SEASONS GREETINGS

THE
OFFICERS
AND MEMBERS
OF THE BOARD OF
DIRECTORS OF THE NATIONAL
CONFERENCE OF STANDARDS LABORATORIES
EXTEND TO THE READERS OF OUR NEWSLETTERS
BEST WISHES FOR THE HOLIDAY SEASON AND A HOPE
FOR A YEAR TO COME, FILLED WITH PEACE AND HAPPINESS
FOR
ALL
OF
US
The newly elected officers and board members of NCSL met in Boston on November 3 for their first business meeting. It also was the occasion of the first workshop activity for NCSL in the New England area. Credit goes to LEW WALLACE, and HERB INGRAHAM and SHEL RICHARDSON for their efforts in putting on the workshops with comparatively little lead time.

Lew's workshop, devoted to the theme of the relationship of standards laboratory personnel to the community, the state, and the country was an interesting, animated and exciting experience for the attendees. It was slanted toward the increasingly important role that the technical person should take in affairs outside the laboratory, in order to provide to a questioning world, some of the experience, labor, and knowhow so much needed in the solution of the pressing problems which beset all of us these days.

Shel and Herb, with the experience of three years familiarity with the NCSL Measurement Agreement programs, were able to present to an interested audience, the results of previous comparisons, and to bring out into the open some of the needs felt by laboratory personnel in the New England area. Some photographs were made of the activities but your Editor must apologize for spoiled shots of Shel and Herb. In the photos on the next page, Don Hervig is conducting a part of the discussion period in Fig. 1, Lea Mason is doing the same in Fig. 3 and Frank Hermach has his attendees in another corner in Fig. 4. In Fig. 2, Lew Wallace and a group are going at a discussion point to determine a consensus of opinion. At the conclusion of both sessions, attendees expressed their sincere feelings when they stated that New England should have more such activities.

Several items of general interest were acted upon at the November 3 meeting. As a first order of business, E. ARSENAULT was elected First Vice President, and Chairman C. WHITE announced the appointment of R. ERNST to replace resigned Board Member D. DELAUNAY. Also noted was the appointment of C. KOOP as Chairman of the NCSL Calibration Procedures Library Committee, and assignment of E. LANCE to have responsibility for the operations of NCSL Committees A7, B1, B2, B3/4/5/6, and C5. Chairman White noted that the procedures library would have financial support from the US Army for government fiscal year 1968, but that definite steps would have to be taken to relocate and to redefine the operation of the library after June 30, 1968. Investigations are underway to locate a permanent home for the library and to place it on a business-like basis to permit easier access by qualified activities. Several changes to the Bylaws were discussed and favorable comment received. Subsequent to the Board meeting, the changes were approved by letter ballot. In general, the changes consist in a) redesignating the two Secretaries as simply 1) Secretary-NCSL and 2) Treasurer-NCSL, b) permitting acceptance of non-US activities as Member Delegates with the restriction that dissemination of technical information to such members will be in accordance with present US Government restrictions on dissemination of such information. No other privilege restrictions will exist other than non-US delegates may not hold office on the NCSL Board.
NCSL WORKSHOPS COMING

As announced previously, NCSL is conducting a series of workshops at the Disneyland Hotel, Anaheim, California on January 25 and 26, 1968. The program is scheduled as follows:

Wednesday, Jan. 24 2:00 - 6:00 PM
REGISTRATION
6:00 - 8:00 PM SOCIAL HOURS

Thursday, Jan. 25 9:00 - 12:00 Noon
SESSION A
1. Information for Standards Laboratories--- P. HUNTER
2. NCSL Directory------------------------ W. BOGTWICK
3. Recommended Practices---------------- W. HOLMES
12:00 Noon LUNCHEON
2:30 - 5:30 PM SESSION B
1. Workload Control---------------------- D. HERVIG
2. Measurements Standards Laboratories-- M. ANGELO
7:30 PM NCSL BOARD MEETING

Friday, Jan. 26 9:00 AM 12:00 Noon
SESSION C
1. Calibration Procedures---------------- C. KOOP
12:00 Noon LUNCHEON
2:00 - 5:30 PM SESSION D
1. Procurement Regulations---------------- F. RUSSELL
2. Measurement Agreement Comparison----- H. INGRAHAM

Registration fee will be $15.00, which includes two luncheons. Checks should be made out to "National Conference of Standards Laboratories" and mailed to NCSL at P.O. Box 884, Orange, California 92666.

1968 STANDARDS LABORATORY CONFERENCE PLANNING

JERRY HAYES, Program Chairman has been actively soliciting papers for the biennial meeting at Boulder in August 1968. ORVAL LINDBERG has been in contact with the principal speakers for the keynote address on Aug. 26 and for the luncheon on Aug. 28. NCSL Chairman WHITE has been contacting people overseas, who are well known in the field of measurements standards, in order to prepare another internationally-flavored session which is scheduled for Aug. 27 at 2:00 PM. The tentative title of the session has been established as "THE VALUE OF INTERNATIONAL MEASUREMENTS" and is part of the Conference theme, which is "MAKING VALUABLE MEASUREMENTS".

NCSL INTERNATIONAL

We have recently learned that J. G. Cameron of the Canadian Ministry of Defense, and presently a Liaison Delegate to NCSL, will be speaking to the Montreal Section of the Institute of Electrical and Electronic Engineers on Jan. 31, 1968. His topic is "National Conference of Standards Laboratories". Canadian friends in the vicinity might reserve this evening. Best wishes for an attentive audience, Graham.
An interesting exchange of correspondence took place between your Editor and a Dutch organization whose title, translated is "Working-party on Instrument Behavior" (WIB). A note from Dr. L. Mason, NBS/IBS, in August placed us in contact with F. A. G. Timmermans, Secretary of the organization. In answer to a request, Mr. Timmermans was good enough to send details and reports of his organization.

WIB is much like our American organizations for consumers--Consumers Research, and Consumers Union, with a major exception. Its principal work is in the evaluation of industrial instrumentation, upon request from a sponsor-member of WIB. The organization, formed in March 1963, presently is composed of 18 sponsor-members, ranging from national and international industrial firms to an association of Finnish utilities and industries. Each sponsor pays a fixed annual subscription fee for which he is entitled to a copy of all WIB evaluation reports, and which permits him to sponsor instrumentation evaluations to the limit of his subscription fee (after which a direct charge is levied by WIB).

The actual investigative efforts are carried out by the Dutch TNO (Applied Scientific Research) organization for which WIB acts as entrepreneur or coordinator. TNO is an "independent" non-profit organization, although originally formed by the government. Its budget is defrayed in great part by the government, and the organization is headquartered in The Hague. TNO in general supplies independent and contract research, analysis and testing of materials, and disseminates technical information to activities within and outside The Netherlands, as required. It consists of approximately 4000 persons, of whom 1900 are available to WIB for collaboration, and who form the Organization for Industrial Research TNO.

Instrumentation is tested under standardized environments, to manufacturer's specifications. Opinions are given concerning construction, human engineering, and packaging. Finished reports are prepared in English to facilitate review of evaluations by similar groups located abroad. WIB works in close coordination with the British Scientific Instrument Research Association (SIRA), to the extent of exchanging evaluation reports.

It is interesting to note that some general conclusions reached concerning the results of evaluations already performed, indicate that 1) non-adherence to specifications when environmental temperature is changed, is common-place; 2) pneumatic equipment is supersensitive to vibrations; 3) electronic equipment performance suffers from exposure to damp heat and supply voltage variations.

By continuance of correspondence, it is hoped to encourage attendance by a representative of WIB, at the Boulder conference of NCSL, in August 1968.
YOUR DIRECTORY COMMITTEE NEEDS HELP

Some readers of this newsletter will be taking part in, (or will have taken part in) the workshop discussion at Anaheim, California in January, 1968. For those unable to be at the workshop, the list of questions for discussion there, follow below. Comments will be welcomed by Paul D. Long, whose address is:

Western Electric Co., Inc.
P. O. Box 241
Reading, Pa. 19603

What you have to say need not be confined to these questions; the Committee wants the Directory to be as useful as possible.

QUESTIONS FOR DISCUSSION

NCSL Directory Workshop, Anaheim, California, January 24, 1968

1. How often should a new directory be issued?
2. How often should supplements be issued? (The 1967 Directory has blank spaces to be filled in by holders from supplement data. Questionnaires will be sent to new members as they join.)
3. How to obtain data and keep directory current? (The Directory Committee has no way of knowing about changes unless they are informed; delegates and other contacts should inform the Committee via the NCSL Secretariat concerning all changes.)
4. Should the alphabetical delegate's list be re-instated? (The 1966 preliminary questionnaire showed a majority in favor of not publishing this information. Delegates change relatively rapidly.)
5. How about additions or changes in capabilities column headings? (Keeping these complete and definitive and within space considerations must be considered.)
6. What changes or additions should be made in the directory format?
7. Should non-NCSL-member laboratories pay for copies of the Directory?

TRANSFER OF VOLTAGE UNIT STUDIED

The Air Force (Newark Air Force Station) and the National Bureau of Standards have established a one year joint project to evaluate methods for improving the unit of voltage from one laboratory to another. The objectives of the program are to: (1) improve the assignment of the volt at the Newark Air Force Station, (2) find the most effective means for the interlaboratory transfer of the unit of voltage, (3) establish efficient procedures for the intra- and inter-laboratory surveillance of the volt; and (4) study the problems associated with shipping standard cell enclosures under power. Among the transport standards being studied are shippable saturated cells in air baths, unsaturated cells, and zener diodes.

- from OVERLAF, a U.S. Department of Commerce, National Bureau of Standards publication, issue No. 1, October 1967
NEW CONCEPT IN LOW-TEMPERATURE MEASUREMENT

In the temperature range below 10^{-4}K, and especially below 1{°}K, thermometry becomes very difficult. The need for temperature measurements at these low temperatures, however, has been steadily increasing. This need is especially felt in studies of rocket fuels, superconductivity, nuclear magnetism, and many other areas of science and technology.

Since traditional methods of temperature measurement become difficult to use in the millidegree range, more exotic concepts have begun to appear more practical. One such possibility was recently advanced by R. A. Kamper of the NBS Institute for Materials Research at the Cryogenics Laboratories, Boulder, Colo. This concept offers the promise of a thermometer which can measure directly the absolute temperature of a metallic conductor in the temperature range from 0.001 to 10^{-4}K. An important advantage of the thermometer, in principle at least, is that no calibration is required.

The phenomenon on which the prediction of temperature measurement is based, is electrical noise—a fluctuating voltage which is present in all metallic conductors due to the Brownian motion of the electrons. The magnitude of this voltage varies as a function of both temperature and resistance of the conductor and becomes very small at low temperatures. However, it should be detectable at very low temperatures with the aid of the Josephson effect, which occurs when two superconductors are connected by a weak junction. When a steady bias voltage is maintained between the two superconductors, the junction oscillates at a frequency proportional to the voltage.

The required bias voltage may be conveniently supplied by passing direct current through a resistor connected in parallel with the junction. The electrical noise in this resistor then causes a random frequency modulation of the signal from the junction, spreading it over a band of frequencies.

A preliminary calculation shows that the width of this band of frequencies is proportional to the value of the resistance and its absolute temperature. Thus, in theory, measuring this bandwidth forms the basis of a new type thermometer.

Preliminary experimentation by A. H. Silver and J. E. Zimmerman, of the Ford Scientific Laboratory, and R. A. Kamper, of the Bureau staff, has confirmed the predictions of the calculation over a wide range of resistances and a modest range of temperatures. Although the thermometer has not yet been tested at millidegree temperatures, realistic values for the bias resistance and system stability indicate the possibility of measuring temperatures in this range. To do this, however, it will be necessary to eliminate all spurious noise associated with the junction. It is apparent, therefore, that some development remains on the thermometer. This further development is currently in progress.
On July 24, 1967 the Military Communication-Electronics Board (MCCEB) of the U. S. Department of Defense issued a policy statement related to the use of hertz in place of cycles per second. The statement is as follows:

1. Reason for a policy statement:
   For the last few years there has been an increasing use within the United States of the term hertz (Hz) as the unit of frequency. However, the term cycles per second, also continues to be used as a unit of frequency. Such dual terminology has generated questions as to the DOD policy on the use of the term hertz. Thus a need exists for a policy in this regard.

2. Definition of Hertz:
   Hertz: A unit of frequency equivalent to one cycle per second.

3. Standard terminology for hertz and cycles per second:
   The terms hertz (Hz) and cycles per second (c/s) are fully synonymous and are usable interchangeably from a technical standpoint. Paragraph 112 of the English version of the International Radio Regulations Geneva (1959), shows a secondary substitution of KHz for kc/s, MHz for Mc/s and GHz for Gc/s, where K, M, and G stand for Kilo, Mega, and Giga, respectively. The CCIR in a resolution at the XIfth Plenary Assembly at Oslo in 1966 (published in DOC XIV/1001-E of 18 July 1966) recommends the exclusive use of the hertz terminology and extends the spectrum nomenclature to Terahertz (THz) for \(10^{-12}\) c/s or Tc/s. Wherever these terms are required, the foregoing abbreviations are correct usage. There is no objection, however, to spelling out "hertz" and "cycles per second" where desired and deemed appropriate. When doing so the appropriate prefix, Kilo, Mega, Giga, and Tera, should also be spelled out.

4. Policy on the use of hertz and cycles per second:
   The term hertz shall be the appropriate term for the unit of frequency to be used in referencing radio frequencies, frequency bands, or operating frequencies of communications-electronics equipment in all correspondence, records, standards, procedures, documents, and, where applicable, on equipment. This policy does not require immediate substitution of hertz for cycles per second now appearing in documents or on equipment. No document or record of any description, or nameplate or similar stamping, should be reissued, reprinted, or restamped solely for the purpose of substituting the new term hertz (Hz) for the term cycles per second (c/s). Such substitution should take place only when existing documents require revision for other reasons and when new equipment is procured. The policy should be included in the next change to or revision of existing documents, such as ACP 167. During a period of transition it is inevitable that both terms will be used but this situation should not create serious problems.

5. Conflicting policy now superseded:
   Previous policy statements on this subject are hereby rescinded.

6. Applicability:
   This policy is applicable to the DOD and all of its components.
Sometime during 1958, your editor noted two excellent editorials which appeared in Life magazine. They were clipped and preserved for reference and stimulation in times to come. Perhaps now is as good a time as any to bring one to light and to ponder its message. Perhaps our younger generation sees some of this goof-off which sparked the original editorial, and for that reason is confused as to what is meaningful in life. Perhaps the often-expressed attitude that "the government owes us a living", has its origin in the same trend toward irresponsibility and goof-off. In any event, Life's editor entitled his article "Age of goof-off or plenty?" and had this to say:

"...The wonderful U.S. economy appears to have seen the worst of another slump: its third since World War II, its 15th in this century, its 37th since the nation began. No two of the 37 were exactly alike, but all had a point in common. The point of slumps, including this one, is to correct some widespread misuse of the resources and talents at our disposal.

...Question: Have we yet earned another boom? Have we corrected the misuse of our resources and talents in which the recession caught us? An advertising man, Charles Brower, recently described these errors in graphic terms. Oping that consumers were getting "just bored with us and the things we sell" Mr. Brower called this "the great era of the goof-off, the age of the half-done job. The land from coast to coast has been enjoying a stampede away from responsibility. It is populated with laundry men who won't iron shirts; with waiters who won't serve, with carpenters who will come around someday maybe, with executives whose mind is on the golf course, with teachers who demand a single salary schedule so that achievement cannot be rewarded, nor poor work punished, with students who take cinch courses because the hard ones make them think, with spiritual delinquents of all kinds who have been triumphantly determined to enjoy what was known until the present crises as the new leisure. And the salesman who won't sell is only a part of this overall mess."

...In his little book called "Work and Its Discontents" Daniel Bell of Fortune notes "tendencies toward the evasion of work which are so characteristic of the American factory worker and which today obsess all workers." Unlike traditional featherbedding, this new evasion is motivated not by fear of unemployment but rather by a lost "instinct of workmanship", or the near impossibility of taking personal pride in the products of automation. Since it also appears in the nonautomated service trades--notoriously among appliance repairmen, headwaiters, taxi drivers, etc.--it may even reflect some feeling that in a society as affluent as ours, the direct connection between effort and reward has somehow been broken. Is "goofing-off" a new and permanent American characteristic? Is the Age of Plenty to be an age of gold-bricking?

...That would certainly be a solemn thought for this or any Fourth of July. For if there is one thing that has always distinguished Americans and assured their prosperity, it is their capacity for hard work. They worked like coolies when they had to, which was from 1620 to about 1900; they made heroes of John Henry and Paul Bunyan and set world records of sheer physical
output, for example, miles of railroad track laid in a day or a decade—which still stand. And when tasks got easier they still worked more efficiently than anybody else because of the chronic scarcity of labor in relation to the amount of work to be done. This national emphasis on the efficiency of labor has put $16,000 worth of tools behind the average American worker and made him the most productive in the world.

...Such abundance as we have is the direct result of this emphasis on productivity. It certainly does not bring the need for it to an end. If the Puritan or Calvinist motives for hard work have dwindled, common sense can supply reasons just as strong. The shorter the workday the more important the efficiency within it to keep it short and to keep us capable of coping with the undiminished hugeness of the unfinished work of the world. Life recently sponsored an Arden House conference on "the consumer." The experts concluded that whatever the quality of American production—and a lot of it has been pretty shoddy—there is no visible shortage of authentic consumer wants. The "age of abundance" is far from an age of satiety. Even if Americans were satiated, the fact that two billion non-Americans are still living in an age of extreme scarcity will make it essential for us to go on producing as abundantly and efficiently as we know how.

...The leisure we have won has far better uses than gold-bricking. The slump we are leaving will be back all too soon if we do not continue the correctives it indicated—harder and more intelligent work by labor management and seller. Hard work is a habit we dare not cease to cultivate. Only if we do cultivate it will it earn us the power to cultivate other virtues as well.

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The Importance of Being Excellent

The second of the two Life editorials follows and is a sad indictment of the tendency to equalize toward mediocrity prevalent in the modern society of today. Entitled "The importance of being excellent," it stated:

...The Pursuit of Happiness was named a basic right of all men in a day when all Americans were born to a life of hard work. The Rockefeller Report on Education, published last week, sets forth a complementary goal: the Pursuit of Excellence, i.e. a feeling for intellectual virtues in an era dominated by communal happiness-hunts.

...Excellence, says the report, or "the pursuit of achievement for its own sake," is "a blend of talent and motive, of ability fused with zeal." It is at once the virtue and the satisfaction of doing something superbly. It came down to us from the Greek concept of arete and the Roman of virtus, infused with a later Christian morality. Excellence is a lonely virtue, and that is one reason for its increasing rarity in our culture today.

...Present-day U.S. society, the report points out has intensified democracy's old "bug-of-war between excellence and equality," has posed the problem of how to cultivate the ideal of the one while recognizing the moral values of the other. In the U.S. school system, most of the heavyweight pulling has been done on the side of equality. The moral compulsion to give equal
opportunity to everyone has been turned into a rigid yard-stick by which the number graduated (and the degrees received) are valued more than the kind of education given.

...This "democratic" reaction against excellence goes far beyond the schools--into business, politics and culture. It is, in short, "the constant pressure of an ever more complex society against the total creative capacity of its people..."

...Fending off this pressure, as the report states, has become a fundamental problem, for no number of committees can compensate a country for the value and example of its zealous minds. The zeal for excellence is the common denominator of the 86 Americans enshrined in New York University's Hall of Fame. For them, and those like them in our own time, the effort and the pride of their lonely intellectual achievement has been its own recompense. But its inevitable and indispensable by-product also has been to enrich and strengthen the entire nation.

...It is this kind of strength we need most urgently today. The Pursuit of Happiness has been a long and satisfying 100-yard dash. Having rested, all of us might now consider some of the more demanding, but in the end more necessary, disciplines of the Pursuit of Excellence.

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YOU'RE RIGHT! TCHAIKOWSKY DOES SOUND BETTER WITH 20 MORE POUNDS!

Courtesy Jack Lintelmann NAR/Autonetics
AF CONSIDERS USE OF METRIC SYSTEM FOR BUILDING MAVERICK. In what could evolve into one of the major changes ever introduced into the U.S. missile industry, the Air Force has asked its two MAVERICK study contractors to investigate the feasibility of engineering and producing the missile using the metric system of weights and measures.

While recommendations that the U.S. consider use of the metric system in a variety of manufacturing areas have been made both in Congress and the Pentagon, the new contracts are believed to be the first to specifically cover development of a U.S. missile system.

Reason for consideration of the metric system is that it would greatly facilitate joint development efforts with NATO countries, who employ the metric measurement units exclusively. It was pointed out that a metric changeover would also have the effect of improving joint logistics support and widening the scope of commonality in Free World armament design and use.

The new metric system feasibility contracts have been awarded by the Air Force Aeronautical Systems Division to Hughes and North American Aviation's Columbus Division, who were selected for MAVERICK contract definition a year ago (SPACE Daily, November 17, 1966). CDP was recently extended under dual $1.45 million contracts (SPACE Daily, August 14), with one contractor expected to receive Air Force production go-ahead "early next year."

The new contracts, funded at $650,000 each and covering a 45-day period, call for a study to determine the economic feasibility of engineering MAVERICK from beginning to end in International Standards Organization (ISO) units. The study will encompass scaling the missile entirely in metric units, from nuts and bolts to the complete missile assembly. All production machines would have to utilize metric measurement scales and all inspection tools would have to be scaled to metric units. It was pointed out that the changeover under consideration would not be a simple translation of dimensions from English to metric units.

The air-to-surface MAVERICK missile is a smaller, more advanced version of the WALLEYE TV-guided glide bomb. Unlike WALLEYE, MAVERICK will have an electro-optical guidance system for hitting mobile targets, a warhead for penetrating armoured vehicles and rocket-boosted glide capability. The non-nuclear missile will be carried aboard the F-111, the A-7D and F-4 aircraft. The missile is designed "to destroy military targets in interdiction and close-support operations under visual conditions." Development of the missile has proceeded under a rush schedule designed to ready the missile for Vietnam to succeed WALLEYE, which according to several sources—including the North Vietnamese (SPACE Daily, September 12)—has a number of deficiencies.

Total R&D costs of MAVERICK has been estimated by the Air Force at just over $88 million, including a $10 million FY '68 budget (SPACE Daily, August 23). SPACE Daily September 14, 1967
ENGINEERS--STAND UP AND BE HEARD

Much has been mentioned in public during the past fifteen years of the importance of the engineering accomplishments which have occurred since 1951. There has also been a great deal of confusion created in the public mind by loose reporting in journals which should know the differences between engineering and science, between engineers and scientists. This appears to be working its way toward a satisfactory solution, simply because a number of clear-thinking and determined engineers have felt the responsibility to speak out in defense of engineering accomplishments which have been assumed as scientific accomplishments by default.

Slowly, the engineer is being made aware of the need to have a public voice. In some progressive companies, it is even considered good policy to encourage the technical force (as well as administrative and clerical), to take an active part in community affairs and government. Even NCSL has started, in a small way, to encourage Standards Laboratory personnel to take part in the every-day life of the nation, by conducting Workshops (under the guidance of Lenn WALLACE of IBM) whose theme is participation in the needs of the nation.

In The Electronic Engineer for October 1967, editor A. Socolovsky speaks out on the subject of the "Fifth Estate", namely--you, the engineer. Read what he had to say: "As electronic engineers, we form part of what is loosely called the "technical community," composed of people who have acquired some knowledge and work in one of the branches of technology. We are normally very proud of our knowledge and of our association with very modern and even glamorous projects or products. Above all, the way these projects and products affect the life of our modern society is so evident that we cannot fail to feel a sense of importance, and even pride. It's always fun to be where the action is.

"Our pride is understandable, but, do we realize that our influential position entails not only moral satisfaction and professional awards, but also responsibilities? We are conscious of our power, yet do we use it? Do we, as members of the technical community, stand up and make ourselves heard on those issues which we understand best? I don't think we do. The technical community in general, and we electronic engineers in particular, usually prefer to seek refuge in the haven of our own closed circles, with the excuse that it is for politicians to run the affairs of the nation, and that it is hopeless for engineers to try to influence their ways.

"I have recently attended a meeting for electronic engineering managers where a patent lawyer-engineer, Mr. Robert H. Rines of Boston, called our technical community "the fifth estate" to emphasize our potential political power. Mr. Rines challenged us to speak out at least on those matters that directly affect us, or else others less qualified will solve them as best as they can.

"Mr. Rines' challenge had a sense of urgency. He feels that it is not important just to us, but imperative to the nation, that the fifth estate actively participate in public affairs. "America has given great ideals to the world," he said, "and the world has respected us when the men who conducted our destiny fully understood those ideals. Now America has given to the world the most advanced technology, yet the men who understand it do not participate in our government, nor do the people in government fully understand technology."
"Mr. Rines is right—we are relinquishing our power by default. Do you know how many U.S. Congressmen have any technical background? Two or three. How about in the Senate? Nobody. There, perhaps, lies the first step. Let us participate in the affairs of our communities, of our states, of the nation. To do so, we will have to acquire a clear idea about the influence of our technology in modern society. We will have to study our institutions and learn the issues analyze the products we make and evaluate their importance and influence.

"Let us not be mere bystanders, but participate actively. Such participation may change our lives; some of us will never be the same once we explore our political influence, but we cannot afford not to participate."

As if to emphasize the same desirability—that the engineer should shake himself loose occasionally from the chains tying him to the everyday job, P. Robbins editorializes in The American Engineer in October 1967, on the usefulness of society participation as a preparation for a bigger and better life for the engineer. His topic is related to developing management attributes by the simple expedient of exposure to technical society activities. Here is what he had to say:

"Practically every engineer in his career development at some time must face the decision as to the degree of management responsibilities he wants to assume. Most progressive employers now provide advancement opportunities either via the management route or through increased competence in engineering know-how. Participation in society activities at the chapter, state, or national levels provides an excellent vehicle for the young engineer to test his management abilities as well as his interest in this facet of career activity, and for the older engineer to sharpen his management skills. It is, of course, axiomatic that all engineers do not make good managers and that some good engineers have been spoiled by being encouraged to follow the management route. How, then, does society activity provide a testing ground for management skills?

"According to authorities on management, there are perhaps four qualities and skills which stand out as paramount in management leadership. They might be summarized as planning, communicating, getting things done through others, and courage. All of these may be tested in the crucible of volunteer society effort. As anyone who has served as an officer of a chapter or state society is well aware, progress during the term of office of an individual is accomplished only with a considerable amount of planning. It may not be of the magnitude of a forty-hour-a-week assignment, but it is a small pilot project for the person who wants to test his skills in this area or wishes to develop them further.

"The whole gamut of society activities tests the individual engineer's ability to communicate. From the presentation of his position as a member in an open meeting, to leading a committee's consideration, to making a formal presentation at a banquet or before his peers, he runs the gamut of the ability to present ideas to the understanding and motivation of others.

"Perhaps nowhere is the ability to get along with people more severely tested than in a volunteer organization. It takes real tact and diplomacy to mobilize the potential of the organization toward any single program, let alone the
multitude of programs that face the engineering profession. In a volunteer organization, it is too easy for those who disagree, or those who are irritated, or those who are of a different opinion to sit on their hands, or sulk, or actually resign. Thus, the active participant in society programs has an almost continuous opportunity to judge his aptitudes in getting along with others and accomplishing worthwhile progress.

"The attribute of courage is perhaps the one most severely tested in society activities. The easiest thing for the average member, of course, is to do nothing—not even participate. It takes courage to volunteer to do a job; it takes courage to stand up and express one's opinion, particularly if it is contrary to the prevailing discussion; it takes courage to assume the chairmanship of a committee; it takes courage to become an officer at any level.

"Much is said these days for the need for continuing education, and a number of surveys have indicated that engineers are most desirous of courses in the various elements of management. Participation in society affairs has a dual reward—one of sharpening the engineer-management skills, and at the same time contributing toward the progress of one's profession.

THE METROLOGIST'S DILEMMA

After all these years of training
And work of vast import,
I find my prestige slowly draining
With each request for a weather report!

(R. D. Brewster)
(Collins Radio)
CALIBRATION OR QUALIFICATION OF PANEL METERS

The panel meters discussed herein are defined as those indicating meters which are part of, or mounted in, equipment panels or instrumentation, having typical accuracies of 2 to 10%, and whose parent equipment or instrumentation is not periodically calibrated.

The first issue to be settled is whether calibration of the panel meter is required. If a meter is used for relative indication only, such as indicating a peak or a dip where the sensitivity is not of prime importance, calibration can usually be dispensed with. Meters whose accuracy is not particularly important, or which indicate relative magnitudes only, can usually be allowed to remain uncalibrated.

If it is established that calibration is required, the best approach must be selected. In general, it is best to disturb the meter as little as possible. This suggests calibrating such meters in place, using internally generated stimuli whenever possible. The standard may be connected to the panel meter terminals if no other connections are available. The equipment is then energized and adjusted to convenient meter indications, usually at major scale divisions, and the corresponding indications of the standard are noted or recorded.

In case the equipment cannot be used to supply the stimuli, an external source or generator may be employed. The meter should be isolated from other circuits unless it is known that the application of the external signal will not adversely affect the rest of the equipment.

Removal of the panel meter for calibration should be resorted to only when in-place calibration is not practicable. If removed, it should be calibrated in the same position (vertical, horizontal or sloping) as it is normally mounted. In addition, the material and thickness of the panel are sometimes significant, and should be considered. In rare instances, the proximity of components generating magnetic fields (transformers, chokes, waveguide isolators, etc.) may affect the calibration.

The selection of calibration points will vary with the normal use of the meter and should be considered. For example, a meter which monitors a fixed value can be spot calibrated at the critical value. Meters which may indicate any value within their ranges will require a linearity test at full scale and at least three equally spaced divisions on one range, and a full-scale test on each remaining range. Other meters, such as those used over a narrow range, may require calibration over a restricted portion of the scale.

The standard used should provide a 4:1 accuracy ratio, e.g. a ±2% meter would require a standard of ±0.5% error. Since most meters are rated in terms of a percentage of error at full scale, and therefore have a fixed error for each range, the full-scale values of the meter and the standard must be considered. For example, of a 10-volt ±0.5% standard is used to calibrate a meter having a full-scale value of 2 volts ±2%, the error of the standard would be ±2 1/2% at 2 volts, and therefore unsuitable for calibrating the 2-volt ±2% meter. Another consideration might be that the standard should not overload the equipment. In case of the in-place calibration of a voltameter using internally-generated stimulus voltages, the standard should
be of high enough impedance to not draw excessive current from the source. This consideration might apply to other sources or generators, also.

Suitable standards include the Fluke differential voltmeters, whose accuracy and high impedance at null makes them very desirable. Other meters can be used, with due regard for the accuracy at the measured voltage level and for loading effects. Current-indicating meters can be calibrated against a 0.5% (or appropriate accuracy) ammeter.

Range and short-time stability are the primary considerations for a voltage/current source, although waveform errors can be significant in a-v or a-c measurements. Most general purpose power supplies are suitable; a battery and variable resistor may be used for dV/dc, and an autotransformer may be used to reduce the 60- or 400-cps power line voltage for av/ac. Note that alternating voltmeters and ammeters should be calibrated at the frequency of normal use.

When calibrating panel meters, the physical aspects must be kept in mind. Watch for sluggish or sticky action that may be indicative of worn or misaligned bearings, bent shafts, etc. Examine the meter for bent or rubbing pointer, loose connections, cracked glass, or other discrepancies.

(Metrology Bulletin, Oct '64--USN Metrology Engineering Center, Pomona, Calif.)
TECHNICAL REFERENCES

From IEEE Trans on Inst and Meas for Sep 1967:


2. "A Thin-Film Bolometer Mount", Sakurai and Nemoto.


From IEEE Trans on Inst and Meas for Dec 1967:


NEW PUBLICATION

The "new look" in trade magazines which was imparted to Milt Aronson's "Measurements and Data" appears to have taken hold successfully, judging from some unbiased comments picked up at several meetings. The trick of featuring a "Book of the Month" is a clever enticement to read more of the same by purchasing the entire book. A great deal of effort has been put into the publication since issue No. 1 in January and several of the articles in succeeding issues have been referenced in this Newsletter's Technical References for this issue. If you are interested in a new concept of instrumentation publication, contact Mr. Aronson care of Measurements and Data Corporation, 1101 E. Entry Drive, Pittsburgh, Pa. 15216.

TECHNICAL REFERENCES (contd)

From Measurements and Data for Jan-Feb 1967:


45. "Home Study Course-Transistors". A do-it-yourself project.

From Measurements and Data for Mar-Apr 1967:

46. "Cryogenic Thermometry", Sparks & Powell. A description of work carried on at NBS to check thermocouple wire characteristics and gold-iron alloy response.


From Measurements and Data for May-Jun 1967:


49. "Home Study Course—Numbers, Codes and Logic". Do-it-yourself.

From Measurements and Data for Jul-Aug 1967:


From Measurements and Data for Sep-Oct 1967:


52. "Data Rejection Criteria", C. Emmerich. Deals with criteria for rejections, depending upon error analysis method employed.

53. "Home Study Course - Logarithms/Exponents. How to get rid of the mental rust spots induced by use of computing machines.

-21-
In conjunction with NEREM there is usually held a number of business meetings of various IEEE activities which have some interest for members of NCSL. One such was the regular meeting of the Administrative Committee of the IEEE Instrumentation and Measurement Group. In Fig. 5 you will find Chairman George Schaffer, center, discussing a point on the agenda while Paul Ely, Secretary takes notes, and Chairman-elect Frank Harmach, right, views an item of business coming up. In Fig. 6 committee members, left to right, are Gordon Partridge, Herb Brownell, Norbert Kuers, Andy Dunn, and George Hoadley (Editor of the I-M Transactions). Fig. 7 from left to right shows members Harvey Lance, Bob Sodeman, R. Kelly (Observer), Ivan Easton, R. Sayres (of IEEE Hqtrs) and Fred Tischer (observer) behind Ed Houghton.

Figures 8, 11, and 12 give some idea of the audience participation at the NEREM exhibits, and Fig. 9 illustrates one way to make the attendees stop and look. Fig. 10 shows one reason why business of signing up new members for IEEE was booming this year, while Fig. 13 shows three active NEREM Program workers Pete Burke, K. C. Black, and Ken Shapleigh resting their weary bones.

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[Image of bridge with people] Courtesy SCM Corp.
RECENT NBS PUBLICATIONS

NBS ANNUAL REPORT

A review of current research programs and a comprehensive discussion of the national measurement system are featured in the just-published 1967 Technical Highlights of the National Bureau of Standards. Also included is supplementary information on Bureau organization, personnel, budget and technical publications of the staff. The discussion of the national measurement system is an attempt to view the increasing complexity of U.S. measurement activities in an orderly fashion and to assure that NBS fulfills its proper role in that complex. The main body of the report deals with significant scientific and technical accomplishments during the fiscal year. Brief mention is made of a variety of studies and experiments. Order Miscellaneous Publication 293, 162 pages, 55 cents, from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

CORRELATIONS FOR PREDICTING LEAKAGE THROUGH CLOSED VALVES


In this publication, various flow formulae (molecular, transition, and continuum) are examined, and two simple methods of correlating leakage for single-phase fluids are deduced. The correlations obtained (excluding transition flow through long channels) indicate the leakage is inversely proportional to the square root of the density, or inversely proportional to the absolute viscosity, of the fluid. Thus, for gases, the leakage is directly proportional to the sonic velocity of the gas. The proper relationship must be established by experiment for each valve, fitting, etc.

DESIGNS FOR SURVEILLANCE OF THE VOLT MAINTAINED

BY A SMALL GROUP OF SATURATED STANDARD CELLS


This publication describes a procedure for maintaining surveillance over a small group of saturated standard cells giving specific designs and their analysis for intercomparing 3, 4, 5 and 6 cells in a single temperature controlled environment. The procedures suggested give information on (1) the stability of the differences in emf among the group; (2) the components of variability and dependence of the measurement process precision on environmental influences or procedural changes; and (3) estimation of the magnitude of some of the possible systematic errors affecting the process.

The same type of cell used to maintain the National unit of electromotive force--a group of saturated standard cells such as those mentioned above--is also maintained in local laboratories as a primary standard of electromotive force. These cells are in general calibrated at NBS at periodic intervals; the mean emf of the group is assumed to stay constant between calibrations.
However, since such calibrations are done only at intervals of one year or more, some technique must be employed to maintain surveillance over the local unit, between calibrations. This publication is intended to provide methods for that surveillance and techniques for detecting certain type of systematic errors. Local laboratories will find it a valuable handbook and guide.

REALISTIC UNCERTAINTIES AND THE MASS MEASUREMENT PROCESS--AN ILLUSTRATED REVIEW


This paper is a condensed version of a lecture, with photographs of the slides used, giving a review of the mass measurement process from the initial basic concept to the statement of a measured mass value, examining in detail certain important elements which are likely to be misunderstood or misused. The authors have emphasized the importance of viewing measurement as a production process, and have presented methods of evaluating process parameters. One of the laboratory's standards has been used as an additional unknown in routine calibration, in order to provide an accuracy check. As time goes on, results on the standard provides the basis for precision and accuracy statements.

MEASUREMENT--PACEMAKER OF AMERICAN ECONOMIC GROWTH


STANDARD REFERENCE MATERIALS


This catalog describes the various NBS Standard Reference Materials which are used to calibrate measurement systems and to provide scientific information that a be referred to a common base. A schedule of prices and quantities is included for each material, as well as directions for ordering.

NBS OFFICE OF THE DIRECTOR APPOINTMENTS

Three new appointments have been announced in the Office of the Director of the National Bureau of Standards. Dr. ROBERT D. HUNTOON has been named head of the Office of Program Development and Evaluation; Dr. GEORGE S. GORDON, Chief of the Office of Industrial Services; and Dr. A. ALLAN BATES, Chief of the Office of Engineering Standards Liaison and Analysis, the post vacated by Dr. Gordon. Before accepting his new appointment, Dr. Huntoon had been Director of the NBS Institute for Basic Standards, a post he had held since May 1964. Dr. Gordon had been Chief of the Office of Engineering Standards Liaison and Analysis since June 1966. Before his recent appointment, Dr. Bates was Chief of the Building Research Division, NBS.
NEW HEAD OF COMMERCE OFFICE OF STANDARDS REVIEW

Dr. JOHN M. RICHARDSON, a scientist with 15 years' experience in the National Bureau of Standards, was sworn in as Director of the new Office of Standards Review by Secretary of Commerce Alexander B. Trowbridge November 7. Since 1960, Dr. RICHARDSON has served as Chief of the NBS Radio Standards Laboratory in Boulder, Colorado. Before that he was engaged in research in microwave physics, especially in atomic standards of frequency and time.

The Office of Standards Review recently was established under the Assistant Secretary of Commerce for Science and Technology to administer certain standardization activities of the U. S. Department of Commerce. Broadly speaking, the purpose of this new Office is to encourage the formulation of domestic and international standards for advancing United States commerce and trade, economic growth, and consumer protection.

Intelligently drawn standards, specifying preferred forms or performance for various goods or processes, are becoming increasingly important both nationally and internationally. These standards are sometimes called "product standards" because they refer to products, and they are sometimes called "engineering standards" because they refer to the engineering and design of goods and processes to achieve certain levels of safety, performance, serviceability, interchangeability, and so forth.

Voluntary standards are developed by cooperation of interested parties. Where the public health, safety, or welfare is at stake, mandatory standards may be imposed by law as in the case of those pertaining to food, drugs, and automobiles. The Office of Standards Review will deal with those mandatory standards which are administered by the Secretary of Commerce, such as flammable fabrics, and in addition will be concerned with voluntary standards. The Office of Standards Review will also provide analysis and advice to the Assistant Secretary for Science and Technology with respect to the Fair Packaging and Labeling Act and the long-standing voluntary standards program of the Department of Commerce. In carrying out its tasks, the Office will work closely with existing standards organizations both public and private.

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NEW CHIEF AT BOULDER FREQUENCY SECTION

ROGER E. BEEHLER, National Bureau of Standards physicist, has been appointed chief of the Atomic Frequency and Time Standards section, Time and Frequency Division of the Radio Standards Laboratory. He succeeds Dr. James A. Barnes who was chosen to head this recently created division. As chief of the section, BEEHLER is responsible for basic and applied research in the development and maintenance of the NBS Frequency Standard—and of the NBS standard interval of time.
NEW NBS CALIBRATION SERVICES

REFLECTION COEFFICIENT

Calibration services for the measurement of reflection coefficient magnitude of waveguide reflectors (mismatches) in WR284 waveguide has been announced by the Radio Standards Laboratory. Similar calibration services in five smaller waveguide sizes (WR187, 137, 112, 90, and 62) have been available for several years. Calibrated mismatch devices are useful as reference standards for the calibration of impedance-measuring equipment such as slotted lines and reflectometers. The calibration can be performed at any frequency within the range of 2.60 and 3.95 GHz. However, it is more economical for the customer if calibrations are performed at the selected frequencies of 2.85, 3.25, and 3.55 GHz. Measurements can be made over the range from 0.024 to 0.2, with an uncertainty of the reflection coefficient magnitude expressed as \((0.0002 + 0.002 |\Gamma|)\), where \(|\Gamma|\) is the numerical value of the measured magnitude.

NBS FORCE MEASUREMENTS

Two new deadweight machines of 6,000 lbf and 25,000 lbf capacities have recently been put into service by the NBS Institute for Basic Standards. These machines supplement existing larger machines of 112,000-lbf, 300,000-lbf, and 1,000,000-lbf capacities. Deadweight machines are used for applying the accurately known forces necessary for the calibration of elastic force-measuring devices such as proving rings and load cells. Such devices are used as reference standards for the calibration of testing machines and for measurements such as those of rocket thrust.

The new machines differ from the larger machines in that each weight can be applied independently to the device being calibrated. As a result fewer weights are needed and test loads can be changed more rapidly. With the addition of these new machines, NBS can now apply test loads from 5 to 1,000,000 lbf with load accuracy within 0.002 percent. Conversion weights were incorporated into the 6000-lbf machine to provide an alternate 3000-kgf range.

NEW NBS MICROCOPY RESOLUTION TEST CHARTS

Starting December 1, 1967, the microscopy resolution test charts issued by NBS, Standard Reference Material No. 1010, will have higher spatial frequencies than those issued previously. The Bureau announced its intention to extend the range of these charts about a year ago.

The previous type was designed in 1963 and had 21 patterns of black bars on white background ranging from 1 to 10 cycles/mm. These patterns were arranged to permit the extension of the chart to include higher spatial frequencies. The new type has five additional patterns with spatial frequencies of 11, 12.5, 14, 16, and 18 cycles/mm. In every other respect both charts are identical and may be used for the same purposes.
EDITORS SPEAK OUT

George Rostky, in EEE for Sept. 67 pleads "Let's work together". He's talking to specification writers. Read his plea--"For five years EEE has been crusading against unclear and deceptive specs. In our Specifying Guides, in many feature articles, in Test Equipment Trends and in other parts of the magazine we've called attention to traps in artfully-worded specs. More recently, many of the engineers featured on our covers in the "Speak Out" series have also highlighted important examples of specsmanship.

"Yet we seem to be fighting a losing battle. It's not that dishonesty is rampant in our industry--far from it. But we are facing something like Gresham's Law applied to specs. If Sir Thomas Gresham, that shrewed 16th Century merchant were alive today, he would no doubt have extended his comment that bad money drives good money out of circulation. He would today point out that bad specs drive out good ones.

"All you need in any field is one vendor with a poor product and with not enough financial and engineering strength to improve it. To stay alive he conceals his product's weakness with fancy wording. If his wording is clever enough he can make his product appear far better than superior ones. And if he can stay in the fray long enough, he forces more reputable vendors to adopt his fancy terminology.

"In the long run, of course, engineers who get stuck learn to spot cleverly written specs, but by that time too many vendors may already have a new specification language. And a new vendor may start still another spec-writing race.

"Should we resign ourselves to an ever-ascending spiral of specs we can't understand? No. Together we can stop this nonsense. EEE will continue to expose and combat misleading specs. If you will do the same. if you will question a vendor very carefully when he hides a product behind tricky mathematics, "scientific" verbiage and undefined superlatives; if you will make short work of vendors who clothe poor products in fine words; then we can wipe out specsmanship forever. Let's work at it together".

Again, in the October 1967 issue of EEE, Rostky states that power supply specifications are a mess--"They're bad because the same words mean different things to different people. And this provides a convenient loophole for vendors to crawl into when their designs are not as good as they may have hoped.

"The situation is so bad that some vendors provide their own glossaries of power-supply terms. This means that you have a devil of a time comparing specs. Say you're interested in supplies from Vendors A, B and C. Let's make it easy and say that all three firms have glossaries.

"You start checking the specs, keeping a dictionary at your side. No. Not a dictionary, three dictionaries. What do you do when the definitions don't agree? And what do you do when one glossary speaks of ripple, another speaks of ripple and noise, and a third speaks of PARD? And what do you do when, for the same term each vendor has a significantly different meaning? How, then, do you compare the specs?"
Fortunately, the National Electrical Manufacturers Association, working with several leading power-supply vendors, has been wrestling with the problem and is making important progress—slowly. I presented my views at the first NEMA meeting in January 1963, shortly after publication of EEE's first major report on the subject, "Power Supplies: A Maze of Confusion."

"At a more recent NEMA meeting in July 1967, I spoke on the latest NEMA draft spec. Though this draft hasn't clarified all the knotty terms that bug a power-supply user, it has gone a long way. It has already shut several important loopholes.

"When the spec is completed, it won't be perfect. Nothing is. But it may provide a powerful and needed tool for both vendors and users. To NEMA and its power-supply group, EEE extends hearty congratulations and thanks due from the entire engineering community. Also, on behalf of all engineers, EEE has two more words for the NEMA group: Please Hurry."

Lewis Goodfriend in Sound and Vibration for July 1967, objects to claims for research which are improperly founded. He says "There are three facets of research in vibration and airborne sound that continue to puzzle us year after year. The first relates to the subject areas selected for research. Second is the apparent lack of support for basic research among acoustical products companies. The third facet concerns publication of poorly done research and its corollary, poorly documented papers that may or may not report significant information.

"Our observations indicate that very little basic research is being done either at universities or in industrial concerns that make and sell acoustical products such as mufflers, ceiling tile, building components, vibration reduction systems, and shock suppression systems, to name a few. There is a lot of cut-and-try experimentation, but this can hardly be dignified by the name of experimental research. In addition, a large volume of application engineering is assigned to corporate research laboratories. This misses the mark, too. It simply is not research.

"Turning to academic research, we find many "research" projects supported by Federal grants. There are also numbers of published papers alleged to be reports of research. Some of these are clearly partial fulfillment of the requirements for an advanced degree. Others look like staff members' efforts to survive the "publish or perish" phenomenon. We should not overlook the publication of progress reports which are interesting since they usually deal with no progress. This leaves a few genuine research papers. But, where is work of the stature of that produced by Harvey Fletcher, W. P. Mason, or P. M. Morse and R. H. Bolt? Our present climate of Federally funded university "research" and product development industrial "research" must be re-oriented to once again produce work of such depth and quality. For example, little theoretical information of value has been published on the use of reverberation rooms since the 1944 paper by Morse and Bolt. It is even more appalling that many authors use such rooms for transmission loss, sound absorption, and sound power measurements that are not only of questionable validity but are theoretically indefensible.
"A review of references or obviously omitted references is also illuminating. One category easily detected this way is the "new look at an old subject" which was preceded by identical papers in another related field. Lack of a reference to earlier work indicates to us that the author really did not go through literature. Another category contains what might be termed the "company references only" paper. Here the author lists only those papers published by his colleagues or predecessors in the company or institution. Typically, where a colleague has referred to Rayleigh in a 1930 paper, we find not the original source, but the "in-house" reference. Of course, there is no regard to the fact that such "in-house" publications are virtually inaccessible. A second category in this category is the "author references only" paper. Here we find a list of the author's prior work often referring to topics more fully covered in other material. In some cases, indeed many, references to the author's own work are well justified, but basic references should be repeated.

"Disquieting conclusions present themselves after our review of current published work and projects in acoustical research:

1. Problem solving, not basic research, appears to receive the most attention and money in industrial and university research facilities.

2. Published work is often accompanied by inadequate references. Careful literature search no longer appears to be one of the basic precepts for modern acoustical research in spite of the fact that the use of adequate reference material, and the documentation of such use, is of great value. It assists a reader in orienting himself, reduces further research on the subject, and simplifies analysis and discussion of the paper itself."

Although many industrial standards laboratories do not engage in research directly, Goodfriend's complaints are worth studying carefully. He is reflecting on a fundamental lack of energy and honesty which is apparent in too many technical papers presented today. If you are interested in writing technically, think seriously of his complaints. (CEW)

Goodfriend, in the August issue of Sound and Vibration for August 1967, tears into the significance (or lack) in much of the measurement data presented in today's project reports. Although presented from the narrow viewpoint of the magazine's specialty—sound and vibration—the criticism is nonetheless pertinent to each field of engineering. Study his points and determine how often you have detected similar poor practices in the reports which come across your desk. He titles his editorial "The Meaning of Measurements" and he starts by saying "We have read the report several times and have examined the curves in great detail. We are now convinced that the one-inch thick report weighing two pounds resting on the Editor's desk tells the reader little more than the title of the project and the hopes of its authors. Why? Possibly another look at the report will tell us.

"In looking at the results we note that all of the acoustical measurements made with the blower in the room have a rising high frequency spectrum. This contradicts our own knowledge that the spectrum should be falling for the test
specimen. The curves of the background noise without the test specimen running, show high frequency background noise levels far below those of the blower. We determined that if the sound level meter used for the measurements was on an incorrect setting while measuring a noise with a rapidly falling spectrum, the attached analyzer would be reading the internal noise level of the meter itself. Therefore, the analyzer could not show the actual levels of the sound to be measured.

"The next trouble spot encountered in the report came when we looked at the background noise levels in the room—they had a rather flat spectrum rising slightly at the low frequency end. The instrument manufacturer's specifications verified that in some octave bands, room "noise levels" were identical to the internal instrument noise for the combined sound level meter-octave band analyzer being used.

"Next we looked at the vibration levels measured on the floor of the room, at the base of the blower, and on the unisolated blower frame. The change in spectrum from one location to the other did not agree at all with the isolators used for the blower support. Again, equipment specifications assisted in solving the inconsistency. Once the accelerometer was moved from the frame to either of the isolated positions, the electrical signal caused by the acoustic noise output of the blower was greater than the vibration induced output. The change in spectrum shape occurs because of the difference between acoustic output and vibration output of the blower, and the differences in the sensitivity of the accelerometer to acoustic and vibration excitation.

"Data recorded for the acoustical output of the motor-blower assembly covered octave bands from 31.5 to 8000 c/s (center frequency). The room, however, had no dimension larger than 15 ft. Under these conditions there are so few modes within the room that the data in the 31.5 or even the 63 c/s band could not be valid. If this were not enough, we also found a similar fan in our file of old spectra which has a pure tone in the 31.5 c/s band at a frequency far removed from any room mode. This means that the level of the pure tone, measured in reverberation room, is completely unrelated to the actual sound output of the blower. Later along in the report we did find a mention of the pure tone, but no comment on the possible error introduced by the method of measurement.

"More questions than answers were provided by the text, and so abandoning it, we turned to the charts for solutions. We were again foiled; the charts certainly contained some of the necessary information, but without spending at least as much time as the author, we could not perform any meaningful cross checks. The charts were in four different sizes, with no combination that could be overlaid. The scales varied from one set to another and the reference acceleration level was omitted.

"Of course, there are fundamental questions about design approval of a product on the basis of testing only the production prototype and, maybe, one or two production units. Certainly, a major influence here is the cost of sound and vibration measurements on one sample which may be as high as the entire production quality control program on electrical and aerodynamic properties. But, testing one or two units leads to some questionable statistical, and ethical, results.
"Conclusions are usually a joy to read since for the most part they are brief, optimistic, and exude confidence. Still, our final judgment on this report must be negative in spite of the carefully performed tests and the volume of data reduction and presentation. The report was of little value to the reader and the work of little value to the firm that subsidized it.

"How does this happen? It can happen because the organization needing the information has no one on the staff who can really interpret the data or design the experiment, and because competent use of electronic instruments is no protection from non-electronic difficulties that occur. The above cited report is hypothetical, but all of the examples were taken from recent reports that have passed across the Editor's desk."

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AN ODE WRITTEN UPON LEARNING CYCLES HAD BECOME HERTZ'S

Hertz Rent A Cycle -- I thought I was going Hertz the day they named the cycle Hertz. From names like Dekhotinsky save us. Will they name the second "Avis?" What now of foot-pounds, ergs and joules will they be named for water fowls? To quote the Bard, would rose smell sweeter if name were changed to foot or meter? Oh, doctors, eggheads, pros and seers, please don't confuse us engineers.

- from "High Voltage" (The Electrical Maintenance Engineers Association of California) A.C.

THE LAME LEADING THE HALT DEPARTMENT -- A poor mathematician, The Antenna has had difficulty in converting cycles to hertz and asked some engineers at the National Forestry Service Engineering Branch for assistance. They came up with the following equation which they avow, makes hertz-to-cycles conversion a "sinh":

\[ F_h = F_c \left[ \frac{\cosh \Theta_h \sqrt{1-\tanh^2 \Theta_h}}{\sin^2(e-\pi \Theta_c) + \cos^2(e-\pi \Theta_c)} \right] \left[ \frac{3}{2} \right] \]

\[ F_h = \text{Frequency in hertz} \]
\[ F_c = \text{Frequency in cps} \]

Readers who find this simple formula time-saving are invited to spend their leisure time in the nation's beautiful forests, helping to prevent fires.

- from Electronic News Monday, September 11, 1967 A.C.
California Receives New Weights and Measures Standards

On Wednesday, November 22, California became the fifth State to receive new weights and measures standards under a program to replace the standards of all 50 States. Dr. Allen V. Astin, Director of the U. S. Department of Commerce’s National Bureau of Standards, presented one new set of weights and measures standards to officials of the State of California at 10:00 A.M. in a ceremony at the California Department of Agriculture in Sacramento.

Many of the standards and instruments used by the States in weights and measures administration were provided by the Federal Government 100 years ago or more. The National Bureau of Standards is supervising replacement of the State standards to update and extend measurement competence throughout the Nation, as required by scientific and technological advances. Standards have previously been presented to Ohio, Illinois, Oregon, and Utah. Within the next few months sets will be presented to Connecticut, Delaware, Kentucky, New Mexico, and Tennessee. It is expected that new standards and instruments will be provided to about 10 States per year until all State standards and facilities have been modernized.

Each new set includes standards of mass (weight), length, and volume and necessary laboratory instruments, including high precision balances, all specially designed to meet State weights and measures requirements. Each set costs the Federal Government about $70,000, including calibration, installation, and training of laboratory personnel. The State contribution to the program, in the form of new or expanded laboratory facilities and better qualified personnel, will be considerably more than the Federal cost.

Measurement uniformity among the States began in 1836 when Congress authorized the Federal Government to supply each State with "... a complete set of weights and measures adopted as standards -- to the end that a uniform standard of weights and measures may be established throughout the United States."

In the United States, the actual regulation of weighing and measuring equipment in commerce is retained largely by the States. The National Bureau of Standards is the principal technical resource for the States in this area.

Four Nations Compare Microwave Standards

The NBS Institute for Basic Standards (U. S. Department of Commerce) is serving as pilot laboratory in an international cross-check of power standards at 3 GHz. Canada, the USSR, Japan, and the USA are each supplying one or more transfer standards which will be compared with the primary standards in all four countries. Measurements on the transfer standards have been completed at NBS and they are now being compared with the primary standards in Canada. Data obtained at each national laboratory will be reported to the International Bureau of Weights and Measures at Sevres, France, which will issue a final report when all the results are in.
Seminars on eight topics have been announced for the 1967-68 series of Precision Measurement Seminars held at the National Bureau of Standards. These will take place, depending on the topic, either at the NBS laboratories in Gaithersburg, Md., indicated below by (G), or in Boulder, Colo., indicated by (B). The announced topics are as follows:

- Low Frequency Electrical Standards (G), Dec. 11-13, 1967
- Length Measurements (G), April 1-5, 1968
- Precision and Accuracy in Measurement and Calibration (G), Feb. 12-15, 1968
- Frequency and Time (B), Feb. 1968
- High Frequency and Microwave Attenuation (B), March 1968
- Microwave Calibration Workshop (B), May 6-10, 1968
- Colorimetry and Spectrophotometry (G), May 6-8, 1968
- Radiation Quantities (G), May 15-17, 1968

The seminars are one of several NBS activities that provide advice and assistance on measurement and calibration problems to the growing number of standards laboratories in tracing to NBS standards the accuracies of measurement needed for research work, factory production, or field evaluation. Participation is open to a limited number of persons from measurement and standards laboratories who meet appropriate prerequisites relating to education, work experience, and current professional activity. Further information is available from Dr. L. Mason, NBS/IES, Washington D. C. 20234.

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**Coaxial Transmission Lines With Minimal Discontinuities**

Disk-shaped supports for rigid coaxial transmission lines are sometimes trimmed for smaller step discontinuities in the center conductor and minimized reflections in the line. An equation developed at the NBS Radio Standards Laboratory gives the effective dielectric constant of cutaway supports, from which the correct center conductor diameter can be found.

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**Atomic Second Adopted As International Unit Of Time**

A new definition of the international unit of time, the second, was adopted Friday, October 13, 1967 in Paris by the 13th General Conference on Weights and Measures. The second has now been defined in terms of a characteristic rate of electromagnetic oscillation of the cesium-133 atom. The Conference also made terminological decisions in regard to the "micron," the "degree Kelvin," and the candela; and it added several to its list of derived units in the International System.

Speaking for the governments represented, which include those of all the leading scientific and industrial countries, the Conference agreed overwhelmingly that the moment had come to replace the existing definition, based on the earth's orbital motion around the sun, by an "atomic definition."
The Conference decided that:

The unit of time of the International System of Units is the second, defined in the following terms: "The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the fundamental state of the atom of cesium 133."

and abrogated the resolutions giving the earlier definition.

The frequency (9,192,631,770 Hz) which the definition assigns to the cesium radiation was carefully chosen to make it impossible, by any existing experimental evidence, to distinguish the new second from the "ephemeris second" based on the earth's motion. Therefore no changes need to be made in data stated in terms of the old standard in order to convert them to the new one. On the other hand, the atomic definition has two important advantages over the preceding definition: (1) it can be realized (i.e., generated by a suitable clock) with sufficient precision, 1 part in a hundred billion (10⁻¹¹) or better, to meet the most exacting demands of current metrology; and (2) it is available to anyone who has access to or who can build an atomic clock controlled by the specified cesium radiation, and one can compare other high-precision clocks directly with such a standard in a relatively short time—-an hour or so as against years with the astronomical standard.

The 13th General Conference also made several other decisions:

Length. The name "micron," for a unit of length equal to 10⁻⁶ meter, and the symbol "μ" which has been used for it, are dropped. The symbol "μ" is to be used solely as an abbreviation for the prefix "micro-", standing for multiplication by 10⁻⁶. Thus the length previously designated as 1 micron, should be designated 1 μm.

Temperature. The Conference recognized the urgency of revising the International Practical Scale of Temperature of 1948. Noting that the laboratories competent in the area are agreed on the main lines of the changes required, it authorized the International Committee on Weights and Measures to take the steps necessary to put a new International Practical Scale of Temperature into effect as soon as possible.

The name of the unit of thermodynamic temperature was changed from degree Kelvin (symbol: °K) to kelvin (symbol: K). The definition of the unit of thermodynamic temperature now reads:

The kelvin, the unit of thermodynamic temperature, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.

It was also decided that the same name (kelvin) and symbol (K) be used for expressing temperature intervals, dropping the former convention which expressed a temperature interval in degrees Kelvin or, abbreviated, deg K. However, the old designations are acceptable temporarily as alternatives to the new ones. One may also express temperature intervals in degrees Celsius.
Photometry. Recognizing that photometry must take into account the principles and techniques of colorimetry and radiometry, the Conference approved plans drawn up by the International Committee on Weights and Measures to expand the scope of its activities to include the fundamental metrological aspects of colorimetry and radiometry.

The definition of the unit of luminous intensity, the candela, was rephrased to meet the objections of critics who found a certain awkwardness in its wording. The meaning of the definition, which was never in doubt, remains the same. The reformulated definition follows:

The candela is the luminous intensity, in the direction of the normal, of a black body surface 1/600,000 square meter in area, at the temperature of solidification of platinum under a pressure of 101,325 newtons per square meter.

Derived units. To the derived units and associated symbols that the 11th General Conference (1960) had included in its Resolution 12, which introduced the International System of Units (official abbreviation: SI, from the French designation, Système International d’Unités), the 13th General Conference added the following:

- Wave number: 1 per meter (m⁻¹)
- Entropy: joule per kelvin (J/K)
- Specific heat: joule per kilogram kelvin (J/kg K)
- Thermal Conductivity: watt per meter kelvin (W/m K)
- Radiant intensity: watt per steradian (W/sr)
- Activity (of a radioactive source): 1 per second (s⁻¹)

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Low-Frequency Digital Phasemeter

A phase-angle meter developed at the NBS Institute for Basic Standards (U. S. Department of Commerce) gives digital indications of the phase angle (in radians) to four decimal places, between two electrical signals from an arbitrarily low frequency to 10 kHz. Designed by John R. McKinney of the Institute's rheology laboratories, the meter can be assembled from commercially available logic modules. When used with a conventional digital frequency-ratio meter, it supplies precise values for the phase angle between two signals of the same frequency.

The measurement is absolute and is referred to a time base, which may be derived from the NBS frequency standard. Its accuracy is better than 0.01 degree at 1 kHz and is expected to improve at lower frequencies. The instrument is simple in design, inexpensive, easily portable, and requires little space in a laboratory.

The phasemeter is comprised of a logic circuit, which can be assembled from logic modules, and a preset frequency-ratio meter. Both the logic modules and the frequency-ratio meter are commercially available.
Basically, the phasemeter is a timing circuit which measures the average time interval between appropriate zero crossings of the two signals over an arbitrarily selected number of cycles. The reason for using many cycles of a signal is to reduce errors caused by random and incommensurable imperfections accompanying the signals and to average the timing errors between zero crossings. However, considerable ability to ignore certain types of sine wave imperfections, such as d-c offset, noise, a-c hum, and some harmonics, is inherent in the device.

As we go to press, we learn that New Mexico became the sixth state to receive new weights and standards of measure under the Bureau's continuing program of supplementing and replacing old standards.

**Piston Gage Developed For High Pressure Measurements**

A high-pressure piston gage has been developed at NBS for improved pressure determinations up to 26,000 bars or 380,000 psi. The device has been used to obtain a more accurate value for the polymorphic phase transition of bismuth.

High pressures are being used increasingly in scientific research and industrial processes, creating an urgent need for more precise measurements and calibrations. This need is felt especially in the range up to 30 kilobars or 430,000 psi, the maximum pressure for which apparatus generating hydrostatic pressure is currently available.

At pressures exceeding 10 kilobars it becomes exceedingly difficult to connect different instruments in the high-pressure system by means of high pressure tubing. The NBS scientists therefore designed the high-pressure piston gage to include a pressure generator and a large enough inside space to contain the sample immersed in liquid for the necessary measurements.

In the NBS device, Figure 14, a gage piston made of dense, fine-grained, cemented tungsten carbide fits into a 2 mm-diameter bore of a high-pressure cylinder. The lower part of this cylinder is wider and serves as a sample chamber. A ram pushes a movable seal upward into the lower end of the liquid-filled sample chamber, increasing the pressure to the desired value.

The force generated by the internal pressure acting on the cross section of the piston is balanced by loading the piston with a sufficient number of weights through a pivot resting on the piston. To reach the highest operating pressure of this gage, a total load of one ton is balanced on the top of the 2 mm-diameter piston. Piston, pivot, and the entire load are rotated to relieve friction between piston and cylinder. The rotating is accomplished by directing air jets against vanes on the weight holder atop the piston.

The first measurements made with this gage demonstrated the feasibility of the design and also indicated desirable improvements. These measurements have provided a more accurate value for the lowest pressure polymorphic phase transition of a bismuth sample at 25°C: 25,499, with an estimated uncertainty of ± 60 bars. Bismuth is one of the most widely used calibrants in this high pressure range.
Figure 14. Cross-sectional drawing of the NBS-developed high pressure piston gage. The gage piston P fits into the 2-mm diameter bore of the high-pressure cylinder C. The ram R pushes the movable seal S into the liquid-filled sample chamber, increasing the pressure to the desired value. A separate ram E is used to supply end-loading to the tapered cylinder and to push it into the jacket J to generate support pressure on the outer surface of the cylinder. The jacket in turn is supported by pressure in the annular space shown connected to the port JP, and this pressure and the ram force are used to control the clearance between the gage piston and the cylinder. In operation, the force generated by the internal pressure acting on the cross-section of the piston is balanced by loading the piston with a sufficient number of weights.
"OVERLAP"--A NEW NEWSLETTER

The establishment by NBS of the Pilot Program in Mass Measurement has had an interesting by-product. It is a newsletter entitled "OVERLAP" and it is edited by Don Baker who is located in the Metrology Division, Room B 322, Bldg. 220, National Bureau of Standards, Washington, D.C. 20234. Don states the purpose of the Newsletter is to benefit those who participated in the Pilot Program and for others engaged in like projects. He hopes to stimulate readers to discussions of philosophies, techniques, and application of measurement process evaluation to the measurement problems of the national measurement system.

In the first issue, some basic philosophy of the original program is brought out. After describing the philosophical approach to a standardized value of a unit, he proceeds to describe the role of a check standard in the process of intercomparison round robins. He later presents a bit of information—a new buoyancy correction formula for mass measurements. In closing, he relates the effort to establish a program of voltage standard intercomparisons similar to that of Pilot. Engaged in this effort are the Air Force Newark AF Station in Ohio and the National Bureau of Standards. A one-year program of study and experiment has been started.

GENTLEMEN, IN RESPONSE TO A REMARK ABOUT THE U NCALIBRATED BAT RAY

Courtesy: Research/Development @ 1966 F. D. Thompson Pub.

"Quality control man, eh? How are you on long reports, routine tests, instrument calibration, and all that dull jazz?"

Courtesy: Quality Assurance
BACKGROUND READING


H. "Particle Analysis", W. McCrone, Research Development, Sep '67. Laboratories interested in clean-room requirements may benefit by this review.


J. "ISA Instrumentation Index", Issue Two, Sep '67, Instrument Society of America. An assist to information retrieval covering articles published by ISA.


M. "From RFI to EMC", G. Flynn, Electronic Products, Nov. 67. Tracing the history of interference and its mitigation through the efforts of the FCC and DOD, with a look at future problems for industrial designing.
"Not even one letter to the editor today!"

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