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Centennial Issue: NBS/NIST — 100 Years of Measurement



NIST

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The National Institute of Standards and Technology was established in 1988 by Congress to “assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries.”

NIST, originally founded as the National Bureau of Standards in 1901, works to strengthen U.S. industry’s competitiveness; advance science and engineering; and improve public health, safety, and the environment. One of the agency’s basic functions is to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for comparing standards used in science, engineering, manufacturing, commerce, industry, and education with the standards adopted or recognized by the Federal Government.

As an agency of the U.S. Commerce Department’s Technology Administration, NIST conducts basic and applied research in the physical sciences and engineering, and develops measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive work on new and advanced technologies. NIST’s research facilities are located at Gaithersburg, MD 20899, and at Boulder, CO 80303. Major technical operating units and their principal activities are listed below. For more information contact the Publications and Program Inquiries Desk, 301-975-3058.

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- Distributed Computing and Information Services
- Software Diagnostics and Conformance Testing
- Statistical Engineering

¹At Boulder, CO 80303.

²Some elements at Boulder, CO.

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Cover: Photograph showing the original gate from the National Bureau of Standards, transplanted from Washington, DC to the National Institute of Standards and Technology, Gaithersburg, MD site. The NIST Administration Building is shown in the background. There are also NIST laboratories in Boulder, CO.

The *Journal of Research of the National Institute of Standards and Technology*, the flagship periodic publication of the national metrology institute of the United States, features advances in metrology and related fields of physical science, engineering, applied mathematics, statistics, and information technology that reflect the scientific and technical programs of the Institute. The *Journal* publishes papers on instrumentation for making accurate measurements, mathematical models of physical phenomena, including computational models, critical data, calibration techniques, well-characterized reference materials, and quality assurance programs that report the results of current NIST work in these areas. Occasionally, a Special Issue of the *Journal* is devoted to papers on a single topic. Also appearing on occasion are review articles and reports on conferences and workshops sponsored in whole or in part by NIST.

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Barry N. Taylor

The Board of Editors of the *Journal of Research of the National Institute of Standards and Technology* wishes to honor Dr. Barry N. Taylor for his leadership and commitment to excellence as Chief Editor. Manager of the Fundamental Constants Data Center of the NIST Physics Laboratory, Barry has decided that this Centennial Issue will be his final one as Chief Editor. Appointed to this position by the Director of NIST in 1988, Barry guided the *Journal* through the NBS/NIST transition and for the next 12 years. His extraordinary knowledge of measurement science, his penchant for technical accuracy and integrity, and his effective management skills have served to make the *Journal* the flagship publication of NIST.

A renowned metrologist and physicist, Barry has for many years represented NIST and the United States in many international scientific organizations. He is the author of several important publications on the modern metric system and was co-author of a widely disseminated NIST publication for evaluating and expressing the uncertainty of measurement results. He also advises U.S. scientific and voluntary standards organizations regarding United States policy on the metric system. In recognition of his scientific and technical achievements during 30 years of NIST service, Barry has received the Distinguished Executive 2000 Presidential Rank Award.

This Centennial Issue is dedicated to Barry N. Taylor and the inestimable contributions he has made to this *Journal*, to NIST, and indeed, to the Nation.

Board of Editors

Message From the Chief Editor

Dear Reader,

Welcome to the issue of the *Journal of Research of the National Institute of Standards and Technology* that commemorates the Centennial of a truly unique and remarkable institution!

The National Institute of Standards and Technology (NIST) was founded as the National Bureau of Standards (NBS) on March 3, 1901 by the 56th Congress of the United States (Public Law 177). Thus March 3, 2001 is NIST's 100th birthday. In honor of this historic occasion, the January-February 2001 issue of the *Journal* (Volume 106, Number 1) is published as the Centennial Issue with the title "NBS/NIST—100 Years of Measurement."

NBS became NIST on August 23, 1988, when President Reagan signed the Omnibus Trade and Competitiveness Act. Although NIST was founded as NBS in 1901, when NBS was transferred in 1903 from the Treasury Department, its initial home, to the new Department of Commerce and Labor, the word "National" was eliminated from the name by the head of the Department because it was thought that the word "National" was inconsistent with the names of similar bureaus in the Department. In 1934, some 30 years later, the original NBS name was restored because of the proliferation of "Bureaus of Standards" in State governments and private organizations.

Since its founding in 1901, NIST has served as the Nation's national metrology institute (NMI). As such, metrology, which is the science that deals with measurement, has been the foundation upon which the entire institution has rested for its first 100 years of existence. The title of this Centennial Issue, "NBS/NIST—100 Years of Measurement," and the topics covered by the articles it contains, were chosen to reflect its century-old, core measurement mission. (In the present context, we interpret "measurement" to include, measurement, standards, and data.)

But I should hasten to add that NIST does not exist to pursue metrology for its own sake. Rather, its purpose is to provide the measurement infrastructure for U.S. industry, scientific institutions, universities and colleges, and other organizations so that they can function both efficiently and effectively. Simply put, measurement plays an essential and crucial role in science and technology and in trade and commerce. Scientific theories cannot be tested, instruments and machines cannot be designed and built, and the daily routine of the local, national, and global market places cannot proceed without precise measurement.

In soliciting contributions to the Centennial Issue from the NIST staff, I took into account the fact that metrology requires a system of units in terms of which measurement results can be expressed. Since the dominant system in use in science as well as in international commerce is the modern metric system known as the International System of Units (universally abbreviated SI from the French name *Système International d'Unités*), the first six articles revolve around six of the seven base units of the SI: the meter, kilogram, second, ampere, kelvin, and candela, which are the units for length, mass, time, electric current, thermodynamic temperature, and luminous intensity, respectively. I also took into account the fact that not all of NIST's work can be neatly categorized by SI base units and the measurements associated with them. Thus, a number of articles covering other topics are included. However, as the reader will quickly see, the common thread of these articles is also measurement. This should come as no surprise since, as I have emphasized above, NIST's *raison d'être* is metrology.

You will note that the 12 articles in this Centennial Issue vary in form, level of detail, and length. With that old saw “variety is the spice of life” in mind, and recognizing that detailed instructions can be inhibiting, I gave the author(s) of each article wide latitude in deciding the article’s exact content and length. I simply said that the principal focus of each article should be NIST’s current work (i.e., measurement capabilities, methods, and research) in the field covered by the article, but each article should have

- (1) a brief historical introduction that discussed the pivotal developments in the field since NBS/NIST was founded in 1901 and NIST’s role in those developments; and
- (2) a concluding section that looks to the future: What new developments in the field are most likely to occur in the first decade of the new millennium and what role will NIST likely play in those developments?

I believe that most authors followed this guidance. In any event, I hope that you find this Centennial Issue both enlightening and enjoyable, and that my distant successor late in the 21st century finds it good enough to show to the authors writing articles for the Bicentennial Issue of the *Journal* celebrating the 200th birthday of NIST and say to them “It is a good model to follow.”

Barry N. Taylor
Chief Editor

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