

U. S. Department of Commerce

Daniel C. Roper, Secretary

National Bureau of Standards

Lyman J. Briggs, Director



Visitors' Manual

of the

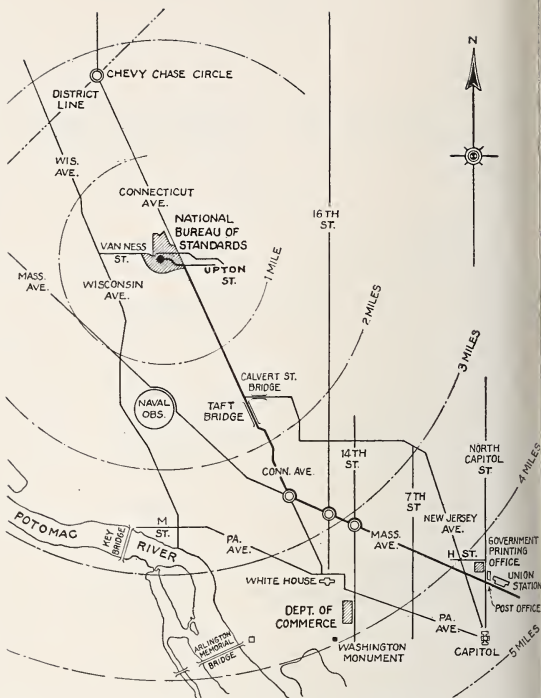
National Bureau of Standards

*A Brief Synopsis of Its
History, Functions, and
Laboratory Facilities*

Miscellaneous Publication M160

(Supersedes Miscellaneous Publication M153)





Location of the National Bureau of Standards in relation to a few of the principal streets and public buildings.

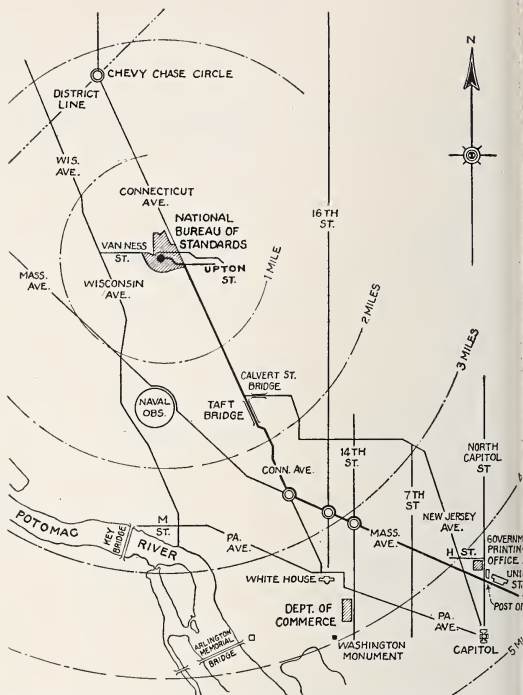
(II)

VISITORS' MANUAL OF THE NATIONAL BUREAU OF STANDARDS ¹

CONTENTS

	Page
Subjects of Bureau activities.....	2
General information.....	3
Points of special interest.....	5
South building.....	5
West building.....	7
Sound chamber.....	8
Low-temperature building.....	8
Wind-tunnel building.....	8
Altitude laboratory.....	8
Dynamometer building.....	9
Northwest building.....	9
Chemistry building.....	12
East building.....	13
Radio building.....	14
Hydraulics building.....	14
Industrial building.....	14
Kiln building.....	16
Fire-resistance group.....	16
Ten-foot wind tunnel.....	16
A few notable accomplishments.....	17
Number of publications issued.....	18
Volume of testing.....	18

¹ Prepared by Hugh G. Boutell, Chief, Information Section.



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SUBJECTS OF BUREAU ACTIVITIES

Electricity

Resistance Measurements
Inductance & Capacitance
Electrical Instruments
Magnetic Measurements
Photometry
Radio
Underground Corrosion
Electrochemistry
Telephone Standards

Weights and Measures

Length
Mass
Time
Capacity & Density
Gas Measuring Instruments
Thermal Expansivity, Dental
Materials & Identification
Weights & Meas. Laws and
Adm.
Large Capacity Scale Test-
ing
Limit Gages

Heat and Power

Thermometry
Pyrometry
Heat Measurements
Heat Transfer
Cryogenics
Fire Resistance
Automotive Power Plants
Lubrication & Liquid Fuels

Optics

Spectroscopy
Polarimetry
Colorimetry
Optical Instruments
Radiometry
Atomic Physics, Radium, &
X-Rays
Photographic Technology
Interferometry

Chemistry

Paints, Varnishes, & Bitu-
minous Materials.
Detergents, Cements, Cor-
rosion, Etc.
Organic Chemistry
Metal & Ore Analysis, &
Standard Samples
Reagents & Platinum Metals
Electrochemistry (Plating)
Gas Chemistry
Physical Chemistry
Thermo-Chemistry and Con-
stitution of Petroleum

Mechanics and Sound

Engineering Instruments
Mechanical Appliances
Sound
Aeronautic Instruments
Aerodynamics
Engineering Mechanics
Hydraulics

Organic & Fibrous Materials

Rubber
Textiles
Paper
Leather
Testing & Specifications
Fiber Structure
Organic Plastics

Metallurgy

Optical Metallurgy
Thermal Metallurgy
Mechanical Metallurgy
Chemical Metallurgy
Experimental Foundry

Clay & Silicate Products

Whiteware
Glass
Refractories
Enameled Metals
Heavy Clay Products
Cement & Concreting Ma-
terials
Masonry Construction
Lime & Gypsum
Stone

Simplified Practice

Wood, Textiles, & Paper
Metal Products & Con-
struction Materials
Containers & Miscellaneous
Products
Materials-Handling Eq-
ipment & Ceramics

Trade Standards

Wood, Wood Products, Pa-
per, Leather, & Rubb-
er
Metal Products
Textiles
Apparel
Petroleum, Chemical & Ma-
cellaneous Products

SUBJECTS OF BUREAU ACTIVITIES—Continued

<i>Codes and Specifications</i>	<i>Shops</i>
Safety Codes	Instrument
Building Codes	Woodworking
Building Practice and Specifications	Glassblowing
Producer Contacts and Certification	Construction Stores & Tool Room
Consumer Contacts and Labeling	
<i>Office</i>	<i>Operation of Plant</i>
Finance	Power Plant
Personnel	Electrical
Purchase & Stores	Piping
Property & Transportation	Grounds
Mail & Files	Construction
Library	Guard
Information	Janitorial

GENERAL INFORMATION

History and functions.—The National Bureau of Standards was established by act of Congress, approved March 3, 1901. Besides continuing the duties of the old Office of Standard Weights and Measures of the U. S. Coast and Geodetic Survey, new scientific functions were assigned to the Bureau. It is charged with the development, construction, custody, and maintenance of reference and working standards and their intercomparison, improvement, and application in science, engineering, industry, and commerce. Originally under the Treasury Department, the Bureau was transferred in 1903 to the Department of Commerce and Labor (now the U. S. Department of Commerce).

Statistics.—The original staff numbered 14 and the laboratories were housed in temporary quarters near the United States Capitol. There are now about 870 employees, two-thirds of whom are scientifically and technically trained. The laboratories occupy 12 major and 7 minor buildings on a site of 56 acres, situated at the intersection of Upton Street and Connecticut Avenue in the northwest suburbs of Washington, 4 miles northwest from the Washington Monument. The altitude of the lower floor of the north building is 335.69 feet above mean sea level, latitude 38°56'32" north, longitude 77°03'59" west.

The Director of the Bureau is Dr. Lyman J. Briggs.

Those desiring other general information about the Bureau may telephone Cleveland 1720, branch 230.

Organization.—The Bureau is organized in three principal groups—the first dealing with research and testing; the second with commercial standardization; and the third with the administrative work, operation of plant, and construction of laboratory apparatus. There are 9 divisions of the first group, made up of 70 sections; 3 divisions with a total of 14 sections in the second group; and 3 divisions containing 19 sections in the third group.

Services.—The Bureau's services are available to the National and State Governments without charge. Work other than that for the Government is undertaken under certain conditions, the main consideration being the value of the work to the Nation as a whole. For private tests a fee is charged, which, however, is turned into the United States Treasury and is not available to the Bureau.

Research associates.—In addition to the regular staff, there are at the Bureau a number of research associates, supported by industrial groups to work on research problems of mutual interest to the Bureau and the industry concerned. Their status is similar to that of Bureau employees. Results of the work of research associates are public property.

Publications.—The results of the Bureau's investigations are made available through its own publications and by articles in the scientific and technical journals. Several series of publications are issued by the Bureau covering various phases of the work. A list of the Bureau's publications (Circular C24 and supplements) may be purchased for 55 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

Results of original research are published monthly in the *Journal of Research of the National Bureau of Standards*, obtainable on a subscription basis at \$2.50 per year (\$3.25 foreign). Semiannual volumes of the *Journal of Research* bound in cloth may also be purchased from the Superintendent of Documents at \$3 per volume. The various papers in the *Journal* are also published and sold separately as *Research Papers*. These are numbered consecutively, as RP1, RP300, etc.

Progress of work in the laboratories, important conferences, and new publications issued can be followed in the *Technical News Bulletin*, issued monthly and obtainable by subscription at 50 cents per year (70 cents foreign) from the Superintendent of Documents.

Nonperiodical publications include *Circulars*, containing compiled information on scientific and

technical subjects; Handbooks, usually containing rights and measures regulations, safety codes, and similar recommended laws, standards of practice, and regulations; Simplified Practice Recommendations, intended to reduce the number of unnecessary types and varieties of articles in common use; Building and Housing publications, covering recommended requirements for building codes, home-owner's problems, and related matters; Commercial Standards, giving acceptable standards of quality agreed on by manufacturers, distributors, and consumers; and Miscellaneous Publications, generally compiled data, charts, etc., that do not fit into the other series. None of these publications is available on a subscription basis.

POINTS OF SPECIAL INTEREST

The laboratories in the following list have been chosen as of greatest interest to the majority of visitors. Likewise they are representative of the Bureau's work, which includes fundamental and applied research and testing.

Special arrangements can be made to visit other laboratories not listed.

Visitors' trip.—A scheduled trip through the laboratories for general visitors starts from room 300, South Building, at 1:45 p. m., daily, excepting Saturdays, Sundays, and holidays. Special arrangements must be made several days in advance for groups of 10 or more. It is possible, on any one trip, to visit only a few of the places listed. In the case of a small group, the guide tries, as far as possible, to accommodate the interests of those making the trip, but the visitor with some definite interest should go to the laboratory concerned rather than on the general trip. The sequence of buildings here given is that in which the trips are ordinarily routed.

SOUTH BUILDING

Room 101—Mass section

The National Standard of Mass, Kilogram No. 2, obtained from the International Bureau of Weights and Measures, is kept in a vault on the first floor of this building. It is a plain cylinder with diameter equal to its height, and is made of an alloy of 90 percent of platinum and 10 percent of iridium. Weights of many different classes are compared with the Bureau's working standards, which in turn are based on the National Standard. The balances used in this work include several of the

highest precision. One of these is a large balance for comparing 50-pound weights with an error of only 1 part in 20 million.

Rooms 108 and 109—Dimensional variations

Equipment is provided for determining the thermal expansivity of solids over a wide range of temperatures and with various degrees of precision, depending upon the use to which the materials are to be put.

In cooperation with the American Dental Association, great improvements have been made in dental materials and technique. The advances are all based on precision measurements.

Room 114 and corridor—Interferometry

A demonstration apparatus is arranged to show the bending of a steel bar 5 inches in diameter, under the pressure of a finger. Optical methods are employed by the Bureau in making all sorts of precision measurements of length. The equipment of this laboratory includes apparatus for constructing length standards directly from light waves.

Rooms 201 and 202—Capacity and density

Tests are made of glass volumetric apparatus and hydrometers; and the density and thermal expansion of liquids are determined.

Room 209—Length measurements

In this laboratory length-measuring instruments of all kinds are checked against the working standards of the Bureau. These in turn have been compared with the National Standard Meter No. 27 (made of the same platinum-iridium alloy as the Standard Kilogram) which is kept in the vault on the first floor of this building. High-precision length measurements are made in a special underground room, where the temperature of the standards is practically constant. (Open only by special arrangement when no work is in progress.)

Room 212—Spectroscopy

In this section the spectra of the elements are photographed, and the position and intensity of the lines determined with high precision, thus furnishing reference standards for the science of spectroscopy. The spectra of rare gases occurring in the atmosphere may be viewed through a small spectroscope. This laboratory has made important contributions to the art of photography, particularly in the production of special emulsions for photographing through haze.

m 218—Time section

atches and clocks are here compared under controlled conditions with the Bureau's standard clocks, which are installed in a special room in the building. These clocks do not vary more than one-hundredths of a second per day. They are compared daily with the standard clocks of the United States Naval Observatory through radio signals.

m 400—Colorimetry and spectrophotometry

The colors of materials and illuminants are analyzed and specifications for colors are developed in this section. Standard railway signal colors (of which the Bureau is the custodian), standard pigments, United States flag colors, commercial standards for sanitary ware, and fluorescent materials are illustrated.

WEST BUILDING

m 102—Engineering instruments

Pressure gages, liquid meters, anemometers, and extinguishers are among the instruments and appliances tested in this laboratory. A standard for elevator interlocks was developed by this section.

m 203—Testing of thermometers

In this and the adjoining laboratories, mercury-glass and other types of thermometers are compared with the Bureau's standards by immersing the instruments in a bath, which may contain either a low-freezing liquid, water, oil, or melted metal depending upon the temperature desired. The range of temperatures covered is from -40° to $1,000^{\circ}$ F.

m 212—Pyrometry

Devices for measuring high temperatures from 100° to $4,000^{\circ}$ F, including thermocouples, and optical and radiation pyrometers, are tested in this laboratory. The apparatus and method necessary for the realization of a new primary standard of temperature (the Waidner-Burgess standard) were developed in this section.

m 306—Optical testing of sugar

The standard test for purity of a sugar solution is made by means of an instrument known as a saccharimeter." This instrument measures the

rotation of a beam of plane polarized light passing through the solution. The Bureau also carries out research work on the properties of sugar. By special arrangement with the United States Treasury Department, the Bureau supervises the equipment and methods used in testing sugar at the U. S. Customs laboratories, which are located at the various ports of entry.

SOUND CHAMBER

Transmission, absorption, and reverberation of sound in rooms by acoustical building materials are studied in this laboratory. A revolving loud-speaker is used as the source of sound in the reverberation chamber and will be demonstrated by special arrangement.

LOW-TEMPERATURE BUILDING

The discovery of deuterium (heavy hydrogen) was the result of cooperative work between the staff of this laboratory and Columbia University. Here the production of the lowest temperature so far attained in this country, that of liquid helium (-456° F), has made possible the study of the properties of materials at very low temperatures, particularly superconductivity in metals. Liquid air (temperature -310° F) is usually on hand and its effect on the properties of common materials can be demonstrated.

WIND TUNNEL BUILDING

Main laboratory—Aerodynamics

This is one of the three wind tunnels at the Bureau employed in studying the characteristics of air flow in the tunnel itself and the behavior of model airplanes, automobiles, bombs, buildings, chimneys, etc., in an air stream. This tunnel is 54 inches across at smallest section, and in it a wind speed of 75 miles an hour can be attained.

ALTITUDE LABORATORY

This was the first laboratory ever built for studying the performance of aircraft engines under flight conditions. It was completed in 1917. The low air pressures and temperatures encountered at altitudes up to 30,000 feet can be duplicated. It is suitable only for liquid-cooled engines, and consequently is not often used at the present time, but the fundamental facts brought out as the result of this pioneer work are applicable to all engines.

DYNAMOMETER BUILDING

Main laboratory—Automotive power plants

Investigations are conducted in this laboratory on the performance of internal-combustion engines with special reference to fuels, lubricants, and devices intended to promote economy and efficiency. The equipment includes electric dynamometers to which any engine may be coupled. A special test plant is provided for studying modern air- or liquid-cooled aircraft engines, and there are many pieces of special apparatus for testing fuels, lubricants, and ignition systems.

NORTHWEST BUILDING

Basement—Experimental foundry and metal-working equipment

In this laboratory alloys can be prepared by melting in induction, electric-arc, or gas-fired furnaces, and can be cast, rolled, forged, or drawn into the shape desired. The equipment employed is similar to that used in actual mill practice but on a smaller scale.

Room 105—Microstructure of metals

The crystalline structure of metals and alloys is studied in this laboratory and in adjoining rooms. The effect of working, heat treatment, corrosion, etc., can be determined.

Room 202—Gages

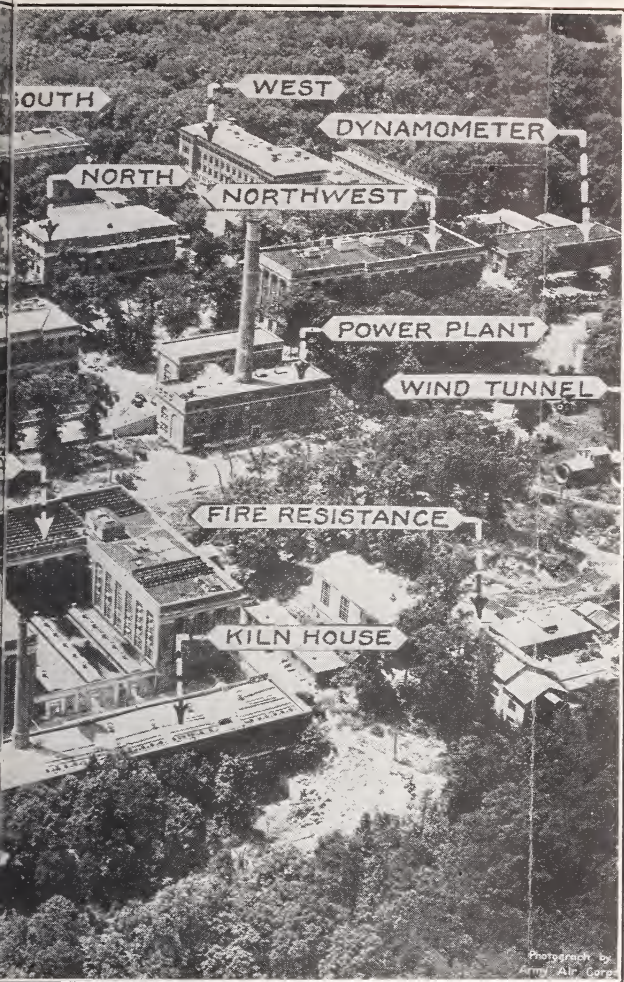
This section is engaged in testing precision gages used for controlling the dimensions of machine parts. By the optical methods used in these laboratories, the lengths of gages can be determined to one-millionth of an inch.

Room 203—Library

The Bureau has a library of nearly 42,000 volumes on physics, chemistry, and engineering. It receives practically all the domestic and foreign periodicals in these fields. Its facilities are utilized by research workers from all parts of the country.

Room 311—Aeronautic instruments

Testing of aeronautic instruments for scale errors, effect of temperature and pressure, elastic defects, vibration, and other factors affecting the performance of these instruments constitutes the work of this section. Fundamental research and a certain amount of development work on special instruments are also being carried on.



ional Bureau of Standards
 [g south]

Bureau's grounds is on Connecticut Avenue, to the left of this picture. The room 300, South Building, shown near the top center.





Airplane view of the National Bureau of Standards
 [Looking south]

The names of the principal buildings are shown. The main entrance to the Bureau's grounds is on Connecticut Avenue, to the left of this picture. The trip through the laboratories starts at 1:45 p. m. from room 300, South Building, shown near the top center.

CHEMISTRY BUILDING

Room 8—Electrochemistry

As the result of work conducted in cooperation with the electroplating industry, important improvements have been made in processes for chromium plating and for the rapid deposition of copper. The equipment includes a small electroplating plant, used for preparing specimens for exposure and laboratory tests.

Rooms 14-C and 318-C—Standard samples

The preparation and distribution of standard samples of ores, ceramic materials, metals, and pure chemicals are conducted in these laboratories.

Room 112—Electrochemistry

The equipment of this laboratory is used for measuring conductivity and hydrogen-ion concentration.

Room 205—Gas chemistry

Special equipment is provided in the gas chemistry section for testing gas appliances, particularly as regards safety. Several devices are installed for the rapid analysis of products of combustion and of mixtures being burned. The laboratory is of great interest to those engaged in the study of the utilization of gas.

Room 208—Gas chemistry

Here will be seen a considerable variety of apparatus for the analysis of gases, especially some very well-designed equipment for volumetric analysis, and elaborate apparatus for the fractionation of gases by distillation.

Room 211 and shaft in corridor—Petroleum

The equipment of this section includes unique stills for the fractional distillation of petroleum, an important step in determining its composition.

Room 303—Organic chemistry

Pure crystalline rubber has been produced in this section.

Room 410—Apparatus for determining hiding power of paint

Accelerated-weathering equipment for organic protective coatings and apparatus for determining the breakdown of protective coatings are among the special features of this laboratory.

(NOTE.—A special mimeographed guide to the laboratories in the Chemistry Building may be obtained on application at the Chief Chemist's office, room 215.)

EAST BUILDING

Rooms 106 and 107—Tests of electrical measuring instruments

This laboratory is provided with a special switch-board for connecting different circuits, and an optical device for reading the scale of an instrument with great accuracy.

Room 109—Heavy-current testing

Tests are made up to 10,000 amperes, current being supplied from a special storage battery.

Room 111—Resistance measurements

The oil bath in which wire standards of resistance are immersed during test contains a special stirring arrangement and temperature control. Precision standards for other laboratories are thus compared at a constant temperature with the standards which represent the Bureau's basic unit of electrical resistance.

Room 307—Life tests of incandescent lamps

Each year several thousand lamps, representing Government purchases of about 3,000,000 lamps per annum, are tested to ascertain whether they comply with the Federal specification requirements for rating and life.

Room 314—Integrating sphere for determining the mean spherical candlepower of lamps

By means of a hollow sphere, the inside surface of which is painted white, and at the center of which is placed the lamp, the total amount of light given off in all directions by any electric lamp is determined by a single measurement.

Room 317—Tests of radium and development of radio meteorograph

Practically all radium sold in the United States is tested in this laboratory. The rate of gamma radiation is compared by means of an electroscope with that of a standard sample.

A special meteorographic apparatus and radio-transmitting set have been developed in this laboratory in cooperation with the U. S. Weather Bureau. These instruments are attached to sounding balloons

and send back automatic signals giving weather conditions at altitudes up to 20 miles.

Room 407—Optical instruments

This laboratory is equipped for testing lenses including the highest grade of photographic lenses used in airplane mapping.

Room 408—Standard cells

In this laboratory the Weston normal saturated cells, by which the standard of voltage is maintained for the United States, are kept, and compared with the standards of voltage of other nations.

RADIO BUILDING

Main hall—Museum and library

Here will be found an exhibit showing various types of electron tubes, French and American radio sets used in the World War, miscellaneous apparatus developed for research, and publications, reports, and books of the radio section.

Rooms 213-214—Standard of radio-frequency

In this laboratory is located the Bureau's fundamental standard of radio-frequency, consisting of six quartz oscillators and auxiliary apparatus. The frequency as obtained from this standard does not differ from the true frequency by more than one part in 10,000,000.

(NOTE.—Other parts of the radio work may be seen by special arrangement with the section office.)

HYDRAULICS BUILDING

This building, which is 285 feet long and from 60 to 92 feet wide, contains supply and measuring basins, flumes, and pumping and metering equipment for every variety of hydraulic investigation, including experiments with models of large structures. A maximum flow of 250 cubic feet per second is possible in the main flume, which is 12 feet square and 200 feet long. (Open to visitors by special arrangement with chief of the section.)

INDUSTRIAL BUILDING

Basement, west end—Cement-, concrete-, and stone-testing equipment

Samples from about 70 percent of all cement which the Government buys are tested by the Bureau, but most of this work is done in field laboratories rather than in Washington.

usement, center—Large testing machines for structural materials

The vertical machine on the west side of the room is the greatest capacity of any machine in the world, 10,000,000 pounds in compression. On the east is a 600,000-pound machine for either tension or compression, and specially designed for testing steels. In the room next to this machine is the very high-precision testing machine with a capacity of 2,300,000 pounds in compression and 150,000 pounds in tension.

Room 25—Optical glass

Here are shown examples of glass produced by the Bureau and the method used in examining glass for striae and strain.

Room 136—Textiles

The equipment includes many special machines for determining properties of textiles. Tests of textiles and paper are made in a room in which the humidity and temperature are automatically kept constant.

Room 107—Paper

The Bureau has a complete papermaking plant, including a paper machine for making a sheet 29 inches in width, with which improvements in processes and the use of new materials can be studied. In particular, the life of paper, including the paper used by the Government for printing currency, has been increased three or four hundred percent through the research work of this laboratory. Considerable attention has been given to the most effective methods for preserving important books and documents in libraries. The Declaration of Independence and Constitution have been protected from ultraviolet rays, following methods worked out by the Bureau.

Room 227—Rubber

The work of this section occupies several laboratories on this floor and in the basement. Automobile tires are tested for power loss and endurance, on special machines which simulate service conditions and greatly shorten the time needed for a test.

Room 307—Organic plastics

This section is engaged in studying plastic materials used for a great variety of purposes, including aircraft windows, electrical panels, household articles, and ornamental trimmings for buildings.

Room 319—Leather

In this and adjacent laboratories may be seen samples of leather made from various kinds of hides, a machine for measuring the durability of shoes, and investigations of tanning solutions. Means for increasing the life of leather, and for combating deteriorating influences, such as sulphuric acid in the atmosphere, are receiving particular attention.

Room 336—pH measurements

The amount of active acid present in materials has an important effect on their useful life. Methods for measuring this quantity are being developed in this laboratory.

KILN BUILDING*East end—Optical-glass plant*

The Bureau operates one of the few plants now making optical glass in the United States. Most of the glass made here is used by the Navy Department for binoculars, gun sights, periscopes, and similar devices. The equipment includes machinery for making pots, melting and annealing furnaces, and instruments for determining quality of glass.

Center

Furnaces are installed for ceramic material, and for enameling metals. An automatic electrically heated kiln will prove of interest to ceramists.

West end

This large room contains a rotary cement kiln and ball mills for experimental production of cement.

FIRE-RESISTANCE GROUP

West of the Industrial Building is a group of structures in which tests are made to determine the intensity and duration of fires and the fire resistance of building materials and constructions. The equipment includes a large furnace for wall panels and another for testing safes.

TEN-FOOT WIND TUNNEL

This outdoor wind tunnel, located just west of the fire-resistance group, has a diameter of 10 feet and maximum wind speed of 75 miles per hour. Tests on large models of buildings, chimneys, full-sized airplane wing sections, etc., are made in this tunnel.

A FEW NOTABLE ACCOMPLISHMENTS

The National Bureau of Standards—

Redetermined the constant of gravitation with accuracy 10 times as great as ever before obtained. Carried out researches on density and thermal expansion of liquids of importance in industry, and calculated standard density and volumetric tables that are widely accepted; for example, ethyl alcohol, petroleum oils, linseed oil, turpentine, milk and cream.

Cooperated with the American Petroleum Institute in setting up standards for oil-country tubular rods, pumping equipment, etc., and in the standardization and inspection of limit gages necessary for maintenance of these standards.

Cooperated with the National Screw Thread Commission in setting up screw thread standards and standard methods of inspection.

Constructed the first altitude laboratory for measuring the performance of airplane engines under high conditions.

Developed the radiobeacon which, in combination with a special aerial and receiving set on the airplane, gives the pilot a visual switchboard indication whether he is following the correct course.

Discovered that a thin coating of pure aluminum will greatly decrease the atmospheric corrosion of duralumin, a special light alloy largely used in aircraft construction.

Worked out successful process for plating steel and other metals with chromium, the hardest metal known, thus prolonging the life of gages, printing plates, and other mechanical parts several hundred percent.

Developed the paper now used for printing United States currency, with strength increased three or four times, resulting in increased service life.

Discovered that certain waste water from paper mills makes a satisfactory material for tanning leather.

Established the dextrose (corn sugar) industry.

Made three standards for planeness for testing gages, flat to within one five-millionth of an inch.

Constructed standards of length from fused quartz, known to 1 part in 5,000,000.

Commenced experiments in making optical glass in 1914 and at last solved the difficult technique, so that optical glass of many grades is now produced as routine matter.

Designed and constructed many special instruments, such as strain gages, proving rings, textile and paper testers, etc.

Assisted in securing the adoption of a uniform international temperature scale by the International Conference on Weights and Measures.

Published books on house construction and repair, home ownership, zoning regulations, and plumbing requirements.

Helped to eliminate unnecessary variety of sizes and styles of over 160 articles in common use, securing agreement of manufacturers to concentrate on production of those in greatest demand, thus lowering cost of manufacture and distribution.

Assisted industry in agreeing on satisfactory standards of quality for over 60 products, and published the results as commercial standards.

Published National Directory of Commodities Specifications and developed certification and labeling plan for making available to both large and small purchasers the benefits of buying by specification.

NUMBER OF PUBLICATIONS ISSUED

During the fiscal year 1937 the number of papers published in the monthly Journal of Research of the National Bureau of Standards was 107. In addition, the Technical News Bulletin was issued each month. Thirty-seven papers were published in other series of the Bureau, including Simplified Practice Recommendations, Commercial Standard Circulars, Handbooks, and Miscellaneous Publications. In addition, 128 papers were published in outside scientific and technical journals.

VOLUME OF TESTING

In 1 year the National Bureau of Standards tested approximately—

- 1,440 electrical standards and instruments.
- 2,040 electric batteries.
- 6,550 electric lamps, representing purchases of 3,000,000 lamps by the Government.
- 3,190 gages and samples of gage steel.
- 5,110 weights and balances.
- 1,800 scales.
- 420 timepieces.
- 13,700 pieces of glass volumetric apparatus.
- 1,820 hydrometers.
- 2,360 laboratory thermometers.

- 4600 clinical thermometers.
 - 270 samples of engine fuels and lubricants.
 - 770 samples of sugar.
 - 640 samples of radium and radioactive materials
determining a sale price of \$1,000,000.
 - 630 engineering instruments.
 - 035 aeronautic instruments.
 - 360 specimens of engineering materials.
 - 200 fusible boiler plugs.
 - 700 samples of metals and alloys.
 - 000 samples of cement and concrete, represent-
ing purchases of 5,000,000 barrels of
cement.
 - 550 miscellaneous samples of ceramic materials.
 - 520 samples of rubber.
 - 220 samples of textile materials.
 - 340 samples of paper.
 - 620 samples of leather.
 - 450 samples of paint and varnish.
- In addition to the above, 2,680 miscellaneous
chemical tests were made and 8,620 standard samples
were distributed.





