

During the formative years the Washington Section found its meeting places in a variety of locations—there was no one designated spot. These included: the University Club, Commercial Club, Washington Public Library, Harvey's Restaurant (famous for its seafood), the Continental Hotel, and the Department of Commerce Building.

## PRECURSOR ROLES IN THE EVOLVEMENT OF NATIONAL CONFERENCES

### 1. Conference on Precision Electromagnetic Measurements (CPEM)

#### a) THE 1949 CONFERENCE ON HIGH FREQUENCY MEASUREMENTS

In 1947 and 1948 there existed within the American Institute of Electrical Engineers (AIEE) the AIEE Subcommittee on High Frequency Measurements, the parent committee being the AIEE Committee on Instruments and Measurements. Dr. Harold Lyons, Chief of the Microwave Standards Section of the CRPL, was a member of this subcommittee of nine members. It was an enthusiastic group that believed the time had come that a national conference could be staged relating primarily to measurements and instrumentation at high frequencies (above the audio range), including the microwave range (considered at the time to be from 300 MHz upwards to the millimeter wavelengths). This subcommittee met in New York City in the spring of 1948 to initiate planning of a national conference on high frequency measurements. The result was a joint effort of the AIEE, The Institute of Radio Engineers (IRE), and the National Bureau of Standards, with the AIEE Subcommittee assuming the leading role. Washington, D.C. was selected as the location of the conference, with Lyons in charge of the Local Arrangements Committee.<sup>15</sup>

The 3-day meeting, called the Conference on High Frequency Measurements, was held on January 10, 11, and 12, 1949. Quoting from the conference program, it was stated:

Washington has been chosen as the location for this conference largely on the basis of the presence of the many Government Laboratories and of the great interest in the subject in that area. This conference is the first to be held on a national basis that is devoted solely to the field of high-frequency measurements and instrumentation. It has been arranged in line with the current AIEE policy of sponsoring conference-type meetings covering thoroughly a limited field.

The conference was a success much beyond expectations. The quality of the technical program was high, and there were 549 registrants in attendance.<sup>16</sup> Thus was initiated the first of a series of biennial conferences on precision electromagnetic measurements that continues to the present time, in which NBS has taken a leading role.

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<sup>15</sup> Frank J. Gaffney of the Polytechnic Research and Development Co. was chairman of the AIEE Subcommittee on High-Frequency Measurements and served as chairman of the conference.

<sup>16</sup> This first conference of its kind was held in the auditorium of the New Building of the Department of the Interior in the downtown area of Washington; fortunately so, for the Bureau facilities would have been inadequate to accommodate the unexpectedly large attendance. Technical papers were divided among four sessions, namely: Measurement of Frequency, Measurement of Power and Attenuation, Measurement of Impedance, and Measurement of Noise and Antenna Measurements. Half-day inspection trips were made to the Naval Research Laboratory, the Naval Ordnance Laboratory, and the National Bureau of Standards. A luncheon at the Roger Smith Hotel provided for a social gathering.



Conference on High Frequency Measurements  
Washington, D.C.

January 10, 11, 12, 1949

Luncheon at Roger Smith Hotel, headquarters

*Invited guests, members of AIEE Subcommittee on High Frequency Measurements, and members of Committee on Local Arrangements.*

*Seated facing camera, left to right*

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<i>E. U. Condon</i>	<i>Director, NBS</i>
<i>F. J. Gaffney</i>	<i>Polytechnic Research and Development Co.</i>
<i>Everett S. Lee</i>	<i>President, AIEE</i>
<i>Newbern Smith</i>	<i>NBS</i>
<i>Hugh Odishaw</i>	<i>NBS</i>

*Standing, back row, left to right*

<i>H. R. Meahl</i>	<i>General Electric Co.</i>
<i>E. F. Felch</i>	<i>Bell Telephone Laboratories</i>
<i>F. A. Hamburger</i>	<i>Johns Hopkins University.</i>
<i>Hugh E. Webber</i>	<i>Sperry Gyroscope Co.</i>
<i>Ivan G. Easton</i>	<i>General Radio Co.</i>
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<i>J. Howard Dellinger</i>	<i>NBS</i>
<i>E. C. Crittenden</i>	<i>NBS</i>
<i>Harold Lyons</i>	<i>NBS</i>
<i>Wilbert F. Snyder</i>	<i>NBS</i>

## **b) THE 1951 CONFERENCE ON HIGH FREQUENCY MEASUREMENTS**

The second Conference on High Frequency Measurements was planned well in advance with a somewhat different organizing structure than the first conference. The IRE Professional Group on Instrumentation had been organized in March 1950. Thereafter, a Joint AIEE/IRE Committee on High Frequency Measurements was organized with Professor Ernst Weber, Polytechnic Institute of Brooklyn, as chairman. The Joint Committee consisted of the AIEE Subcommittee that functioned at the first conference. Lyons was now chairman of the subcommittee. The IRE group of the Joint Committee was formed from the Professional Group on Instrumentation. Preparing for and conducting the

second conference was a combined effort of the Joint Committee and NBS. Again, Lyons was chairman of the Local Arrangements Committee. The second conference was again held in Washington, with a repetition of the same dates as the first conference, January 10, 11, and 12—2 years later. Attendance was approximately the same as the first conference.<sup>17</sup>

### c) THE THIRD AND FOURTH CONFERENCES

Attendance at the Third Conference proved to be greater than either the first or second, a total of 669 registering for the 3-day meeting. Again, the conference was held in January (January 14-16, 1953) and the biennial event appeared to be firmly established, with Washington as the place of meeting. And again the conference was under the joint sponsorship of the AIEE, IRE, and NBS, and with NBS largely taking care of the local arrangements. For the first time an international touch was placed on the conference by the presence of Louis Essen of the National Physical Laboratory located at Teddington, England. Essen was invited to present a paper on the precise measurement of the velocity of electromagnetic waves.

The Fourth Conference was held in Washington and again, January (1955) selected as the time of meeting. However, conditions had changed. Personnel of NBS who had taken leading roles in staging the earlier conferences had been transferred to the new Boulder Laboratories in Colorado. Moreover, possibly there was a waning interest in the conferences. But whatever the reasons, the Fourth Conference was disappointing by comparison with the earlier conferences, especially so in the fall-off in registration. Rejuvenation would come 3-1/2 years later in Boulder, Colo.

### d) THE CONFERENCE MOVES FROM WASHINGTON TO BOULDER

With a renewed interest, coming mainly from Boulder Laboratories personnel, in restaging the High Frequency Conferences, steps were taken in 1957 and early 1958 to plan for a conference in the summer of 1958. A planning group met in January 1958 at the Boulder Laboratories and a General Arrangements Committee was organized with Bernard M. Oliver (Hewlett-Packard Co.) as chairman, representing the IRE Professional Group on Instrumentation. Ivan Easton (General Radio Co.) represented the AIEE and served as chairman of the Technical Program Committee. Once again it was a cooperative effort of the AIEE, the IRE, and NBS. An intensive publicity effort was soon underway to alert thousands who were considered to be potential attendees of such a conference.

A new name selected for the conference, a Conference on Electronic Standards and Measurements, covered a wide scope of research and the measurement art. The frequency range would be less restricted, beginning with direct current (zero frequency) and extending into the millimeter wavelengths of the electromagnetic spectrum. And the locale would be shifted from Washington, D.C. to Boulder, Colo.—a totally new environment from the preceding conferences.

Unlike the apparent waning interest of the Fourth Conference, meeting in Boulder was a "shot-in-the-arm" to a renewed interest in the conference. The expected 400 registrants swelled to more than double, reaching 870. With families, the entire assemblage reached 1200. Combining a vacation with attendance at the conference drew many families to the Boulder meeting. The logistics of housing the unexpected overflow became quite a problem but was successfully solved by using additional facilities provided by the University of Colorado.

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<sup>17</sup>This conference was one of a number scheduled in Washington during 1951 as a part of the celebration of the Semicentennial of the National Bureau of Standards. A feature of the Second Conference was an evening of demonstration lectures, staged in the auditorium of the Department of Interior. Two of the three demonstrations were presented by personnel of the Bureau's Microwave Standards Section, one on microwave spectroscopy, the other on a recording microwave refractometer, neither lending itself to easy and simple demonstration.

The subject matter of the four technical sessions was much the same as the previous conference, yet showed an abundance of new research in a fast growing field.

The 3-day conference was held at the Boulder Laboratories on August 13, 14, and 15, 1958. The first morning was given over to the dedication ceremony for the new Electronic Calibration Center (see ch. X, pp. 351-355). Thereafter followed six sessions of the technical program.<sup>18</sup> The conference was a marked success and served to continue the four earlier conferences dating back to 1949, and presaged the biennial conferences of a similar nature to come in the ensuing years.

#### e) A CONFERENCE SPAWNS ANOTHER CONFERENCE

Embarking on the outstanding success of the 1958 Conference at Boulder, the next conference was held again at Boulder during the period of June 22-24, 1960.<sup>19</sup> Again, sponsorship was a joint effort of the AIEE, the IRE, and NBS. Ivan Easton, representing the AIEE, was chairman of the General Arrangements Committee, and George E. Schafer, of the Radio Standards Laboratory, NBS, was chairman of the Technical Program Committee.

Subject matter of the six technical sessions was much the same as the 1958 Conference with at least one modification, that of scheduling a session titled, "Current and Future Problems in Standards and Electronic Measurements."<sup>20</sup> At this first session, Harvey W. Lance, chief of the Electronic Calibration Center at the Boulder Laboratories, presented a paper entitled, "The Nation's Electronic Standardization Program: Where Do We Now Stand?" Most significant of the topics discussed by Lance in his paper, at least when viewed in the light of the passage of time, was his statement relating to "a serious need for an association of standards laboratories." (This topic is treated in considerable detail in a following section, see pp. 690-694.)

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

#### f) THE 1962 CONFERENCE BECOMES INTERNATIONAL

The 1962 Conference took on a new complexion, that of international participation. The name changed once again, that to, "International Conference on Precision Electromagnetic Measurements," and has remained so to the present time (except that the word "International" was replaced in 1964 with the year of the conference, and continues to be so named to the present). An even dozen international papers were presented at the conference, coming from five countries. Four of the 10 technical sessions were chaired by registrants from 3 other countries. Partial support of the conference to provide the international participation came from a grant by the National Science Foundation.

Appearing for the first time in the title of a technical session was the subject of "Quantum Electronics." It would be a common subject at future conferences.

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<sup>18</sup>The titles of the technical sessions are indicative of the subject matter covered in the 37 papers presented and show the increased span of interest that was covered compared to the previous conferences. The session titles were:

- The Relationship of Standards to Physical Constants
- Frequency and Time Interval Standards
- Direct Current and Low Frequency Standards
- Radio Frequency Standards
- Microwave Standards
- The Organization and Operation of Standards Laboratories

The NBS Boulder Laboratories, being host to the conference, were responsible for handling the many details for such a meeting. The operation was under the skilled guidance of Harvey W. Lance, chairman of the Local Arrangements Committee, Lance being chief of the Electronic Calibration Center.

For those attendees who were not acquainted with the Colorado Rockies a new experience was offered, that of attending a chuckwagon dinner held outdoors at the Stanley Hotel in Estes Park. The evening of Western atmosphere was given a further touch with an illustrated lecture on "Historic Mining and Ghost Towns of Colorado," presented by Mrs. Francis Wolle of the University of Colorado. Special events and programs for the ladies and children were featured throughout the conference.

<sup>19</sup>There was a slight change in name of the 1960 Conference, that from "Conference on Electronic Standards and Measurements" in 1958 to "Conference on Standards and Electronic Measurements" for 1960.

<sup>20</sup>A session on "Methods of Measurements for Materials" was also a new subject at this conference.

For the 1962 Conference, as well as for the two previous conferences at Boulder, a well-organized and large-scale "Open House" of the Boulder Laboratories was staged. Demonstrations and explanations of measurement techniques were made available to the conference registrants and visitors in many rooms of the Radio Building and the Cryogenic Engineering Laboratory. Unlike the guided tours of the previous conferences, this "Open House" was conducted on the plan of the individual's selection of laboratory exhibits.

John M. Richardson, chief of the Radio Standards Laboratory, was chairman of the General Arrangements Committee. George Birnbaum, formerly of NBS, was chairman of the Technical Program Committee.



*General Arrangements Committee for 1962 International Conference on Precision Electromagnetic Measurements, Boulder, Colo.*

*Left to right: W. D. George, publicity; L. M. Matarrese, treasurer; J. M. Richardson, chairman; C. Peterson (NBS Washington), international affairs; G. Birnbaum, technical program; J. F. Brockman, executive secretary. All members of NBS staff (Birnbaum, formerly). G. B. Hoadley (North Carolina State University) not present for photo.*



*Not all is the digesting of technical papers at a Conference on Precision Electromagnetic Measurements. At the 1962 Conference the conferees and their families line up for a chuck wagon dinner during an August evening on top of Flagstaff Mountain from which there is a panoramic view of Boulder and its environs. Green Mountain in background.*

#### g) THE CONFERENCE BECOMES FIRMLY ESTABLISHED

The 1964 Conference on Precision Electromagnetic Measurements met in Boulder during the period of June 23-25. By 1964 Boulder became the accepted locale for the biennial event. The event also became associated with the alphabet letters "CPEM," thus coining a new initialism. For the first time since the 1949 Conference, sponsorship of the series of conferences changed. The Institute of Electrical and Electronics Engineers (IEEE) had formed by 1963 with the combination of the AIEE and the IRE, and the newly formed Professional Technical Group on Instrumentation and Measurement was now the organization interested in the affairs of the CPEM. Sponsorship of the 1964 Conference came from the IEEE Professional Group noted above, the NBS, and U.S. Commission I (Radio Measurement Methods and Standards) of the International Scientific Radio Union (URSI).

At the 1964 Conference papers on lasers first appeared on the technical program.<sup>21</sup> Electromagnetic measurements were being pushed up into, and being reported on, the optical region.

For the first time there appeared in the program booklet a list of names constituting an Honorary Committee for the Conference. This would be repeated in all later conferences. The 1964 listing contained 29 persons, most of whom were associated with precision electromagnetic measurements.

The 1966 Conference was highlighted by the presence of Dr. J. Terrien, director of the International Bureau of Weights and Measures, Sèvres, France, who gave the Keynote Address.<sup>22</sup> Later he took part in an evening program of an informal panel discussion on the national measurement systems of various countries. The discussion was moderated by Lance of the Boulder Laboratories. Eleven participants representing nine countries took part on the panel. John Richardson, chief of the Radio Standards Laboratory, represented the United States. Each spoke on the national measurement system and the national laboratory of his respective country [5].

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

By the time of the 1972 Conference (June 26-29) a cooperating sponsor had been added to the "old guard" of the IEEE, the NBS (the Institute of Basic Standards), and the U.S. National Committee (formerly only U.S. Commission I) of URSI. Joining in sponsorship was the international organization of URSI, the Union Radio-Scientifique Internationale.

#### h) THE CONFERENCE GOES ABROAD

After eight conferences, held biennially in Boulder from 1958, and the four earlier conferences in Washington, D.C., the international step was taken to hold the 1974 Conference in London, England. Added to the sponsors of the 1972 Conference were: the Royal Society and the Institution of Electrical Engineers; plus three cooperating sponsors: the Institution of Electronic and Radio Engineers, the National Physical Laboratory, and the Scientific Instrument Manufacturers' Association, all England-based organizations.

Of a total of 136 papers presented at the conference, 38 came from the United States, with 11 each from NBS Washington and NBS Boulder. In all, papers came from a number of countries scattered around the world.

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

"CPEM 76 Salutes NBS  
National Standards—75 Years of Progress"

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<sup>21</sup> A paper on the optical maser was presented at the 1962 Conference.

<sup>22</sup> The title of Terrien's address was "The work of the Bureau International des Poids et Mesures concerning electromagnetic units and measurements." [4]

## i) SUCCESS BREEDS SUCCESS

The unexpected success of the First Conference, in 1949, held in Washington, has continued through 14 conferences to the present time. By 1960 a permanent committee, later to be called the Executive Committee, was organized in order to establish continuity and sound planning from one conference to the next. From the beginning NBS, and particularly the "radio" (and later the "electromagnetics") personnel, have taken a prominent role in preparing for and staging the conferences. All but one (the London Conference) have been within the environs of NBS, and 10 at the Boulder Laboratories. Throughout its existence the CPEM has been closely associated with NBS.<sup>23</sup>

## 2. A new conference meets a need—The National Conference of Standards Laboratories (NCSL)

### a) A NEED—AND A NEW CONFERENCE IS ORGANIZED

The first session of the 1960 Conference on Standards and Electronic Measurements at Boulder had for its theme the current and future problems in standards and electronic measurements. In relating to this theme, Harvey W. Lance, chief of the Electronic Calibration Center at the Boulder Laboratories, presented a paper entitled, "The Nation's Electronic Standards Program: Where Do We Now Stand?" As stated earlier, in a commentary of the 1960 Conference (see p. 687), Lance's suggestion of "an association of standards laboratories" was a somewhat bold yet wise course to be followed, when viewed in retrospect. On that occasion he stated:

. . . there is a serious need for an association of standards laboratories. This association might be a new and distinct organization or it might be made a part of an existing professional or technical group. There are many needs which such an association could fulfill. Specifically, it could take the initiative in working out and setting up standard procedures in its member laboratories. In this way a high degree of uniformity could be obtained, even though the absolute accuracy might be subject to question. Later on, with accurate standards available, the procedures used to insure uniformity still would be applicable.

The suggestion by Lance gave rise to considerable discussion which was continued at a previously unscheduled meeting the following day (June 23, 1960) at a time 1 hour earlier than the scheduled technical session of the morning. Approximately 125 were in attendance of the nearly 800 persons that were attending the 1960 Conference, indicating an enthusiastic interest in such an association as proposed by Lance. After further discussion, with Lance serving as chairman pro tem, it became the consensus of the group that an ad hoc committee be appointed by the Conference Committee. The Ad Hoc Committee of approximately 20 members met on 3 occasions during the next 12 months and then on September 21, 1961, in a meeting at Los Angeles, a definite course was set up to follow in organizing an association. The result was a vote of acceptance by the Ad Hoc Committee of a resolution prepared and presented by Lance who was serving on the committee. A General Committee was appointed for the newly named National Conference of Standards

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<sup>23</sup>The reader may wonder why a comparable conference of staying quality did not develop among the wave propagation groups within the CRPL in cooperation with outside organizations. Indeed, there was such a start but did not develop beyond the initial conference. The Quarterly Report for April-June 1947 of the CRPL stated:

. . . the Division sponsored a Radio Propagation Conference on May 8, 9, and 10, attended by 145 persons, including some English and Canadians who are working on radio propagation problems. The meeting was highly successful—the Conference is but the first of a continuing series that the Division expects to sponsor.

But there were no more of these conferences. It appears, in retrospect, that the various meetings of URSI sufficed the need for such conferences.

Laboratories (NCSL). Lance became corresponding secretary of the committee.<sup>24</sup> Thus, on this date (September 21, 1961), a new technical organization came into existence on the American scene.

Shortly after the NCSL was organized, at its request NBS agreed to be a sponsor of the organization. This was a practice followed by the Bureau in its relation with a number of technical groups.

#### b) WHAT IS NCSL?<sup>25</sup>

The NCSL defines itself as:

A continuing, nonprofit laboratory-oriented organization to promote cooperative efforts toward solving the common problems faced by standards laboratories in their organization and operation. . . . Its membership consists of academic, scientific, industrial, commercial, or governmental laboratories concerned with the measurement of physical quantities, the calibration of standards and instruments, and the development of standards of practice. It provides a liaison with technical societies, trade associations and educational institutions interested in these activities.

“Great oaks from little acorns grow.” So it is that this organization, now of 238 standards laboratories, grew from a “seedling” dropped as a suggestion by Harvey Lance at the 1960 Conference on Standards and Electronic Measurements.

#### c) THE NCSL BECOMES A SUCCESSFUL ORGANIZATION

The National Conference of Standards Laboratories met at the Boulder Laboratories for its first national meeting during the 3-day period of August 8-10, 1962. More than 600 persons representing approximately 200 laboratories were in attendance. Dr. Astin, director of NBS, was the conference chairman, indicating the desire on the part of NBS to exercise its sponsorship of the new organization by encouragement and assistance. In his welcoming remarks Astin indicated the “great interest” of NBS in the work of the conference. A review of the titles for the nine sessions “indicates the nature of the first NCSL Conference and the subject matter presented and discussed.”<sup>26</sup>

Proceedings of the 1962 Standards Laboratory Conference were published by NBS as a *Miscellaneous Publication* [6].

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<sup>24</sup> William A. Wildhack, associate director of NBS, was a member of the General Committee of 12 members, Lloyd B. Wilson of the Sperry Gyroscope Co. was chairman. The committee membership was well balanced between leading representatives of industrial standards laboratories and of government standards laboratories.

During the following year 13 committees were set up to pursue various operations within the new organization in order to place it upon a firm and useful basis. Later, the membership of these committees was increased.

<sup>25</sup> A caption borrowed from the NCSL Directory of later years.

<sup>26</sup> Titles of the nine sessions of the 1962 Standards Laboratory Conference were:

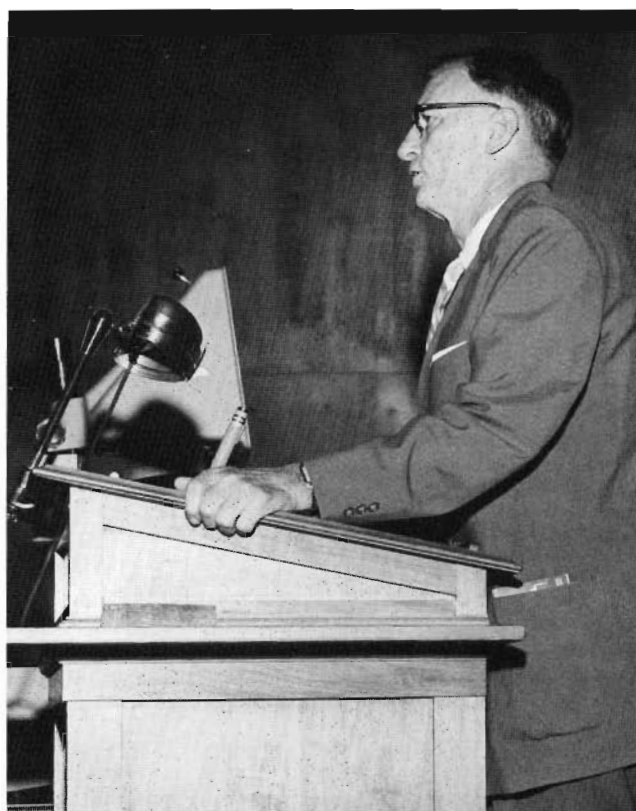
Session:

1. National Bureau of Standards Service to Industry
2. Error Analysis of Measurement Systems
3. National Conference of Standards Laboratories Business and Information
4. Corporate Measurement Standards Programs
5. Measurement Agreement Comparisons Among Standardization Laboratories
6. Training of Measurement Personnel
7. Calibration Recycle Analysis and Work Load Control
8. NCSL Relations to and Cooperation with Technical Societies
9. Recommended Practices for Standards Laboratories

In total, there were 34 papers presented, plus 6 panel discussions on subjects relating to 6 of the sessions.



*General Committee of the National Conference of Standards Laboratories (NCSL) meeting at Boulder Laboratories, 1962 Standards Laboratory Conference. Left to right: C. E. Johnson (Boeing Co.), vice chairman and technical program chairman; L. B. Wilson (Sperry), chairman of General Committee; H. W. Lance (NBS), corresponding secretary, and chairman of conference administration committee; C. White (Avco), recording secretary and treasurer; W. A. Wildhack (NBS), representative for NBS.*



*A. V. Astin, director of NBS, and chairman of the 1962 Standards Laboratory Conference of the NCSL, delivering the introductory remarks of the Conference.*



*On the 2 days (August 6 and 7) preceding the 1962 Standards Laboratory Conference of the NCSL, J. Herbert Holloman, Assistant Secretary for Science and Technology, Department of Commerce, made his first visit to Boulder Laboratories.*

*Left to right: F. D. Weaver of the Electronic Calibration Center explains operation of Wenner bridge to Holloman; A. V. Astin, director of NBS; and F. W. Brown, director of Boulder Laboratories.*



*Boulder Laboratories auditorium with participants of the 1962 Standards Laboratory Conference of the NCSL. W. A. Wildhack of NBS presiding at session on "National Bureau of Standards Service to Industry."*

In 1964 the NCSL chose to join forces with the Instrument Society of America, and particularly with its Measurement Standards Instrumentation Division, at the ISA 19th Annual Conference in New York City. Also joining was the Precision Measurements Association, another fledgling group. By now the NCSL was caught up in the mounting interest of many groups, institutions, technical societies, and Government agencies in standards, precision measurements, and calibration services.

The year 1966 saw the NCSL convening at the Gaithersburg facility of NBS, a half year before the Dedication (November 15, 1966). By now nearly 150 standards laboratories had joined the organization.

The 1968 meeting of NCSL was a return to Boulder, where the organization had come into being, at least as a conception. A theme was chosen for this conference, that of "Making Valuable Measurements."<sup>27</sup> During the preceding years Lance had been a vice chairman of the NCSL Board of Directors, and then became chairman for the ensuing year. During this period he was Assistant Chief for Program Planning and Development of the Radio Standards Laboratory.

Following its biennial schedule, the conference returned to NBS at Gaithersburg in 1970, and on this occasion chose the theme, "Innovative Metrology—Key to Progress." The 1972 Conference, held at Boulder, was a joint meeting with five other societies and had the keynote of "The Role and Value of Measurements."<sup>28</sup> The NCSL conducted its own conference at NBS, Gaithersburg, Md. in 1973. The 1974 Joint Conference was held at Gaithersburg with seven societies joining forces.<sup>29</sup> The theme of this meeting was "Measurement Science in Transition." Upon a return to Boulder in 1975 the NCSL conducted its own conference. The year 1976 found the NCSL back in Gaithersburg, Md. in celebration of the 75th Anniversary of NBS, the Nation's Bicentennial, and the 15th year of the NCSL. The theme for the conference (or symposium) was "The National Measurement System—Today and Tomorrow."

## **EXERCISING THE LEARNING PROCESS—BY SCHOOLING, BY SHARING TECHNICAL KNOWLEDGE WITH OTHERS**

### **1. A book approach to learning in time of war**

Advances in radio technology, plus the early discovered usefulness of radio communication in World War I, fostered a need for both instructional material and advance treatises in radio engineering. Thus, at the request of the Army Signal Corps, two books, *NBS Circular 74* (Radio Instruments and Measurements), and *The Principles Underlying Radio Communication* were written by the Radio Section, each gaining widespread recognition and acclaim.<sup>30</sup> (See ch. III, pp. 52-56.)

Twenty-five years later, World War II fostered a repeated request for a document that would aid in the training of personnel to meet adequately the application of radio communication in modern warfare. First (in 1942), the National Defense Research Committee (NDRC) requested a handbook that resulted in the Radio Section preparing the

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<sup>27</sup> In his address to the conference, NCSL Chairman Charles E. White stated:

The theme of our Conference is "Making Valuable Measurements." It was not chosen by the Program Committee in a light manner. Rather, it is a reflection of the concern with which we view the whole structure of controlled measurements. It reflects the continuing displays, in a majority of U.S. industries, of the non-serious and non-appreciative attitude displayed by top management toward the impact upon the quality of products and goods of uncontrolled or poorly controlled measurements.

(Shades of Ralph Nader—the Author (WFS))

<sup>28</sup> Joining forces with the NCSL were: the American Society of Quality Control, IEEE Group on Instrumentation and Measurement, ISA Metrology Division, NBS Institute for Basic Standards, and the Precision Measurements Association.

<sup>29</sup> The Scientific Apparatus Makers Association joined as the seventh sponsor for the 1974 Joint Conference.

<sup>30</sup> The request for a textbook, later to be called *The Principles Underlying Radio Communication*, came from the Training Section of the Signal Corps. The book was written to replace the former Signal Corps circular *Radiotelegraphy* and some of the wartime pamphlets on certain radio subjects.