:** This course is designed to provide a better understanding of the use of minicomputer systems for systems engineers, engineering managers, and others concerned with total systems design. The course will cover all aspects of systems implementation using minicomputers: hardware selection and configuration, software design and programming, peripheral equipment, interfacing with special equipment, and operations management.

**FEE:** $410 (both 261 A&B $600).

For further information, please write to the Director, Continuing Engineering Education, George Washington University, Washington DC, 20052, or call (202) 676-6105 or toll free (800) 424-9773.
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<td>Dr. A. McCoubrey</td>
<td>NCSL Secretariat</td>
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<td>NCSL Secretariat</td>
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<tr>
<td>VP Admin</td>
<td>Hugh Starling</td>
<td>(713) 928-4570</td>
<td>5000 Gulf Freeway, Box 2175, Houston, TX 77001</td>
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<tr>
<td>IA</td>
<td>Sam L. Davidson</td>
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<td>Schlumberger Well Services, 86 S. Cobb Drive, Marietta, Ga. 30063</td>
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<td>IB</td>
<td>Robert M. Lady</td>
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<td>Lockheed Georgia Co. Department 61-15, Z/262, 86 S. Cobb Drive, Marietta, Ga. 30063</td>
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<td>Dave R. O'Brien</td>
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<td>VP Lab Mgmt &amp; Ops</td>
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<td>George Rice</td>
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<td>Rockwell-Autonetics, 3370 Miraloma Avenue, Anaheim, CA 92803</td>
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<td>Gary Davidson</td>
<td>(213) 533-1884</td>
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<tr>
<td>3C</td>
<td>Charles (Chuck) N. Corbridge</td>
<td>(503) 644-0161, Ext. 7880</td>
<td>Tektronix, Inc., MS 58-188, P.O. Box 500, Beaverton, Oregon 97077</td>
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<td>VP Measure</td>
<td>Graham Cameron</td>
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<td>2A</td>
<td>Frank Flynn</td>
<td>(614) 522-7400</td>
<td>Department of the Air Force, HQ Aerospace Guidance &amp; Metro Center, Newark Air Force Station, Ohio 43055</td>
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<td>2C</td>
<td>Geron Smith</td>
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<td>Yellow Springs Instrument Co., P.O. Box 279, Yellow Springs, Ohio 45387</td>
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<td>VP Comm.</td>
<td>John Lee</td>
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<td>4A</td>
<td>John Minck</td>
<td>(415) 856-2060</td>
<td>Hewlett-Packard Company, Stanford Park Division 5U, 1501 Page Mill Road, Palo Alto, California 94304</td>
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<tr>
<td>4B</td>
<td>James N. Gilbert</td>
<td>(301) 871-2165</td>
<td>Automation Industries, Inc., Vitro Laboratories Division 14000 Georgia Avenue, Silver Spring, Maryland 20910</td>
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<tr>
<td>4C</td>
<td>Bob Weber</td>
<td>(408) 742-2957</td>
<td>Lockheed Missiles &amp; Space Co., 1111 Lockheed Way, Dept. 0/48-64, Bldg. 151, Sunnyvale, CA 94088</td>
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OIML
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